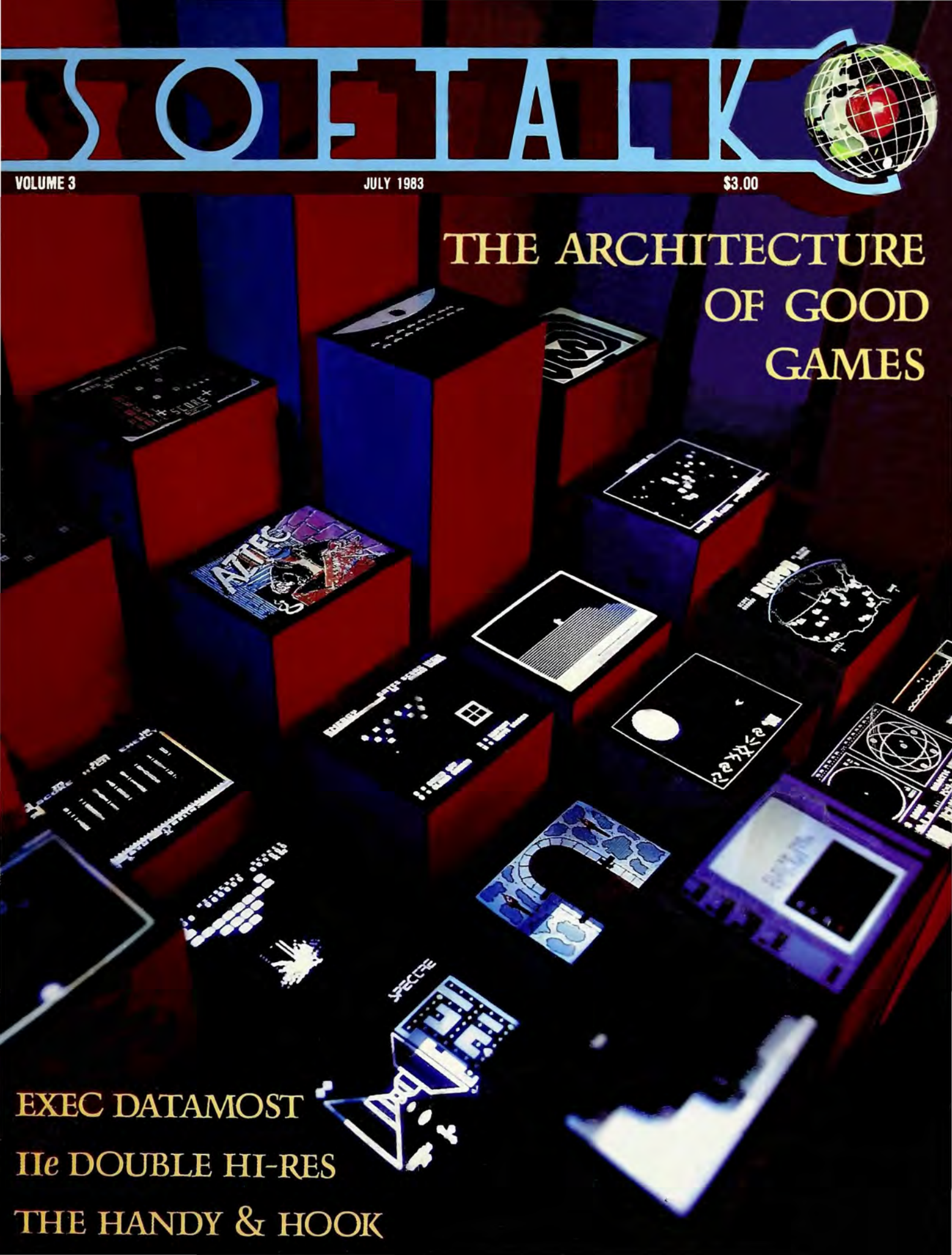
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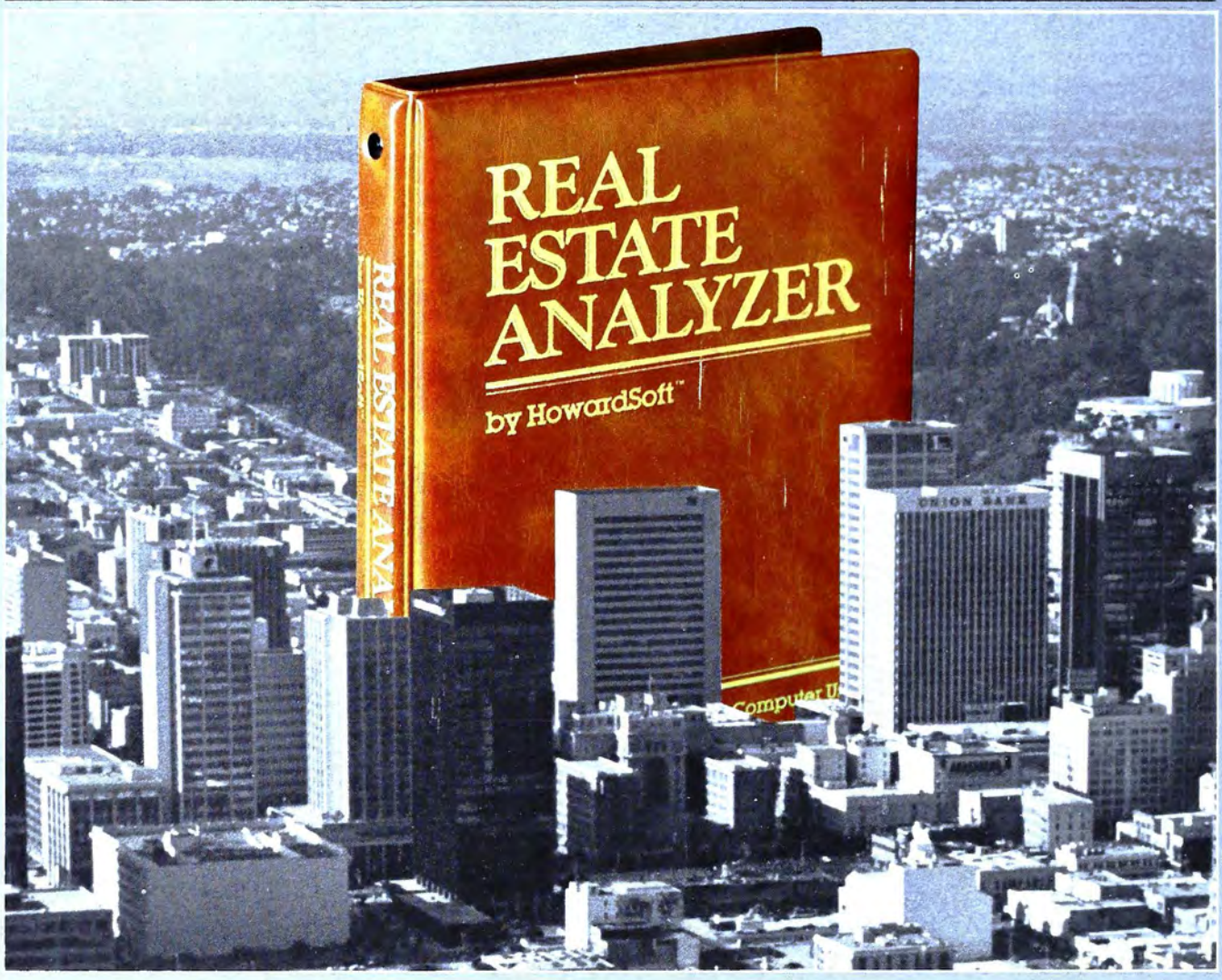


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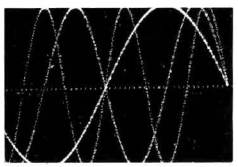
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Owner of the world's largest Apple system and programmer of Buckminster Fuller's World Game, now he's responsible for the world's largest Applesoft prompt—on the Diamond Vision screen at the US Festival.

DAVID HUNTER 82



The IIe's Super-Res Secret

Revision B IIe's—with 128K—allow doubled high resolution or sixteen clear true colors in regular hi-res.

DON WORTH 120



Great Games Are Good for You

When games are well thought out and well made, playing them can improve your mind—and your disposition, too.

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The III That Thinks It's a II Plus Plus

When the Apple III emulates a II, it's a bare-bones II. Here's how to teach your III to call on its own powerful resources to behave like a thoroughly souped-up Plus.

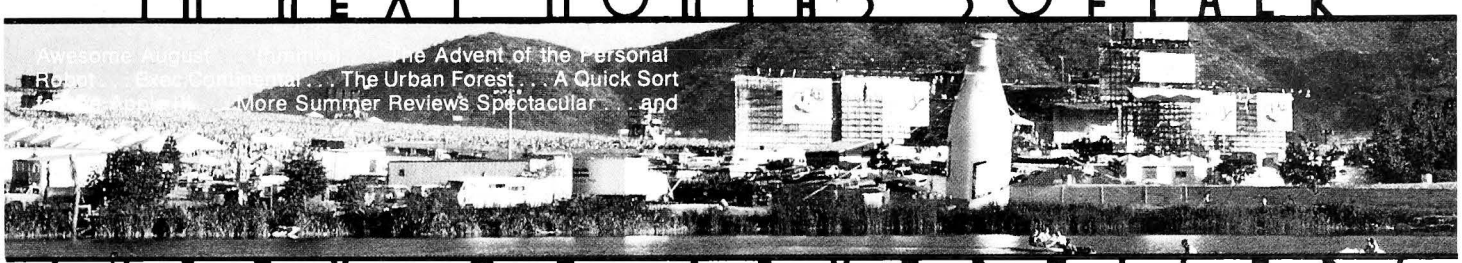
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CONTEST: Design-A-Game Construction Set

You read a game review that says the game is not bad. You go to the store, buy the game, and bring it home to play. The review was right; the game isn't bad. It's horrible. Sound familiar? If you're like most people, it should.

The truth is, the game isn't all that bad—we just have high expectations. And no wonder! After spending all those hours, quarters, and tokens in the local arcades, we've grown accustomed to the smooth graphics, realistic sound effects, and sweaty palms those game machines give us. Let's face it. A big reason we have Apples at home (or in the office) is to be able to recreate similar effects without having to dig out the quarters. Anybody who denies this is either a potential buyer of another computer or a liar.

So where does that leave us? In the dark? In the rain? Incognito? No way! We have a problem, and there's nothing to be gained by closing our eyes and ignoring it. The masses (that's us) will no longer sit and be spoon-fed the mediocrity that game writers settle for just because they want to quit programming early and watch *Gilligan's Island* reruns.

After all, programming games is the occupation they chose, and it's up to them to do it right or not do it at all. And don't settle for any of that "But the Apple has its limits as a game machine" nonsense. We once heard of a guy who wrote a game for the Apple that, when the game ended, would shoot itself through the ceiling and skywrite "Surrender, Dorothy!" all the while playing the theme from *Superman III* in Dolby stereo.

So if the Apple is capable of all sorts of incredible things, then that must mean that today's game programmers simply lack imagination. The ball's in our court, contest fans. This contest, if it's done properly, will revolutionize computer gaming. If nothing else, it will cause the world to sit up and take notice of what this eight-bit, 6502-based baby can do. Rumor has it that Secretary of State George Shultz has already expressed an interest in the Apple as a weapon (for defensive purposes only, of course).

Here's how the contest works. Send us a written description of the ultimate computer game. That's it.

As usual with these kinds of contests, there are no rules; everything is legal. What we want you to describe to us is how the game looks, what the object is, what hardware (real or imaginary) is required, special effects, and anything else you can think of that makes up the ultimate game. Oh, yeah. Don't forget to give your game a title. And be imaginative. Names like *Alien Blaster*, *The Shooting Game*, *Outer Space Experience*, and other dull names will be sneered at and stepped upon.

In this contest, there won't be any moaning about the machine's limits; the only limits are in your imagination. If you're having a rough time getting started, check out the example that follows. That's what we mean by imaginative. Your entry, of course, will be much better.

The only real limit in this contest is the length of your entry. Entries should be no more than one page long. If you type, your entry must be double-spaced. That means an empty line between lines. Hence the name. We're serious. If you handwrite your entry, please write neatly. If we can't read your writing, we can't play your game.

Send in your entry with your name, address, phone number, and vital statistics, postmarked by August 15, 1983.

The best entries, including those that don't win, will be forwarded to computer game publishers around the country to let them know what kinds of games they should be coming out with. Let your voice be heard!

The best entry overall will receive $100 in shiny new merchandise made by our advertisers and will be featured in a special Contest Winners section in our gala Third Anniversary and one month (October) issue. Is that incentive or what?

Now get to work, and more important, have a heck of a good time!

EXAMPLE

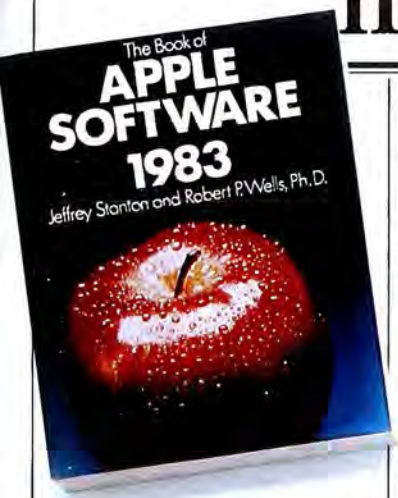
Rocket Robin Hood. This game is the latest arcade offering from Brodersirimost On-Line Software. In this game, you control Socialist Sam, intergalactic redistributor of wealth.

On the screen you see Capitalist Carl and his troops, on their way to this year's debutante ball. Carl and his group are in charge of the ball's budget, so they're the ones you want to rob. Jump his troops when they fly by, and then the real fun begins.

The first round of battle is hand-to-hand fighting between you, your forces (which you control through telepathic impulses to the 6502), and Carl's field fighters.

Hand-to-Hand Combat Grips, by Holy Cow Hardware, are plugged into one of fifteen game ports. The Grips attach to the palms of your hands, measuring the force exerted by your fingers. If you happen to grasp hands with

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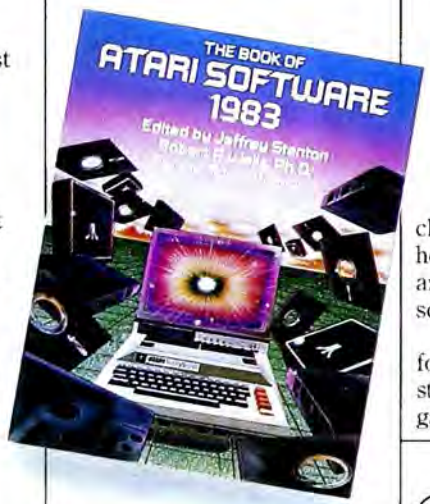
Not only does each evaluation tell you all the hard facts (like price, hardware requirements, language, etc), it also gives you a letter grade (A through F) in categories like Ease of Use, Reliability, and Value for Your Money.

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FUN AND GAMES

Apple Graphics and Arcade Game Design $19.95

It's finally available. Everything you wanted to know about creating arcade games – from Space Invaders to Pacman – but didn't know who to ask.

Jeffrey Stanton takes you from game concept through Lo-Res and Hi-Res color graphics at the machine language level. And he gives you a thorough grounding in the Apple's screen architecture and the advantages of bit-mapped design.

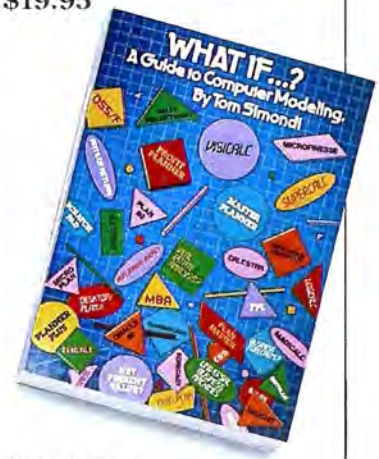


Using flow charts and working examples he discusses scoring, laser fire, and bomb drops in both single screen and scrolling games.

This is the "must-have" book for anyone who wants to understand and create a computer game.

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an opponent, his grip will be exerted through the Grips to your own hands. Thus, you'll be able to actually feel your opponent's strength.

If you manage to beat Carl's field fighters, he'll realize he needs blasters to beat you, and the game will turn into a shoot-out. Unlike the earlier games in this series, in which your blaster was nothing more than a light pen with a trigger, *Rocket Robin Hood* comes with an actual blaster that shoots low-intensity lasers. You see, in *Rocket Robin Hood*, holograms of Carl, his troops, and the surrounding area jump out of the screen and into the room you're in.

If it seems like an unfair fight, it's because the holograms can actually see you; they're mentally controlled by employees of Brodersirimost On-Line at their headquarters.

After you down one of Carl's henchmen, you take their money and credit cards by using the Vacu-Beam (shift control-V). Distributing the money to the poor people is done by focusing your eyes (which optically control the loot shooter) on various destitute neighborhoods.

Send in your entry, postmarked by August 15, to I'm Bored with Games, Softalk, Box 60, North Hollywood, CA 91603. ◨

They call me: _____

I live at: _____

My city, state, and zip are: _____

_____

My telecommunications code: (_____)

_____

And here's what I wanna win: _____

_____

CONTEST WINNERS:

Horsies, Jockeys, And other Fools

No More Fooling Around. Let's get this contest over with. If you think that sounds like we have a negative attitude about the April *Softalk* Fools contest, we'll let *you* score all the entries next time. After opening, judging, and scoring all the entries, the contest staff was dragged away to the North Hollywood Asylum for the Contestly Insane, muttering things like, "Nyah, nyah, you can't make a vegetable out of me!"

Enough is enough. Let's find out who won.

It was a close race, but when it came down to the wire, Ronald Lynch (Honolulu, HI) was the winner. Lynch scored a whopping seventy-six out of a possible eighty-three points to nose out John Beltrami (Buffalo, NY), who totaled an impressive seventy-four (answers and point values are given at the end of the Contest Winners section).

Lynch will have himself a field day when he goes down to Discount Computers to pick up his winnings. Right now, he has his eyes set on Adventure International's *Tunnel Terror*, Penguin's *Spy's Demise*, and the Mach III joystick from Hayes Products.

A special congrats goes to Anthony Chiang (Hercules, CA). Of the hundreds of contestants, he was the only one able to identify rebus number fifteen as a Revlon makeup kit, Ultima II. Tell your parents, Anthony. All those hours spent in front of the television weren't wasted after all.

And Now, the Fools. Spouse wars erupted all over the place because of the Fools contest. Frances L. Grew (Pasadena, CA) hoped she would win "so I can show my husband. He felt I wouldn't be able to get five of them!" Frances scored 80 percent correct, which wins no prizes, but at least a little more respect from Mr. Grew.

Sandy Hagglund (Bloomfield, CT) answered rebus number twenty-four: "This caused several arguments over whether it's *Transend* or *Transforth*. I say it's the former, and my husband insists it's the latter." She: 1. He: 0.

"This is an entry in your Fools contest," wrote Stan Johns (Aurora, CO), "a position my wife assures me I am overqualified for."

Whether you're qualified or not, employment in this great land of ours is still hard to find. To wit, entries from Roger and Ellen Middlebrook (Eugene, OR) came to *Softalk* accompanied by job resumes. At first, we thought they were applying for the position of *Softalk* Fool. More careful reading revealed that they were looking for jobs in the computer field. Resumes are on file in the *Softalk* contest personnel office. Any takers?

The Audubon Society would like to thank Elaine Uomini (Santa Barbara, CA) for smacking our artist on the head. Uomini wrote, "Number seven is a robin (at least, I think *you* think that's a robin. However, robins do *not* have blue feathers with red breasts. Bluebirds have blue feathers and red breasts, and robins have brownish blackish feathers with a red breast)." Though Uomini caught that blooper, she misread the pennies in number twelve as being "meadow muffins or field Frisbees. You can't make a fool out of me! Unless there really is a company, Meadow Muffin Microsoft."

Bulletin! Mother of sloppy son savors smart-aleck insinuations. "From the mother of this month's Slob of the Month," wrote Sonia Kantor (Palo Alto, CA), referring to her son's soiled entry in an earlier contest, "we really enjoyed your comments about Jason. If I win, Jason picks the prize." Sorry, Sonia. Your entry was neater than Jason's, but you didn't win. Have Jason pick up his room instead.

Foolish Behavior. "Number thirty-eight is a file being dissolved: *File Dissolver*," Tim Dieckman (Alma, WI) answered. "This is what I'm going to make to dissolve all my files of *Softalk* at my school if I don't win!" You heard him, faithful readers. Dieckman stepped across the line; so if he's found with carpet fibers up his nose, you'll know he's the one who started it.

Attention, Sandra Caliguire (Ocala, FL): *Ms.* magazine wants you! Fighting the never-ending battle to make bacon bits out of male chauvinists, Caliguire noted, ". . . and in all those pictures, only one woman (who must withstand harassment to boot!)? Phooey! No doubt responses to the [Sierra On-Line] hot-tub-ad fiasco have affected the art department, too. Then again, perhaps the ape and koala are female, thereby redeeming the page, except for those of society who blacklist magazines dealing with naked apes and koalas. Life is foolish, isn't it?"

Rebus number eight caused a lot of trouble. Frequently submitted answers included "three fraternity brothers singing; Three Sigma," "three men holding each other; *Threshold*," and "Who gives a stink?" Perhaps the most original answer for this one came from Richard Gastwirt (Weston, CT), who wrote, "The Beatles wearing dungarees; *Dung Bee-*

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tles." Three Beatles? Poor taste, Richard. Your servitude for such a remark is to listen to all of Ringo Starr's albums in one sitting.

The Central Intelligence Agency and the Secret Service are everywhere, so we dare not laugh (but we snicker) at Dawn Mulhauser's (Ronan, MT) answer to number fifteen. "It's a person doing things on an ass backwards; *Presidents of the U.S.*" Wrong, but still worth a few yucks. Yuck, yuck, yuck, guffaw.

No yucks to Richard E. Hard (San Antonio, TX), who thought he had a real original joke. "I hope you will accept constructive criticism. Don't use addresses such as 'Softalk Fools.' After all, everyone in your organization may receive unwanted mail. P.S. If I win, the above was all a joke." Well, Richard, your joke was about as good as your contest entry.

Is your name here? Sarah Belitz, Ruth Doerr, Christopher Judd, David "Lisa's brother" Oerman, Mike Starks, Andy Hart, and Marcy Fullen. If it is, bring a note from your parents, and set your calendar a day ahead. All your entries were late, but we counted them anyway.

Fooltalk. A lot of people thought rebus number one depicted a guy "soft talking" a girl, leading to the incorrect answer, "*Softalk*." Thomas Johnson (Beaver Falls, PA) got right to the point: "Kind of egotistical to put yourselves first, isn't it?" Egotistical, eh? Read what else Johnson wrote: "When you ran that turkey-counting contest, I counted every darned turkey in the book, got the right answer, and then didn't send it in!" Sure, you did. Uh-huh. Right.

Sam Schwartz (Elkins Park, PA), on the other hand, interpreted number one as "the conversation is superficial. It's *Softalk*." Thanks a heap! If that's the way you feel, go start your own magazine (but keep subscribing to *Softalk*; we still want your money).

Insulting our intelligence even more, Christian Pavlovich (Washington, DC) wrote about number nine, "centaur + e = Syntauri Corp. (see the May *Softalk*)." Pavlovich was last seen scrawling out a letter to George Lucas: "Dear George, I just saw the most awesome movie; it's called *Return of the Jedi*. Have you seen it yet?"

And as usual, we're always interested in what contestants request as prizes. Such requests are good sociological indicators of the present state of microcomputerdom and its inhabitants.

From Eric Chun (Cerritos, CA): "Games, games!"

From Russel Brown (Memphis, TN): "I would like the money."



Peggy Burns of the Game Shop (Acton, MA) presents Lauren Flewelling with his prize for winning the Puns 'n' Anagrams contest in the February issue. Why did Flewelling go to a place called "Game Shop" to pick out a business program? Guess we'll never know.

From Barbara Seidman (North Brunswick, NJ): "I would like a second disk drive, a printer (daisy wheel), all cards necessary for the above plus cards for *VisiCalc*, an eighty-column card with upper and lower case, and a whole bunch of software for my children. If I win this, I deserve all of the above." Well, at least we know where Seidman's children rank.

They're Off! The date was May 7, 1983. The place, Churchill Downs, Louisville, Kentucky. Eighth race. A crowd of 134,444 gathered to watch Eddie Delahoussaye ride Sunny's Halo one and a quarter miles in two minutes, two and one-fifth seconds.

That race won the horse's owner $426,000, which, for two minutes' work, is more than $12.5 million an hour. To win that much in our contests, at $100 worth of merchandise per month, that would take . . . well, a long time.

Chris Decker (Hibbing, MN) didn't want to wait that long, and he settled for winning a mere $100 in prizes. Decker correctly predicted the sex of the winning horse (colt, one point), the winning time (2:02 1/5, zero penalty points), and Eddie Delahoussaye (fifteen bonus points) as the winning jockey.

Decker says he isn't much of a race fan, but when it came down to this part of the Oracle contest, "I dug out a bunch of sports magazines and checked the times of past winners, and I based my prediction on that." Decker will be trekking down to Team Electronics to spend his winnings on a Microcomputer Business Industries MBI Appletime Card.

In case you're wondering about the other answers to this part, the horse's region of origin was foreign, and Sunny's Halo, whom nobody picked, was the winning horse. Decker's winning total was sixteen points. Right behind him were Elizabeth Lewis (Richmond, VA), Hartzell V. Schaff (Rochester, MN), Tracy Bochantin (New Athens, IL), and E. J. Pokorny (Lenzburg, IL), with fifteen points each.

Caveat (third), Roving Boy, and Copelan were contestants' favorite horses, but the latter two didn't run. Laffit Pincay (third), Jorge Velasquez (fifth), and Willie Shoemaker (not present) were the Oracle picks to ride the winner, and only a handful were able to peer into the crystal ball and see Delahoussaye win.

The new tote board is out, and the current leaders and their point totals in the year-long race for the Apple IIe are: Edward Radanovich (Bellevue, NE), fifty; David Miles (Gillette, NY), forty-eight; Michael Wolgelenter (Palo Alto, CA), forty-seven; Carl Webb (Vista, CA), forty-five; and Shirley Young (Farmers Branch, TX), thirty-six. If these numbers don't seem very high, take note that the last-place contestant (no, we won't embarrass you here; we're not *that* mean) is bringing up the rear with negative 1,559 points.

If You Can't Hack It, Fake It. Not everyone was taking this contest seriously. Larry Gilbert (Corvallis, OR), whose other predictions included that Mark Hamill would win the Oscar for best actor, that no teams would make the NCAA Basketball Tournament Final Four, and that Apple would release the Supertronic Game System, thought he was being funny when he predicted that the winner of the Kentucky Derby would be a foreigner. He accidentally was right.

Vernon Conley (Columbus, OH) predicted that the Lone Ranger would be the winning jockey, while Jeff Moyers (Keezletown, VA) picked Herve Villechaize.

On the serious side of things (we'll keep this short), congratulations are due to those few who predicted that the horse would be of foreign origin. They are, in order of neatness in penmanship, Richard Jordan (Memphis, TN), Rick Jones (Spokane, WA), Elizabeth and Charles Lewis (Richmond, VA), Eric Siebert (Lisle, IL), Sandra Wright (Oceanport, NJ), and somebody whose writing we couldn't read (Bob's Big Boy, CA).

Then there was the question of sex. Gregg Johnson (Westerville, OH), Greg Cheong (As-

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toria, OR), and Chris Kogelnik (Rumson, NJ) are three guys who were obviously cutting class when they should have been learning about the birds and the bees. You see, Johnson and Cheong predicted that the winning horse would be a "female colt." Kogelnik, however, couldn't be fooled. His prediction was "male filly."

David Taylor (Chico, CA) exemplifies everything this contest stands for: altruism, honesty, and the love of money. He didn't try to fool anyone by pretending to know about horse racing. Taylor wrote, "If I could predict the outcome of the Kentucky Derby, I'd make a fortune" and wouldn't have to enter contests like these.

So much for altruism.

That's all the fun for now, faithful ones. Keep your eyes glued to these pages for more items and bits about contestants who thought they had it, until *we* let them have it—in front of thousands and thousands of readers. Next month we'll find out how hot it was in San Jose and unwrap a few Maypoles. But until then, keep reading *Games*, *Mad*, and *Softalk*. Over and out.

For What It's Worth. Here are the answers to the rebuses that fooled thousands and made a rich man out of one. All pictures that contained product or company references were worth two points. Those that produced "nyah, nyahs" were worth three.

1. That's a guy using a pickup line on a gal, and she's telling him to drop dead: Infocom's *Deadline*.

2. Sierra mountains on an assembly line: Sierra On-Line.

3. Someone left these eggs in this spacious area: *Space Eggs*, by Sirius.

4. Let's see, a mike, a rowboat, and a train terminal: *Micro/Terminal*, by Microcom.

5. A spotlight: *Spotlight*, from Apple.

6. Why this man is juggling words is anybody's guess: He must be Quark's *Word Juggler*.

7. That's supposed to be a robin with a hood on its head: it's Robin Hood, redistributor of wealth. We couldn't fool you; there's no game or company called Robin Hood. This calls for a "nyah, nyah" (three points).

8. These closely bound brothers represent brotherhood: the Germans call it Broderbund.

9. Brand X? Nope. The centaur is branded with an *E*: Syntauri Corporation.

10. A castle, a wolf, and a stein: *Castle Wolfenstein*, by Muse.

11. Lightning: Lightning Software.

12. Some cents and a bull. Bull sense? Nonsense; cents, bull: Sensible Software.

13. This makeup kit from Revlon is known as Ultima II: Sierra On-Line's *Ultima II* should have been obvious. Spinnaker's *Facemaker* was a popular answer.

14. The blitz is on for the quarterback who's attempting to throw a cannonball: *Cannonball Blitz*, again by Sierra On-Line.

15. He's a "tech" sort of fellow sitting on an ass. That makes him an ass-tech: Datamost's *Aztec*.

16. Here's one nobody got. That's straw forming a *T* on a sample (simulation of a) check. Straw + *T* + check + simulation = Strategic Simulations. Did you think this was going to be easy?

17. Snoopy the beagle has left a bag on his house: *Beagle Bag* from Beagle Bros.

18. It's raining E.T.s. E.T. was an alien, which makes this Broderbund's *Alien Rain*. Apple Galaxians were too hard to draw.

19. Not bowl *A*, and not bowl *Z*. It's bowl *O*, or *Bolo* from Synergistic. You should have spit on this bad pun.

20. The gravestone says "Here lies a Greek letter *A*." That makes it an *Alpha Plot*, by Beagle Bros.

21. We thought this was a giveaway. A riding crop and a duster. Slipshod's *Cropduster*, what else? Yep, this is a "nyah, nyah" (three points). Informed readers ought to know Slipshod went out of business months ago, and they never did publish a program called *Cropduster*. It was an illusion.

22. Here are two possible solutions to a crime, and they're sitting on top of a desk: Desktop Solutions.

23. Marvel Comics Group never picked up this pi-man as a superhero character, but Penguin did: *Pie Man*.

24. The arrow is pointing to *tran*'s end: *Transend*, by SSM Microcomputer Products.

25. This quick file folder was the first to cross the finish line: Apple's *Quick File*.

26. Isn't it cute? A little koala drinking some koala tea: Quality Software.

27. Only a few people saw Kant in this tall *N* as "Kant in N tall": Continental Software.

28. Was the navy waving hello or good-bye? It doesn't matter. They're always like that because they're a *Wavy Navy* from Sirius.

29. It's an *A* that's counting, accompanied by a plus two: *Accounting Plus II* from Software Dimensions.

30. The ape in the rill is being watched by the fool: April Fool. Uh-huh, another "nyah, nyah" (three points).

31. Lucy in the sky . . . whoops! It's a night of diamonds: Sir-tech's *Knight of Diamonds*.

32. We're not taking a political stand. It's just a cross on fire: *Crossfire*, once again by Sierra On-Line.

33. Those pieces of art are sighing: Artsci.

34. Don't make such a big deal out of it; it's just an accent: Accent Software.

35. When the king falls, it's checkmate. In this case, it's Masterworks's *Chequemate*.

36. What it did, no one knows. Nonetheless, this two is a prisoner. *Prisoner 2* from EduWare.

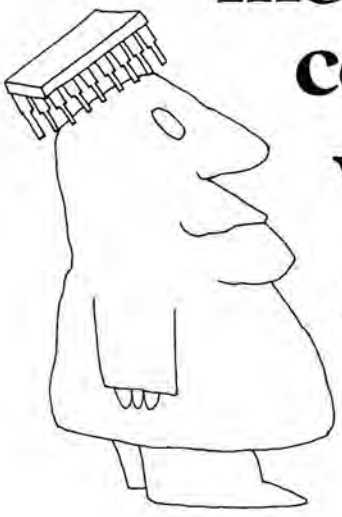
37. Writing on a street of banks makes this man Broderbund's *Bank Street Writer*.

38. Horrible Pun Department: the file is sitting in fizzy water, making it a fizzy file: *VisiFile*, by VisiCorp.

39. Not too hard; this is a man lifting a giant pork chop. He's Broderbund's *Choplifter*.

40. Here's an easy one to wrap it up. The guy writing on his apple is an *Apple Writer*. ◨

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FASTALK

Fastalk is a quick guide to popular, specialized, new, and classic software. When you need a particular kind of program or just want to see what's new, Fastalk is the place to look for fast answers.

If a program has been reviewed in *Softalk*, it carries the issue date of the review in italics at the end of its listing, and the capsule description given reflects the published review.

A new software entry, which must be of professional quality to be included, is designated by a check mark preceding its name. A new entry loses its check mark after its first appearance and drops out of Fastalk after one to three appearances (depending on genre) if it fails to gain popularity.

A bullet preceding a title indicates a program that *Softalk* has designated as a classic, based on its ability to stand up over time, its significance for its time (breaking new ground or introducing a new genre), or its archetypal qualities.

Other entries in Fastalk are there either by virtue of current activity (the programs are selling at least as much as the least-selling entry on any of the bestseller charts) or because they are representative of the best of programs for a special interest or need (such as card games or non-Basic-specific language terminal programs).

Softalk may arbitrarily omit any package from Fastalk, whether or not it meets the foregoing criteria.

Adventure

Adventuresome story games in which players must deduce commands, make maps, and solve logical puzzles.

● **Adventure.** Crowther, Woods. The original text adventure, created on mainframe, contributed to by many over a long time. Very logical within fantasy framework, excellent puzzles, maps; complex, convoluted, and great. Several publishers: Microsoft, 10700 Northup Wy., Bellevue, WA 98004. $28.95. Apple, 20525 Mariani Ave., Cupertino, CA 95014. $35. Frontier Computing, Box 402, 666 N. Main St., Logan, UT 84321. $10.

Critical Mass. Blauschild. Rungistanian author's next adventure; more colorful graphics, sophisticated and challenging puzzles. Sirius, 10364 Rockingham Dr., Sacramento, CA 95827. $39.95.

● **Cyborg.** Berlyn. Text adventure with brief action skill game hidden in plot. As a futuristic part man, part robot, you're lost in a strange forest, desperately needing food and power. At its release, in its realism and use of true plot, *Cyborg* represented one of the most significant advances in adventuring since the original *Adventure*. Sentient, Box 4929, Aspen, CO 81612. $32.95. *11/81.*

The Dark Crystal. Williams. Hi-res adaptation of fantasy movie. New puzzles challenge even those who've seen the movie. Sierra On-Line, Sierra On-Line Building, Coarsegold, CA 93614. $39.95. *4/83.*

Deadline. Blank, Lebling. Episode one in a series of murder mysteries by the authors of *Zork*. Includes inspector's casebook, lab report. Text. Infocom, 55 Wheeler St., Cambridge, MA 02138. $49.95. *8/82.*

Escape from Rungistan. Blauschild. Graphics adventure with some animated real-time puzzles. Espionage theme. Sirius, 10364 Rockingham Dr., Sacramento, CA 95827. $29.95. *8/82.*

Escape from Traam. Pearson, Sailer. You crash on a world no human has seen. Its strange beauty hides danger that makes escape imperative. Adventure International, Box 3435, Longwood, FL 32750. $29.95.



● **Hi-Res Adventure #1: Mystery House.** Williams. Whodunit in a Victorian mansion. First adventure with pictures. Two-word parser with logical comprehension. Sierra On-Line, Sierra On-Line Building, Coarsegold, CA 93614. $24.95.

Mask of the Sun. A unique animated graphic quest with full though sometimes frustrating parsing. Moving from room to room involves seeing scenery along the way go by—a graphics breakthrough with nice puzzles. Ultrasoft, 12503 Bell-Red Rd., #200, Bellevue, WA 98005. $39.95. *11/82.*

● **Prisoner 2.** Mullich. Totally relandscaped but loyal version of original game: full-color hi-res graphics added, puzzles reworded, obstacles expanded. Sophisticated and difficult exercise in intimidation with elements of satire. Escape from an island requires player to solve logical puzzles, overcome obstacles, and answer riddles. Excellent computer fare; nothing else like it. Edu-Ware, Box 22222, Agoura, CA 91301. $32.95. *The Prisoner, 3/81; Prisoner 2, 10/82.*

✓ **The Quest.** Snell, Toler, Rea. As the king's newest advisor, you must accompany a champion on a dragon-slaying mission. Champion, parser accept advice in full and multiple sentences. Penguin, 830 4th Ave., Geneva, IL 60134. $19.95.

● **S.A.G.A. Series.** Adams. Scott Adams's prototypical adventures—12 in all—spruced up with 100-color graphics and Votrax vocals. Fun, not always logical, very story-oriented series. Each adventure has its own theme and often exotic locale. They map small but score big on imagination. Adventure International, Box 3435, Longwood, FL 32750. $29.95 each.

Serpent's Star. Anson, Clark, Franks, Ormsby. Mac Steele searches the Himalayas for a legendary sapphire in *Mask of the Sun* sequel. Traps are less obvious. Delightful glimpse of a faraway mystical land. Ultrasoft, 12503 Bell-Red Rd., #200, Bellevue, WA 98005. $39.95. *4/83.*

Sherwood Forest. Holle, Johnson. Dating game in legendary times. In premier *Softoon* adventure featuring neat UltraRes graphics. Robin Hood woos Maid Marian all the way to the honeymoon. Go for it. Phoenix Software, 64 Lake Zurich Dr., Lake Zurich, IL 60047. $34.95. *3/83.*

Starcross. Science-fiction prose adventure that comes wrapped in a flying saucer. Set in the year 2186, main puzzle is to discover *raison d'etre* of miniworld asteroid. Likable, engaging. Infocom, 55 Wheeler St., Cambridge, MA 02138. $39.95. *11/82.*

Suspended. Berlyn. Well-plotted adventure demands control of six independent robots who can act simultaneously. Intelligent, challenging exercise in logic. A milestone. Infocom, 55 Wheeler St., Cambridge, MA 02138. $49.95. *4/83.*

● **Swordthrust Series.** Set of adventures, seven so far, that integrate fantasy role playing. Create one character, make friends in each new adventure, battle monsters and achieve goals together. Good stories, fun to map. Vocabulary no mystery, but puzzles are. Single character goes through all. CE Software, 801 73rd St., Des Moines, IA 50312. Number 1 prerequisite for rest. Each adventure, $29.95. *8/82.*

Transylvania. Antiochia. Some of best graphics ever in a hi-res adventure. Excellent puzzles and logic—no unfair tricks. Enjoyable. Penguin, 830 4th Ave., Geneva, IL 60134. $34.95. *6/81.*

✓ **Witness.** Galley. It's 1938, a society woman is dead, the killer is loose and may strike again. You have 12 hours to figure out whodunit before someone else takes the deep six. It may be you. Infocom, 55 Wheeler St., Cambridge, MA 02138. $49.95.

● **Zork I, II, III.** Text lives! Three masterpieces of logic and grand adventure to revel in. Hard, logical puzzles with erudite parser that understands complete compound sentences and questions, has amazing vocabulary. *I* and *II* use standard scoring, standard goals; *III* has unique point system, and benevolence conquers. Infocom, 55 Wheeler St., Cambridge, MA 02138. $39.95. *Zork I, 6/81*; *Zork II, 3/82*; *Zork III, 9/82*.

Business

Accounting Plus II and **IIe.** *II* version is integrated package; general ledger, accounts receivable and payable, and inventory-purchasing modules. Menu-driven; prompting. *IIe* version is stripped and rebuilt to take advantage of available functions. Software Dimensions, 6371 Auburn Blvd., Citrus Heights, CA 95610. *II*, $1,250; *IIe*, $995.

Apple II Business Graphics. Converts numerical data into charts and graphs. Features mathematical and statistical functions. Requires 64K. Apple, 20525 Mariani Ave., Cupertino, CA 95014. $175.

BPI System. Popular six-module business package; programs also available separately. Includes General Ledger (a bestseller), accounts receivable, accounts payable, payroll, inventory control, and job costing. Apple, 20525 Mariani Ave., Cupertino, CA 95014. $395 each; job costing, $595.

Cdex Training for VisiCalc. Brandt. Self-contained Apple-assisted training program and reference guide for the #1 electronic spreadsheet. User-selectable information. Cdex, 5050 El Camino Rd., Los Altos, CA 94022. $49.95. *3/83*.

dBase II. Speedy relational database-management system. Requires SoftCard. Ashton-Tate, 9929 W. Jefferson Blvd., Culver City, CA 90230. $700.

DB Master. Comprehensive database-management system with password protection, extensive report creation options. 1,000 characters per record. Stoneware, 50 Belvedere St., San Rafael, CA 94901. $229. *10/81*.

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1st Class Mail. Schoenburg, Pollack. Fantastically user-friendly program for specialized database applications. Twelve fields, ability to sort and filter on any field or combination. Continental, 11223 S. Hindry Ave., Los Angeles, CA 90045. $74.95. *6/82*.

General Manager. User-definable database-management system; can use one to four disk drives or hard disk. Change screen and field formats without reentering data. Current version supports IIe and 80-column card at no extra cost. Sierra On-Line, Sierra On-Line Building, Coarsegold, CA 93614. $229.95. Hard-disk version, $374.95.

The Incredible Jack. Word processor, database, and spreadsheet, plus mailing label print and sort. Gives 80-column u/lc display automatically on the IIe, with 64K, 80-column card on the II Plus. Business Solutions, 60 E. Main St., Kings Park, NY 11754. $129.

✓ **Infostar.** Hajicek, Collier, Rubinstein. Database management for nonprogrammers. Maintains updates, generates simple or customized reports. MicroPro, 33 San Pablo Ave., San Rafael, CA 94903. $495.

List Handler. List-lover's delight. Prints lists, labels, and letters. Handles 3,000 records per disk and eight disk drives. Takes requests. Silicon Valley Systems, 1625 El Camino Real, #4, Belmont, CA 94002. $89.95. *2/83*.

Multiplan. Easy-to-learn electronic work sheet using plain-English commands. Powerful modeling and presentation capabilities. For use in analysis, forecasting, technical engineering, and the home. Versions 1.04 and up use 80 columns and extended memory on the IIe. Microsoft, 10700 Northup Wy., Bellevue, WA 98004. $275.

Payroll. Faulkner. Handles payroll accounting, report generation, and check writing for 300 employees in 15 divisions at Pascal speeds on non-Pascal-equipped Apple computers. Two disk drives required. Broderbund, 1938 4th St., San Rafael, CA 94901. $395.

PFS:File. Page, Roberts. User controls data in totally unstructured database. Up to 32 pages (screens) of information in each record. IIe version has 80 columns, u/lc. Software Publishing, 1901 Landings Dr., Mountain View, CA 94043. $125. *10/80*.

PFS:Graph. Chin, Hill. Works alone or interfaces with files created with *PFS:File* and *VisiCalc*. Produces bar, line, and pie charts merging data from several sources. 80 columns and increased graphics support in IIe version. Software Publishing, 1901 Landings Dr., Mountain View, CA 94043. $125. *5/82*.

PFS:Report. Page. Powerful report generator designed for use with *PFS:File*. Sorts, calculates, totals, formats, and prints presentation-quality columnar reports. Software Publishing, 1901 Landings Dr., Mountain View, CA 94043. $125. *6/81*.

Quick File IIe. Easy-to-use personal database filing system. Fifteen fields; files as long as disk allows. IIe, two disk drives. Apple, 20525 Mariani Ave., Cupertino, CA 95014. $100.

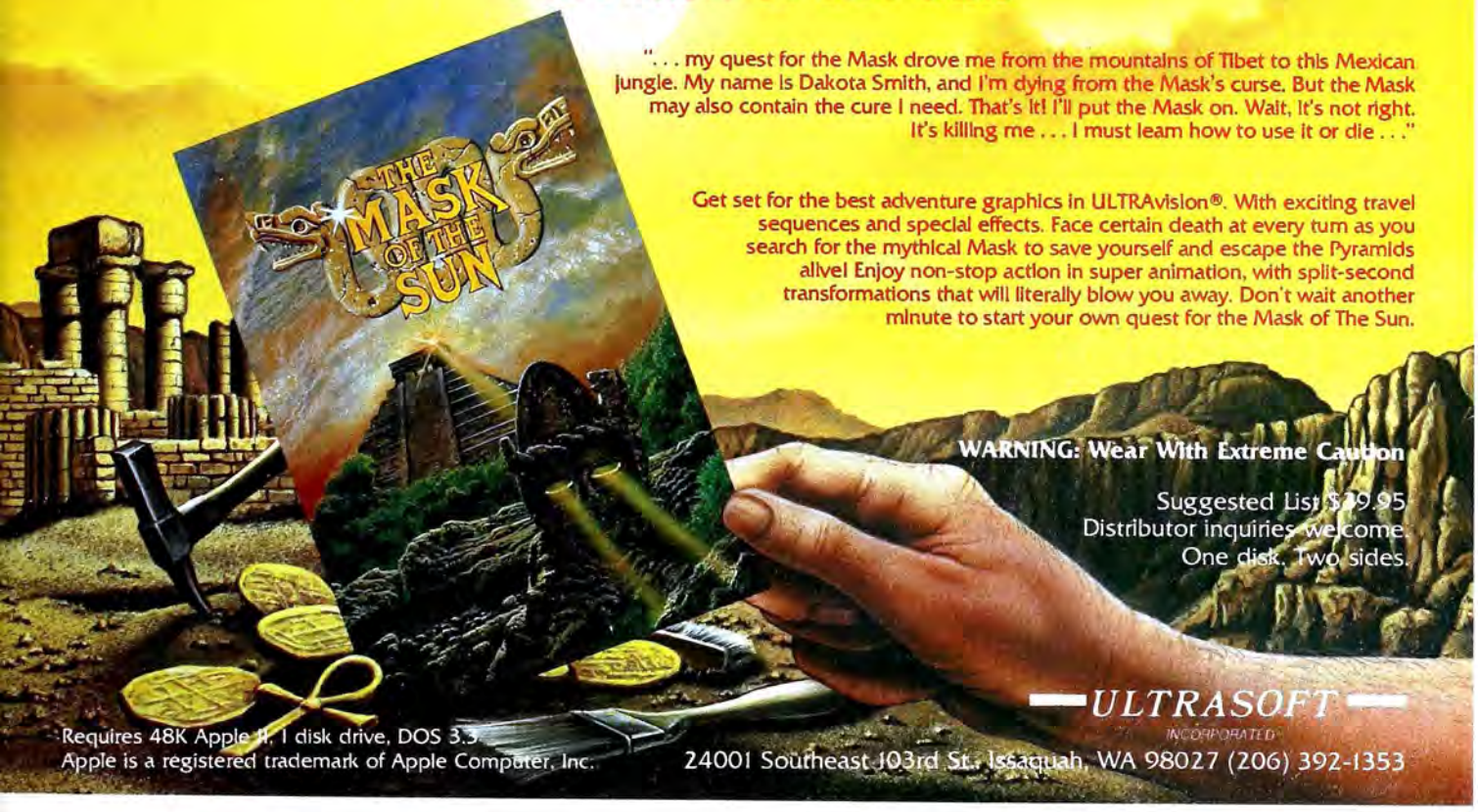
Risk Simulator. Estimates probability distributions related to risk situations, such as automobile maintenance expenses or employer funding of health benefits. Actuarial Microcomputer Software, 3915 Valley Ct., Winston-Salem, NC 27106. $185.

State of the Art General Ledger and **Budget Forecasting Module.** The ledger does 12-period accounting, two-digit subaccounts; handles up to 470 accounts; enters 100 transactions before updating to permanent files. Budget module extends account number to nine

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RHYMES & RIDDLES™ come to life. Ages 5 to 9.



RHYMES & RIDDLES will delight your children. Because when they successfully complete the rhymes, riddles, and famous sayings on the screen, they'll see them come to life–with music and colorful pictures. And RHYMES & RIDDLES not only teaches children the correct lyrics to nursery rhymes and famous sayings. It also helps kids learn to read and spell while they're having fun! That's why parents like RHYMES & RIDDLES, too!

KINDERCOMP™ Numbers, shapes, letters, words and drawings make fun. Ages 3 to 8.



KINDERCOMP is a game that allows very young children to start learning on the computer. It's a collection of learning exercises that ask your children to match shapes and letters, write their names, draw pictures, or fill in missing numbers. And KINDERCOMP will delight kids with colorful rewards, as the screen comes to life when correct answers are given.

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SPINNAKER™
We make learning fun.

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digits; custom designs reports; does previous-year comparisons. State of the Art, 3183A Airway Ave., Costa Mesa, CA 92626. $495, budget module, $395.

VersaForm. Business-forms generator for invoicing, mailing lists, sales analysis, inventory. Hard-disk-compatible. Applied Software Technology, 14125 Capri Dr., Los Gatos, CA 95030. $389. *6/82.*

● **VisiCalc.** Bricklin, Frankston. Electronic work sheet for any problem involving numbers, rows, and columns. No programming necessary. VisiCorp, 2895 Zanker Rd., San Jose, CA 95134. $250. *10/80.*

VisiFile. Creative Computer, Jameson, Herman. Database-management information system for organization and retrieval of information, allowing sort and modification of records. VisiCorp, 2895 Zanker Rd., San Jose, CA 95134. $250.

VisiTrend/VisiPlot. Kapor. Combines *VisiPlot* graphics with time-series manipulation, trend forecasting, and descriptive statistics. VisiCorp, 2895 Zanker Rd., San Jose, CA 95134. $259.95. *7/81.*

Communications

Apple Link. Jaffe, Pierce. Creates intelligent terminal at receiving end with no additional software. Only modem software known that can transmit *ScreenWriter* text files. Also transmits random access text files. Computer Applications, 13300 S.W. 108 Street Circle, Miami, FL 33186. $59.95.

ASCII Express: The Professional. Robbins, Blue. Greatly improved version of original modem software package features automatic redial, individual macro files, and conversion of Integer, Applesoft, or binary programs into text files. Works with a plethora of hardware. Southwestern Data, 10761-E Woodside Ave., Santee, CA 92071. $129.95. *12/82.*

Data Capture 4.0. Copyable, modifiable smart terminal program; compatible with Apple III and most lower-case adapters. Southeastern Software, 6414 Derbyshire Dr., New Orleans, LA 70126. $65.

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F. DISPB—DISPLAYS BINARY FILE INFORMATION
G. SEARC—CAN SEARCH MEMORY OR JUST APPLESOFT PROGRAM FOR DATA. ARGUMENT CAN EITHER BE IN HEX. OR ASCII. CAN REQUEST A LINE NUMBER OR AN ADDRESS OR FOR A DIS-ASSEMBLED LISTING OR FOR THE NEXT 256 CHARACTERS DISPLAYED IN HEX AND ASCII. CAN ALSO DISPLAY FREE SPACE ON DISK(S).

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MUD

7/83

Dow Jones Connector. Guide to the use of the company's News/Retrieval Service and Blue Chip membership, too. Dow Jones Software, Box 300, Princeton, NJ 08540. $95.

Hayes Terminal Program. Standalone disk designed for the Micromodem II lets CP/M, DOS 3.3, and Pascal disks create, list, delete, send, and receive files. Opens access to nonkeyboard ASCII characters and prints incoming data as it's displayed. Hayes Microcomputer Products, 5835 Peachtree Corners East, Norcross, GA 30092. $99.

Micro/Courier. Electronic mail program. Provides file transfer of any DOS 3.3 file (correspondence, *VisiCalc*, charts) automatically and unattended, connected to another *Micro/Courier*. Built-in text editor; maintains 100 mailboxes; permits optional clock and calendar scheduling. Microcom, 1400A Providence Hwy., Norwood, MA 02062. $250.

Micro/Terminal. Access and exchange information with mainframes and minis, databases like the Source, and other remote terminals and personal computers. Allows keyboard mapping, u/lc, 80-column cards. Microcom, 1400A Providence Hwy., Norwood, MA 02062. $84.95.

P-Term: The Professional. Supports all Pascal-compatible interfaces, asynchronous serial cards, Apple-compatible modems, and baud rates up to 2400. Southwestern Data, 10761-E Woodside Ave., Santee, CA 92071. $129.95.

Softerm. Emulation program makes the Apple II Plus into a look-alike for many other popular CRT terminals, allowing use of programs written for other terminals without programming changes. Also enables access to mainframes, timesharing services, and other Apple computers. Keyboard macros and automatic answerback capabilities. Softronics, 6626 Prince Edward, Memphis, TN 38119. $150.

✓ **TermExec.** O'Neil. Turns Apple with modem into an intelligent terminal workstation. Features unattended long file capture, 300 or 1200 baud operation, backscrolling, edited file capture of past terminal sessions from scrolling buffer, full-screen editor, macros, execs for most modems. Exec Software, 201 Waltham St., Lexington, MA 02173. $79.95.

Transend 1, 2, 3. Intelligent-terminal software with multiple hardware compatibility. Advanced, easy to use. *1* sends text only; menu-driven, limited editor. *2* sends text and files like *VisiCalc*, verifies transmission. *3* does both and handles electronic mail with automatic redial, clock calendar, and password protection. Upgrade: difference in price between two packages plus $20 service fee. SSM, 2190 Paragon Dr., San Jose, CA 95131. $89, $149, $275. *9/82.*

Z-Term: The Professional. More than an update. Compatible with a great variety of modems, interface cards, and screen modes. Simple file transfer with integrity. Southwestern Data, 10761-E Woodside Ave., Santee, CA 92071. $149.95.

Fantasy

Role-playing games involving characters that develop through experience in adventuresome stories, and whose actions players determine via set commands.

● **Beneath Apple Manor.** Worth. The original dungeon game for the Apple, created in 1978. Newly released version has hi-res, sound effects, a few more magic items, but still the classic game. Quality, 6660 Reseda Blvd., Reseda, CA 91335. $29.95. *2/83.*

Knight of Diamonds. Second scenario of *Wizardry*, requiring thirteenth-level characters from the original. Individual quests on each of six dungeon levels. Great. Sir-tech, 6 Main St., Ogdensburg, NY 13669. *7/82.*

✓ **Legacy of Llylgamyn.** Greenberg, Woodhead. Third scenario in classic *Wizardry* series. To save Llylgamyn, descendants of the adventurers of *Wizardry* scenarios (requires *Overlord*) must wrest a mystical orb from the dragon L'Kbreth. New full-screen dungeon, Lisa-like information screens. Sir-tech, 6 Main St., Ogdensburg, NY 13669. $39.95.

Missing Ring. Romine. Find wizard's missing ring alone, or with the help of up to four independent characters. Task becomes more complex as number of players increases. Datamost, 9748 Cozycroft Ave., Chatsworth, CA 91311. $29.95.

● **Odyssey: The Compleat Apventure.** Clardy. Fantasy adventure far beyond one place and one setting. Castles, catacombs, an ocean voyage, and the orb of power. Synergistic, 830 N. Riverside Dr., #201, Renton, WA 98055. $30. *10/80.*

● **Temple of Apshai.** Lead title in *Dunjonquest* series, winner 1981 Academy of Adventure Gaming Arts and Design "Computer Game of the Year" award. Epyx/Automated Simulations, 1043 Kiel Ct., Sunnyvale, CA 94086. $39.95.

● **Ultima.** British. Hi-res color adventure, progressing from Middle Ages to beyond the space age. A masterpiece. California Pacific, 757 Russell Blvd., Davis, CA 95616. $39.95. *6/81.*

Ultima II. British. Faster play in a bigger universe with a time-travel option. Typically British look and feel. Events are much more interdependent; larger realm of fantasy with more transactions available. Sierra On-Line, Sierra On-Line Building, Coarsegold, CA 93614. $59.95.

● **Wilderness Campaign.** Clardy. First fantasy game to leave the dungeon for the great outdoors; first in hi-res; first to bargain with merchants; and more. Synergistic, 830 N. Riverside Dr., #201, Renton, WA 98055. $17.50.

● **Wizardry.** Greenberg, Woodhead. Ultimate role-playing fantasy; ten-level maze in hi-res. Generate 20 characters, six at a time on expeditions. Gripping game; superbly reproduced. Sir-tech, 6 Main St., Ogdensburg, NY 13669. $49.95. *8/81.*

Graphics

Alpha Plot. Kersey, Cassidy. Hi-res graphics and text utility with optional xdraw cursor and proportional spacing. Beagle Bros., 4315 Sierra Vista, San Diego, CA 92103. $39.50.

The Complete Graphics System. Pelczarski. A wealth of graphics tools at a reasonable price. Make 2-D drawings with game paddles, add text in destructive, nondestructive, or reverse modes; create 3-D figures and shape tables. Manual features complete outline of command structure. Penguin, 830 4th Ave., Geneva, IL 60134. $69.95; Apple Graphics Tablet version, $119.95. *7/81.*

✓ **Fontrix.** Boker, Houston. Character generator creates unlimited number of typefaces, uses them to write on a screen extended 16 times. Extremely significant development in graphics. Data Transforms, 616 Washington St., #106, Denver, CO 80203. $75.

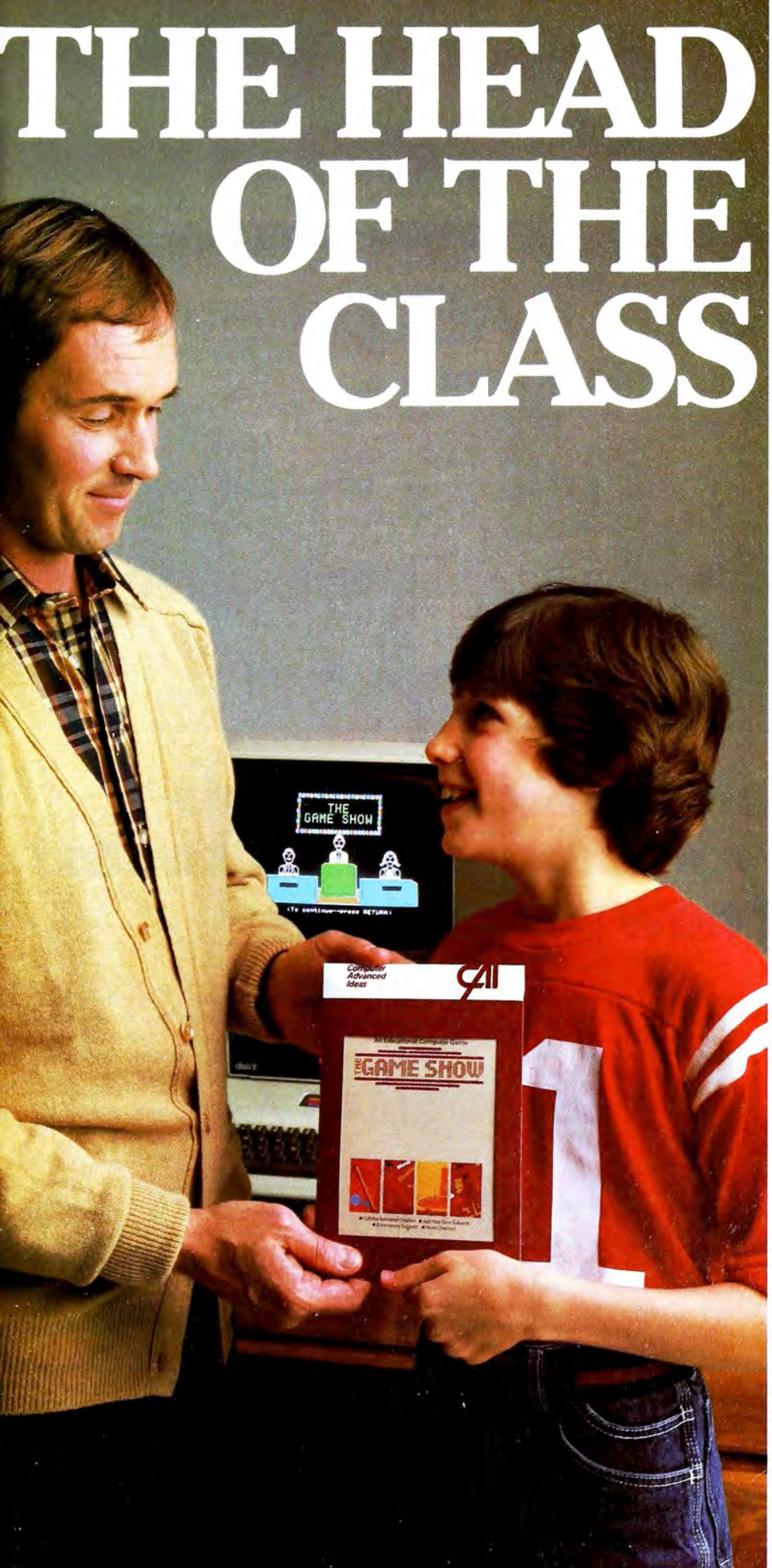
GraForth. Lutus. A graphics language rewritten for maximum speed. Plotting, line, text display, character image, and high-speed 3-D graphics, with variety of colors and drawing options. Includes music synthesizer. Insoft, 10175 S.W. Barbur Blvd., #202-B, Portland, OR 92719. $75. *8/82.*

The Graphics Magician. Jochumson, Lubar, Pelczarski. Outstanding animation package consisting of picture editor and shape-table extender. Comes with utility program to transfer binary files. Penguin, 830 4th Ave., Geneva, IL 60134. $59.95; Apple Graphics Tablet version, $69.95. *5/82.*

LPS II. Superb hi-res-graphics drawing system with light pen. Draw freehand or use circles and lines to create geometric shapes. Fill routine with colors and patterns; fun animation demo; programmable Pentrak driver. Gibson, 23192-D Verdugo Dr., Laguna Hills, CA 92653. $349. *10/82.*

Zoom Grafix. Holle. Graphics-printing utility allows display of picture on-screen prior to print; prints out selected portion at any size. Phoenix, 64 Lake Zurich Dr., Lake Zurich, IL 60047. $39.95. *2/82.*

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Home

The Accountant. Forman. Simple-to-use double-entry finance system features seven integrated files and a set of automatic transactions. A sleeper just beginning to get wider distribution. Decision Support, 1438 Ironwood Dr., McLean, VA 22101. $129.95. *1/82.*

The Beer Game. Raymer. Quiz game and database of almost every brand of beer available in the United States. Records brands you know, then compares to the grand-total list. An obvious labor of love. BPC, Box 74157, Los Angeles, CA 90004. $10.

Bowling Data System. Data Dynamics. Two-disk record-keeping and report-preparation program for infinite number of leagues, up to 40 teams. Weekly recap, season average, more. Rainbow Computing, 9719 Reseda Blvd., Northridge, CA 91324. $149.95.

● **Crossword Magic.** Crossword puzzle maker. Choose subject, words, and clues; program automatically connects words. Play on-screen or make printout. L&S Computerware, 1589 Fraser Dr., Sunnyvale, CA 94087. $49.95.

Dow Jones Market Analyzer (formerly *RTR Market Analyzer*). Automatically collects, stores, and updates historical and daily market quotes. Provides technical analysis and plots 18 different types of charts. Dow Jones Software, Box 300, Princeton, NJ 08540. $350.

Family Roots. Professional genealogy database with unlimited-records capability. Unprotected; works with 80-column and u/lc. Extensive documentation. Quinsept, Box 216, Lexington, MA 02173. $185.

Golf Statistician. Haberle. Helps golfers lower their scores by examining their strengths and weaknesses. GolfSoft, 10333 Balsam Ln., Eden Prairie, MN 55344. $34.95.

✓ **Hi-Res Versatile Calculator.** Tackaberry. Transforms computer into scientific calculator that performs functions in four bases and converts between them. Features ASCII code display and four stack registers. Tackaberry Software, Box 2857, Ormond Beach, FL 32074. $59.95.

Home Accountant. Schoenburg. Thorough, powerful home finance program. Monitors five checking accounts against a common budget, plus credit cards and cash; one-step record or transfer of funds. Continental, 11223 S. Hindry Ave., Los Angeles, CA 90045. $74.95. *4/82.*

Hoss. Calhoun. Systematic Thoroughbred handicapping with user modeling coefficients. Five systems and handbooks. Tout, 360 S. Gordon St., Pomona, CA 91766. $89.

Know Your Apple, Apple IIe. Visually oriented computer tutorials with manuals. Cover disks, drives, and peripherals. Models of clarity. Muse 347 N. Charles St., Baltimore, MD 21201. *Know Your Apple*, $34.95; *Know Your Apple IIe*, $24.95. *Know Your Apple, 3/83.*

Micro Cookbook. Recipe-management system allows entry and modification; selection of recipes by common ingredients, name, or classification. Calorie and nutrition guide. Virtual Combinatics, Box 755, Rockport, MD 01966. $40. *6/83.*

Money Street. Payne. Does accounting, collects data, and balances an unlimited number of checkbooks. 100 user-defined categories, 13 reports. Computer Tax Service, Box 4845, Incline Village, NV 89450. $99.95.

Personal Finance Manager. Gold, Software Dimensions. Handles 200 entries a month from 14 separate accounts. Search-sort-enter routine. Apple, 20525 Mariani Ave., Cupertino. CA 95014. $75. *11/81.*

Pick That Tune. Swearingen. Just like the famous show of almost the same name. Players select the number of notes they think they'll need to I.D. any melody in Pop, Country/Western, Children, and TV categories. Sixteen variations, 1 to 10 players. Additional categories purchased separately. Swearingen Software, 6312 W. Little York, #197, Houston, TX 77088. $29.95. *6/83.*

✓ **Power of Words.** Funk. Ten interactive word games by the author of the *Reader's Digest*'s "It Pays to Enrich Your Word Power." Humor, graphics, auditory clues demonstrate words and reinforce memory. Funk Vocab-Ware, 4825 Province Line Rd., Princeton, NJ 08540. Two disks, $49.95.

Tax Preparer. Record-keeping program with wide variety of federal tax forms and schedules; creates itemized lists. Yearly updates. Howard Software, 8008 Girard Ave., #310, La Jolla, CA 92037. $99.

ThinkTank. Idea processor program allows you to see ideas in outline form. Outline can be collapsed to see the big picture or expanded to reveal hidden details. Living Video Text, 450 San Antonio Rd., #56, Palo Alto, CA 94306. $150.

Home-Arcade

Fast-action skill games; may include elements of fantasy.

A.E. Horai. Blast away like mad in 3-D. Time the release and detonation of missiles and repel the next wave. Innovative graphics, new firing technique, and fugues to boot. Broderbund, 1938 4th St., San Rafael, CA 94901. $29.95. *2/83.*

● **Alien Rain**. Suzuki. Monsters in this classic seem to take it personally when you gun down one of their own kind. Broderbund, 1938 4th St., San Rafael, CA 94901. $29.95. *9/81.*

● **Apple Panic.** Serki. Rid a five-story building of crawling apples and butterflies by running up and down connecting ladders, digging traps, then covering critters before they devour you. Extremely addictive, excellent hi-res play. Broderbund, 1938 4th St., San Rafael, CA 94901. $29.95. *9/81.*

The Arcade Machine. Jochumson, Carlston. Step-by-step arcade-game designer—shapes, scoring, sound, and titles. Begin with variations on five games included, then on to your own. Broderbund, 1938 4th St., San Rafael, CA 94901. $59.95. *11/82.*

Aztec. Stephenson. Graphic fantasy arcade with animation throughout. Datamost, 8943 Fullbright Ave., Chatsworth, CA 91311. $39.95. *1/83.*

Canyon Climber. Mountford. Scale the levels and ladders while avoiding arrows, gorges, and hi-res sheep (no cows). Datasoft, 19519 Business Center Dr., Northridge, CA 91324. $29.95.

● **Choplifter.** Gorlin. Fly your chopper to rescue 64 hostages, avoiding interceptor jets, homing mines, and tanks. Challenging, realistic, and playful. Stunning graphics. Broderbund, 1938 4th St., San Rafael, CA 94901. $34.95. *7/82.*

Crime Wave. Your beat: the city. Bank robbers strike; can you catch them? Metropolitan chase-'em-up on city streets or at the scene of the crime. Penguin, 830 4th Ave., Geneva, IL 60134. $19.95. *4/83.*

Crisis Mountain. Schroeder. Run, crawl, walk, and leap through mountain maze fraught with rolling rocks, geysers, and chasms; defuse nuclear devices. Synergistic, 830 N. Riverside Dr., #210, Renton, WA 98055. $34.95. *10/82.*

● **Crossfire.** Sullivan. Aliens come at you from four directions on a grid laid out like city blocks. Strategy and intense concentration required. Superb, smooth animation of a dozen pieces simultaneously. One of the great ones. Sierra On-Line, Sierra On-Line Building, Coarsegold, CA 93614. $29.95. *1/82.*

● **Epoch.** Miller. Superbly stylized animation enhances this filmic shoot-'em-up. Tremendous sense of being in space; neat classical music and dramatic time-warp sequences. Sirius, 10364 Rockingham Dr., Sacramento, CA 95827. $34.95. *10/81.*

Frogger. Lubeck. Doesn't resemble the coin-op game of the same name, but not a bad little game in its own way. Sierra On-Line, Sierra On-Line Building, Coarsegold, CA 93614. $34.95. *12/82.*

● **Gorgon.** Nasir. Fly over planet shooting and dodging invaders and saving kidnapped inhabitants. Outstanding hi-res graphics, challenging refueling se-

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THE CRITICS' CHOICE

"Once use of the joystick and concept of matching is understood (in Learning with Leeper), a pre-reader can use these programs with little or no intervention. The joy of discovery learning in "Screen Painting" and the solid counting, shape and letter recognition skills developed in other programs make this one of the very best pre-reading programs on the market today."

— Bud Hagen, Editor, "Closing the Gap," an educational journal.

". . . A positive learning environment, one that young computer users will flourish in."

— Softalk magazine, February 1983

"I learned a lot and it was fun."

— Rori, age 6

"These programs are great for my students...their reading skills are being improved...and they don't need keyboard skills to make the programs work."

— Amy English, 3rd grade teacher

"At last I can buy games for my kids that really teach something."

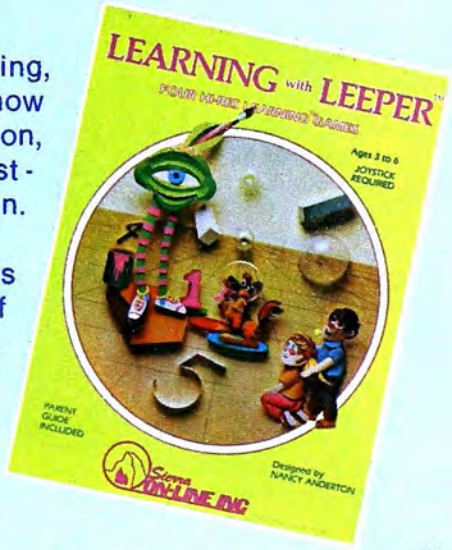
— Marilyn Vartabedian, parent

HI-RES LEARNING™



Children don't hold back. If they like something, you'll know it. If they don't- well, you'll know that, too. When it comes to children's education, parents and teachers are just as honest - it's love or loathe, no in between.

That's why Hi-Res Learning ™ games by Sierra On-Line, an assortment of challenging workouts in basic skills, are earning high marks from children, parents and teachers alike.



Learning with Leeper™
A CES Showcase selection

At Sierra On-Line, we think basic skills and fun deserve equal billing. Learning with Leeper,™ four games for preschool children that teach reading, writing and math readiness, reflects that belief.



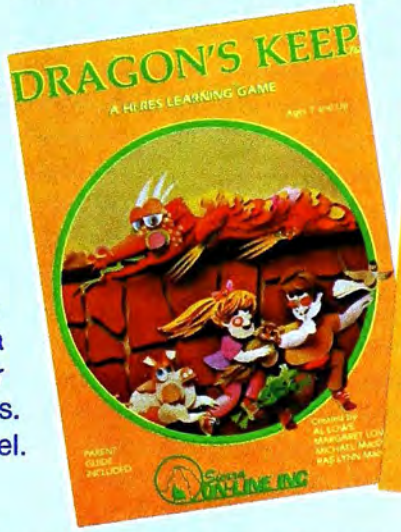
- Bop-A-Bet,™ a maze game that teaches alphabetical sequence, prepares children to use dictionaries, libraries and encyclopedias.



- Dragon's Keep™ and Troll's Tale™: Two enchanting adventure games with controlled vocabularies that emphasize reading comprehension and map skills.

Dragon's Keep,™ a journey into dragon territory to rescue animals, can be played without supervision by any youngster who can read at second grade level.









Troll's Tale,™ is a search through a fantasy land for hidden treasures. Third grade level.

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GAMES from Sierra ON-LINE INC

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quence. Sirius, 10364 Rockingham Dr., Sacramento, CA 95827. $39.95. *8/81.*

✓ **Hard Hat Mack.** Abbott, Alexander. Poor Mack. He must avoid vandals, inspectors, falling rivets, and hungry cement mixers to complete his building. Electronic Arts, 2755 Campus Dr., San Mateo, CA 94403. $35.

It's the Pits. Ray. You are the grimpet's only hope. Can you save him from fiery pits and predatory wirlybats? Three skill levels. Sagebrush Software, 39 Carriage Pl., Urbana, IL 61801. $29.95. *5/83.*

✓ **Jump Jet.** Benton. Twenty tons of thrust separate you from torpedoes, submarines, and kamikaze planes. Vanquish all to recapture your island. Avant-Garde Creations, Box 30160, Eugene, OR 97403. $29.95.

✓ **Lode Runner.** Smith. Design your own puzzles, scenes, and setups, in quest to steal Bungeling Empire's gold. Use tightropes, trapdoors, and ladders to your advantage. Broderbund, 1938 4th St., San Rafael, CA 94901. $34.95.

Lunar Leeper. Bueche. Silly, enjoyable rescue mission with challenging ship control and unpredictable foes. Sierra On-Line, Sierra On-Line Building, Coarsegold, CA 93614. $29.95. *1/83.*

✓ **Mating Zone.** Luhrs. Harmless aliens bounce and breed, raining destruction. Strive for space-invading zero-population growth. Datamost, 8943 Fullbright Ave., Chatsworth, CA 91311. $29.95.

Maze Craze Construction Set. Hammond. Play their mazes or construct your own. Two can enter the same maze. DTI Data Trek, 121 West E St., Encinitas, CA 92024. $39.95.

● **Meteoroids (Asteroids) in Space.** Wallace. Make little asteroids out of big ones, plus occasional hostile alien ships. Hyperspace, autobrake, autofire. Quality Software, 6660 Reseda Blvd., #105, Reseda, CA 91335. $19.95.

● **Microsoft Decathlon** (formerly *Olympic Decathlon*). Smith. Ten standard decathlon events. Hi-res animated athletes, muscle-stirring music; you provide the sweat. Microsoft, 10700 Northrup Wy., Bellevue, WA 98004. $29.95. *6/81.*

Miner 2049er. Livesay, Hogue. Run, jump, climb, and slide through the mines, reinforcing the groundwork along the way. Elevators, cannons, chutes, and ladders help; mutants don't. Hot stuff, best of the genre. Micro Lab, 2310 Skokie Valley Rd., Highland Park, IL 60035. $39.95. *1/83.*

✓ **Pentapus.** Sagan. A giant purple octopus threatens the universe. Destroy it on adult or child's level. Turning Point Software, 11A Main St., Watertown, MA 02172. $29.95.

Pinball Construction Set. Budge. Design and play your own computer games on-screen, with zero programming. A miracle of rare device. Superior. BudgeCo, 428 Pala Ave., Piedmont, CA 94611. $39.95. *2/83.*

Pinball Paradise I, II. Stockla. Pinball games written with Bill Budge's *Pinball Construction Set*. Four games per disk. Golden Knight Software, 11 Lark Ln. S., Huntington, CT 06484. $24.95.

● **Pool 1.5.** Hoffman, St. Germain, Morock. Makes most shots you could on a real pool table, with the advantages of instant replay and slow motion. Four different games. IDSI, Box 1658, Las Cruces, NM 88004. $34.95. *6/81.*

● **Raster Blaster.** Budge. First realistic pinball game. *Softalk* readers' Most Popular Program of 1981. BudgeCo, 428 Pala Ave., Piedmont, CA 94611. $29.95. *5/81.*

Repton. Thompson, Kaluzniacki. The *ne plus ultra* of planet-defending, in the *Defender* style, plus. Top flight all the way. Sirius, 10364 Rockingham Dr., Sacramento, CA 95827. $39.95. *1/83.*

✓ **Sammy Lightfoot.** Schwader. Sammy must dodge a variety of obstacles as he tries out for the circus. He evidently used to be a miner. Sierra On-Line, Sierra On-Line Building, Coarsegold, CA 93614. $29.95.

Seafox. A good sub-versus-convoy home arcader. Variety of vessels, bouncing torpedoes, refueling dolphins, and intelligent depth charges. Broderbund, 1938 4th St., San Rafael, CA 94901. $29.95. *11/82.*

Serpentine. Hypnotic snake-chase maze game. Clean action, thrills, hairy escapes. Recommended. Broderbund, 1938 4th Ave., San Rafael, CA 94901. $34.95. *10/82.*

Snack Attack. Illowsky. Three-maze eat-'em-up; starts at any of five speed levels. Nonfattening. Datamost, 8943 Fullbright Ave., Chatsworth, CA 91311. $29.95. *1/82.*

● **Sneakers.** Turmell. Many-layered shooting game; one of the best. Stomping sneakers and other creatures requires varying techniques. Fun. Sirius, 10364 Rockingham Dr., Sacramento, CA 95827. $29.95. *9/81.*

✓ **Spectre.** Flanagan, Miller. Marooned on a deserted space station, you must conquer confusing mazes to outrun the invading Questors. Datamost, 8943 Fullbright Ave., Chatsworth, CA 91311. $29.95.

Spy's Demise. Zeldin, Hardy. Be the first on your block to run a maze of pile-driving elevators. Fast, frustrating fun. Complete puzzle after all nine levels. Penguin, 830 4th Ave., Geneva, IL 60134. $29.95. *11/82.*

Star Blazer. Suzuki. Bomb-run game with five levels, minutely exact animation, and style to burn. A joy. Broderbund, 1938 4th St., San Rafael, CA 94901. $31.95. *4/82.*

● **Super Invader.** Hata. Progenitor of home arcades. Still good hi-res, still a challenge. *Softalk* readers' Most Popular Program of 1978-80. Astar International, through California Pacific, 757 Russell Blvd., Davis, CA 95616, and Creative Computing, 39 E. Hanover Ave., Morris Plains, NJ 07960. $19.95.

Super Taxman 2. Fitzgerald. Pac up your troubles! Bigger, more complex version of the most perfect extant rendition of a certain arcade game. H.A.L. Labs, 4074 Midland Rd., #23, Riverside, CA 92505. $25. *1/83.*

✓ **Vindicator.** Huey. Mutants, vultures, hatchlings, and other lovelies try to steal eggs in Robotronlike game. Cute dragons. H.A.L. Labs, 4074 Midland Rd., #23, Riverside, CA 92505. $25.

● **Wayout.** Exciting 3-D maze that moves in perspective as you play. Map displayed at all times. Lots of angles and cleptangles. Separate version for IIe. Exquisite motion animation is a breakthrough. Sirius, 10364 Rockingham Dr., Sacramento, CA 95827. $39.95. *10/82.*

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Algebra 1-4. Sets of learning units progressing from algebraic rules to definitions to graphing and inequalities. Individualized teaching styles to fit everyone's needs. Good for adults wanting to overcome math anxiety as well as for schoolkids. Edu-Ware, Box 22222, Agoura, CA 91301. $39.95 each.

Apple Logo. Papert. Custom version (by its inventor) of turtle graphics language. First-rate educational tool. Great kid-friendly documentation. Apple, 20525 Mariani Ave., Cupertino, CA 95014. $175.

✓ **Arcademic Skill Builders in Language Arts.** Victor. Eight programs and audio cassette help students and adults overcome spelling difficulties while teaching them a method of approaching difficult words. Program Design, 11 Idar Ct., Greenwich, CT 06830. $26.95.

Compu-Spell. Teaches spelling through positive reinforcement for grades 4-8. Program keeps a file to monitor spellers' progress. Additional unit designed for adult user included. Edu-Ware, Box 22222, Agoura, CA 91301. Program and one data disk, $39.95. Additional disk, $19.95.

✓ **Computer SAT.** Prepares college-bound student for admittance test. Diagnoses strengths, weaknesses; creates study plan, exercises. Harcourt Brace Jovanovich, 1250 6th Ave., San Diego, CA 92101. $79.95.

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Delta Drawing. Kids can make colorful drawings by using single-key commands. No special talent needed; this one develops programs that create complex graphics. Spinnaker, 215 1st St., Cambridge, MA 02142. $59.95. *11/82.*

Early Games for Young Children. Paulson. Basic training in numbers, letters, Apple keyboard for children ages two to seven with no adult supervision. Has a neat little drawing program. Counterpoint Software, Shelard Plaza N., #140, Minneapolis, MN 55426. $29.95. *11/82.*

✓ **Early Games Music.** Paulson. Illustrates music with fun and theory. Children compose music and set to graphics or learn note reading and piano keyboard. Counterpoint Software, Shelard Plaza N., #140, Minneapolis, MN 55426. $29.95.

Ernie's Quiz. CTW. Four games, four subjects, one disk. Image recognition, counting skills, creativity, and Muppet expertise are introduced with lots of positive feedback. Apple, 20525 Mariani Ave., Cupertino, CA 95014. $50. *2/83.*

Facemaker. DesignWare. Exercises kids' creativity and introduces programlike command sequencing as kids create faces and link them together in animated patterns. Spinnaker, 215 1st St., Cambridge, MA 02142. $34.95.

✓ **Fact or Opinion.** Savitsky, Savitsky. Helps students identify difference between fact and opinion in advertising and situations encountered daily. Could help next time the kids beg for E.T. toothpaste or chocolate greasy-whizzies. Learning Well, 200 S. Service Rd., Roslyn Heights, NY 11577. $49.95.

✓ **Following Directions.** Savitsky, Savitsky. Teaches reading comprehension and the sequential following of directions. Two to six players. Learning Well, 200 S. Service Rd., Roslyn Heights, NY 11577. $49.95.

Gertrude's Secrets. Gertrude the Goose teaches four-to-nine-year-olds shape and color relationships. Solve logic puzzles, create forms. The Learning Co., 4370 Alpine Rd., Portola Valley, CA 94025. $75. *2/83.*

✓ **Hey Diddle Diddle.** Disharoon. Three reading and vocabulary games that strengthen reasoning ability. Ages 3 to 10. Spinnaker, 215 1st St., Cambridge, MA 02142. $29.95.

Instant Zoo. CTW. Identify animals, test perception and reaction, match and decode words. Word editor lets you create your own word lists. Apple, 20525 Mariani Ave., Cupertino, CA 95014. $50.

Language Arts. Mitchell, Roblyer. Drills grades 1-8 in letter recognition, alphabetization skills. Includes Manager Program that allows teachers to make assignments and review progress of 100 students on each disk. Milliken, 1100 Research Blvd., St. Louis, MO 63132. $75.

✓ **Latin Hangman.** Protelsch. Three games test your knowledge of Latin. Famous sayings, English-Latin, Latin-English translations. George Earl, 1302 S. General McMullen, San Antonio, TX 78237. Two-sided disk, $29.95.

✓ **Learning about Numbers.** Clark, Cornelius. Three games teach children basic math skills, counting, and how to tell time. Includes special feature for prereaders. C&C Software, 5713 Kentford Circle, Wichita, KS 67220. $40.

✓ **Learning with Leeper.** Anderton. Four preschool games teach eye-hand coordination, shape matching, and counting. Sierra On-Line, Sierra On-Line Building, Coarsegold, CA 93614. $34.95.

● **MasterType.** Zweig. Learn to type by playing a game; simple and ingenious. IIe version teaches new keyboard. Lightning, Box 11725, Palo Alto, CA 94306. $39.95. *4/81.*

Mix and Match. CTW. Create mixed-up Muppets and teach the Apple about animals. Logic and word-guessing games. Add your own word lists. Apple, 20525 Mariani Ave., Cupertino, CA 95014. $50. *2/83.*

Multiploy. Coletta. From answer base, blast menacing arithmetic problems out of the sky. Ranks and scores kept for tracking progress. Reston Publishing, 11480 Sunset Hills Rd., Reston, VA 22090. $19.95.

● **The New Step by Step.** Software and audio tape team up to teach Basic programming painlessly. Graphics, animation, sound effects, and workbook. Superior. Program Design, 11 Idar Ct., Greenwich, CT 06830. $79.95. *7/82.*

Police Artist. Levin. Pick the culprit out of a lineup or rebuild the culprit's face from memory. Three games can create a million faces. Ages seven to adult. Sir-tech, 6 Main St., Ogdensburg, NY 13669. $34.95. *6/83.*

✓ **PSAT Word Attack Skills.** Priven. Teaches vocabulary and techniques for deciphering unfamiliar words in pressurized testing situation. Edu-Ware, Box 22222, Agoura, CA 91301. $49.

Rocky's Boots. Rascally racoon helps children build logical thinking and computer understanding. Construct machines of logical gates in convolutions of thickening complexity. Music and sound effects add to fun. The Learning Co., 4370 Alpine Rd., Portola Valley, CA 94025. $75. *2/83.*

Snooper Troops. Snyder. Ongoing hi-res mystery series in form of educational games. Highly structured; excellent fourth-through-eighth-grade educational tool. Fun for adults too. Spinnaker, 215 1st St., Cambridge, MA 02142. $44.95 each. *9/82.*

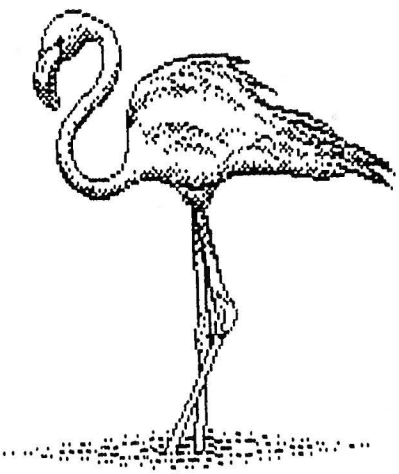
Speed Reading. Coad. Self-teaching program accommodates 20 readers; tests, records their progress. Can use your own reading material. BPI Systems, 3423 Guadalupe, Austin, TX 78705. $195.

Spelling Bee Games. Hi-res games strengthen eye-hand coordination, memory, motor skills. Word lists include shapes, animals, more. Edu-Ware, Box 22222, Agoura, CA 91301. $29.95. *5/83.*

✓ **Spelling Builder.** Victor. Unique set of eight programs and audio cassette teaches students and adults reasons behind spelling; overcomes spelling difficulties. Ideal for those who have mastered basic spelling but have trouble with tricky words. Superior. Program Design, 11 Idar Ct., Greenwich, CT 06830. $26.95.

Step by Step Two. Introduces graduates of *The New Step by Step* to intermediate Basic programming. Teaches peek and poke, hexadecimal numbers, concatenations, and more. Program Design, 11 Idar Ct., Greenwich, CT 06830. $89.95.

Stickybear. Hefter, Worthington, Rice. Animated early education programs. In *Stickybear ABC*, moving pictures with sound represent letters. In *Stickybear Numbers*, groups of moving objects teach numbers and simple arithmetic. Ages three through six. In *Stickybear Bop*, ducks, planets, and balloons bop across screen in three shooting galleries. For all ages. Xerox Education/Weekly Reader, 245 Long Hill Rd., Middletown, CT 06457. $39.95 each. *5/83.*



Story Machine. Helps develop positive attitude toward writing and ability to write correctly. Words come to life when sentence is acted out on-screen. Kids five to nine love to type "The tree ran down the street" and see it do so. Spinnaker, 215 1st St., Cambridge, MA 02142. $34.95.

Type Attack. Hauser. Learn to type while defending the planet Lexicon from invaders. IIe version teaches IIe keyboard. Sirius, 10364 Rockingham Dr., Sacramento, CA 95827. $39.95.

Typing Tutor. Ainsworth, Baker. Four levels of proficiency; individualized drills created with time-response monitoring. Microsoft, 10700 Northup Wy., Bellevue, WA 98004. $24.95.

Strategy

Thinking, planning, plotting games, from war games to backgammon to cards.

Casino. Five hi-res games, Vegas style: blackjack, baccarat, keno, poker, and roulette. Datamost, 8943 Fullbright Ave., Chatsworth, CA 91311. $39.95. *10/82.*

● **Castle Wolfenstein.** Warner. First game to fuse successfully strategy, home-arcade, fantasy. Escape from Nazi stronghold with secret plans. Room layout changes with each new game. Enemy speaks (in German). Muse, 347 N. Charles St., Baltimore, MD 21201. $29.95. *10/81.*

✓ **Caves of Olympus.** Noone, Noone. Your planet is overrun and the only escape is through a subterranean chamber of horrors. Outwit the robotic overseer, avoid death traps to get to the other side. Howard W. Sams, 4300 W. 62nd St., Indianapolis, IN 46268. $39.95.

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version is 40 times faster than the original, which was one of best games ever created for Apple, except for slowness. Strategic Simulations, 883 Stierlin Rd., A-200, Mountain View, CA 94043. $59.95.

● **Computer Baseball.** Merrow, Avery. Simulates individual player abilities from the teams of 13 famous World Series. Enter and play teams of your own creation. Strategic Simulations, 883 Stierlin Rd., A-200, Mountain View, CA 94043. $39.95. *9/81.*

✓ **Delta Squadron.** Louie. To destroy Cetusites' main power source, direct fighter planes down a long, narrow tunnel in this space-war simulation. Nine scenarios. Nexa, Box 26468, San Francisco, CA 94126. $39.95.

✓ **Fighter Command.** Merrow, Avery. Rewrite or relive famous aerial Battle of Britain as either the British or German commander. Play entire campaign or choose from three shorter scenarios. Strategic Simulations, 883 Stierlin Rd., A-200, Mountain View, CA 94043. $59.95.

● **Flight Simulator.** Artwick. Uses aerodynamic equations, airfoil characteristics for realistic takeoff, flight, and landing. Two years on Top Thirty. SubLogic, 713 Edgebrook Dr., Champaign, IL 61820. $33.50.

Gin Rummy. Carpet. Play against computer. Hi-res hand can be arranged. Knocking allowed. Computer plays pretty well. Datamost, 8943 Fullbright Ave., Chatsworth, CA 91311. $29.95. *6/82.*

Hi-Res Computer Golf 2. A masterpiece; requires judgment, strategy, and visual acuity. One of the few computer sports simulations that require dexterity. Avant-Garde, Box 30160, Eugene, OR 97403. $29.95. *6/83.*

✓ **Knights of the Desert.** Kroegel, Landrey, Walker. Re-creation of Rommel's World War II drive into North Africa. Struggle to take the Suez as Rommel or to push him back as the British commander. Solitaire play possible. Strategic Simulations, 883 Stierlin Rd., A-200, Mountain View, CA 94043. $39.95.

● **Microgammon II.** Program for play, practice, improvement of backgammon skills. Pretty good competition. Softape, 5547 Satsuma Ave., North Hollywood, CA 91601. $19.95. *2/81.*

Old Ironsides. Rice, Hefter. Delightful program provides simple but excellent hi-res simulation of thundering ship-to-ship combat. Package includes poster and logbook. Xerox Education Publications, 245 Long Hill Rd., Middletown, CT 06058. $39.95. *5/83.*

✓ **Pensate.** Besnard. Chess-derived game with new tactics. All pieces move in relation to main piece, all 25 have separate rules. Makes full use of computer capabilities. Intriguing and progressive. Penguin, 830 4th Ave., Geneva, IL 60134. $19.95.

✓ **Planet Master.** Cuba. Complex ecological simulation requires player to select six alien endangered species for nurturing. Watchfulness and planning required to protect your animals in an unpredictable environment. Magnetic Harvest, Box 255, Hopkins, SC 29601. $24.95.

✓ **Program X, The Ultimate Puzzle.** Gips. The program captured on an alien spacecraft has already stumped NASA and the CIA. Now you are called in to decipher it. National Software, Box 686, Dover, MA 02030. $29.

Pro Poker. Allen. Hi-res eight-handed poker tutorial between just you and your Apple in kibitz mode. Plays 300 hands per hour; California poker club rules. Quality, 6660 Reseda Blvd., #105, Reseda, CA 91335. $39.95.

✓ **RDF 1985.** Keating. Soviet forces seize Saudi Arabia and the United States must respond in second game of "When Superpowers Collide" series. One or two players. Strategic Simulations, 883 Stierlin Rd., A-200, Mountain View, CA 94043. $34.95.

Rendezvous. Huntress. Space-shuttle simulation in 3-D, created by a senior scientist at JPL. Orbit Earth, match orbit, and dock with space station. Authentic, demanding. Edu-Ware, Box 22222, Agoura, CA 91301. $39.95. *7/82.*

● **RobotWar.** Warner. Strategy game with battling robots is great teaching device for programming. Muse, 347 N. Charles St., Baltimore, MD 21201. $39.95. *1/81.*

● **Sargon II.** Spracklen, Spracklen. Computer chess game with seven levels of play. Hayden, 50 Essex St., Rochelle Park, NJ 07662. $34.95.

Spitfire Simulator. Air flight simulator—Spitfire in combat with German aces—with 3-D scenery and moving target aircraft. Mind Systems, Box 506, Northampton, MA 01061. $40. *12/82.*

Utility

Apple-Cillin. Hardware diagnostic tests for all RAM and ROM, plug-in cards, cp registers, disks; nine video test patterns. XPS, 323 York Rd., Carlisle, PA 17013. $49.95.

Apple Pascal. Structured operating system featuring enhancements of color graphics, sound generation, and Apple's I/O features. Apple, 20525 Mariani Ave., Cupertino, CA 95014. $495.

Audex. Collection of utilities to create, edit, and play back sounds, in Basic and assembly language. Sirius, 10364 Rockingham Dr., Sacramento, CA 95827. $29.95.

Bag of Tricks. Worth, Lechner. Four utility programs for dumping and examining raw tracks, sector editing, reformatting tracks, and repairing damaged catalogs. Indispensable. Quality Software, 6660 Reseda Blvd., #105, Reseda, CA 91335. $39.95.

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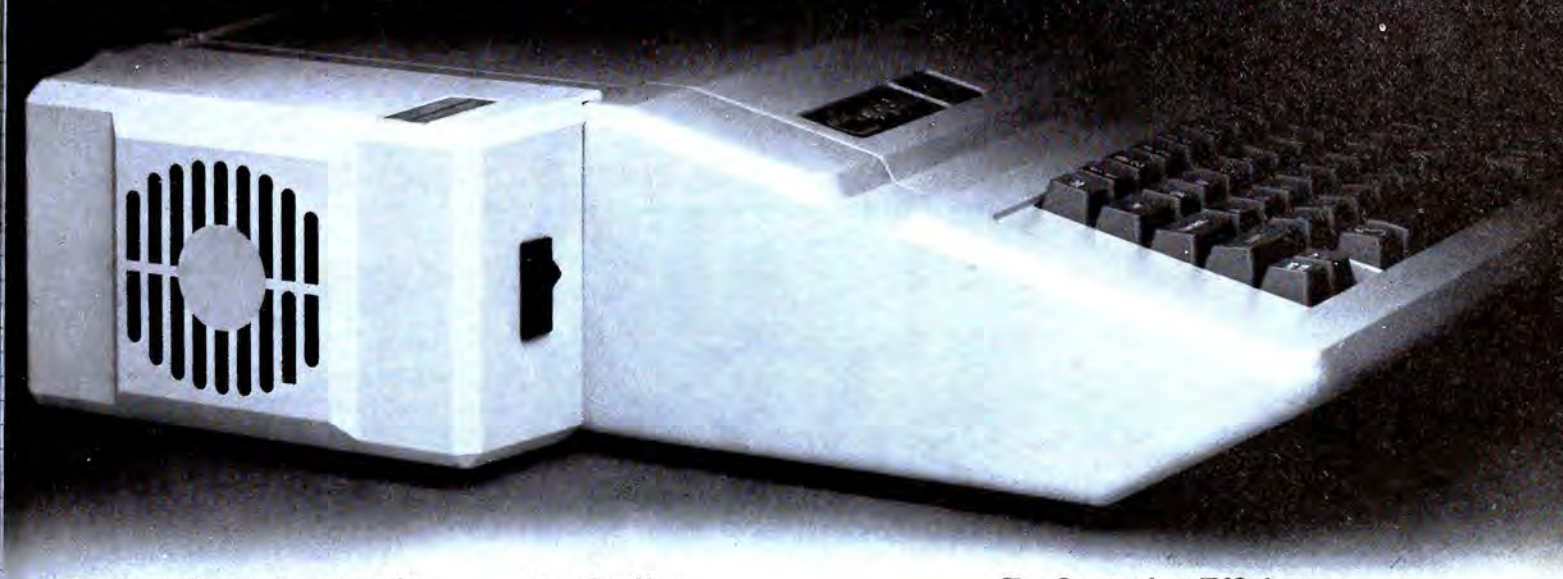
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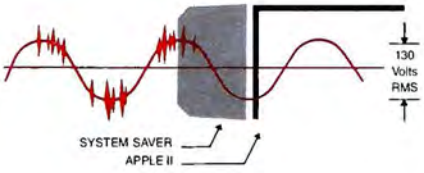
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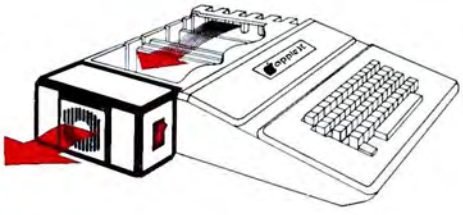


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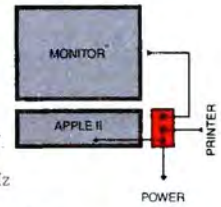
Today's advanced peripheral cards generate more heat. In addition, the cards block any natural air flow through the Apple II creating high temperature conditions that substantially reduce the life of the cards and the computer itself.



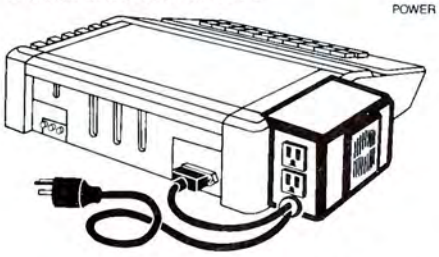
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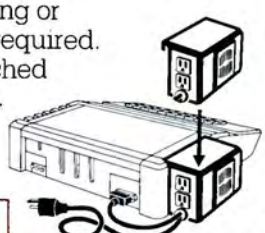
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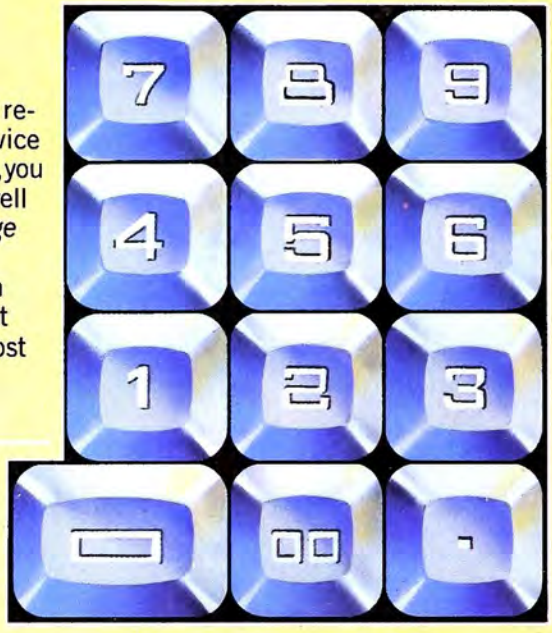
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Advanced Ideas, 1442A Walnut St., #431, Berkeley, CA 94709. $47.50. *3/83.*

DOS Boss. Kersey, Cassidy. Utility to change DOS commands; customize catalog. Good ideas and witty presentation. Beagle Bros, 4315 Sierra Vista, San Diego, CA 92103. $24. *10/81.*

DOS Tool Kit. Excellent utility package; Apple II assembler-editor system and Applesoft toolkit. Edit, assemble machine language programs; write, edit Basic programs. Simplifies graphics, includes character generator. Apple, 20525 Mariani Ave., Cupertino, CA 95014. $75. *10/81.*

✓ **Double Take.** Simonsen. Multiple-utility features two-way scrolling for catalogs, hex/ASCII dumps. Improved list format. Beagle Bros, 4315 Sierra Vista, San Diego, CA 92103. $34.95.

Einstein Compiler. Goodrow, Einstein. Translates Applesoft programs into machine language for run-time up to 20 times faster. Supports all graphics modes, defined functions, and DOS commands. Einstein, 11340 W. Olympic Blvd., Los Angeles, CA 90064. $129.95. *5/83.*

✓ **EPF IV.** Strand. Combines data-management system, Basic editor, and DOS 3.3 System Master. Features automatic insertion of frequently used subroutines, overlay control to maximize program space. Sierra On-Line, Sierra On-Line Building, Coarsegold, CA 93614. $79.95.

● **Global Program Line Editor.** Enhanced version of *Program Line Editor* with programmable cursor and listing control. Edit line by line or by range of lines and search for strings. Synergistic, 830 N. Riverside Dr., #201, Renton, WA 98055. $60. *12/82.*

Hands-On Basic Programming. Kamins, Bennet. Workbook and disk teach Basic programming, other basic knowledge of the Apple. User frustration deliberately omitted from this tutorial. Edu-Ware, Box 22222, Agoura, CA 91301. $79.

Merlin. Does assembly language programming with a dozen editing commands and 28 pseudo-ops. Southwestern Data, 10761-E Woodside Ave., Santee, CA 92071. $64.95. *1/83.*

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Sphinx. Software giving single-pass encryption beyond 10 to the 400th power. Crane Hill, Box 273, Gonzalez, FL 32560. $37.50.

● **Super Disk Copy III.** Hartley. Easy-to-use menu-driven software utility; correct file sizes, undelete, free DOS tracks, more. Sensible, 6619 Perham Dr., W. Bloomfield, MI 48003. $30. *10/81.*

Utility City. Kersey. Twenty-one utilities on one disk. Beagle Bros, 4315 Sierra Vista, San Diego, CA 92103. $29.50.

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Apple Writer II and IIe. Includes WPL (word processing language). Additional functions menu; continuing features and functions menu; continuous readout of characters and length. *IIe* has shift, shift-lock, and tab, four-arrow cursor control, and delete key; data files compatible with *II*. Apple, 20525 Mariani Ave., Cupertino, CA 95014. *II*, $150; *IIe*, $195.

Apple Writer II Preboot. Armstrong, Borgorsen. Allows you to run *Apple Writer II* in 80-column format with the Videoterm 80-column card. Videx, 897 N.W. Grant Ave., Corvallis, OR 97330. $19.

Bank Street Writer. Kusmiak, Bank Street College of Education. Designed for use by whole family. Universal search and replace, word wrap are standard. U/lc without hardware. On-disk tutorial. Takes advantage of memory, keyboard on IIe, if you have one. Broderbund, 1938 4th St., San Rafael, CA 94901. $69.95. *2/83.*

Magic Window II. 40, 70 (in hi-res), or 80 columns in this expanded version. Compatible with Pascal 80-column. With user-tailored, fast menu; underlining; global search and replace. IIe version uses all 64K, more if you have it. Artsci, 5547 Satsuma Ave., North Hollywood, CA 91601. $149.95.

Pie Writer. Business processor allows 9,999 pages. Word deletion, auto indent, spooling, and type-ahead buffer. Hayden, 50 Essex St., Rochelle Park, NJ 07662. $149.95.

ScreenWriter II. Kidwell, Schmoyer. No extra hardware for u/lc, 70-column display, printer spooling. Edits Basic, text, and binary files; complete search and replace. Sierra On-Line, Sierra On-Line Building, Coarsegold, CA 93614. $129.95. *1/83.*

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Super-Text Professional (40/80). Automatic 80-column, u/lc on equipped IIe; with appropriate equipment on II Plus. On-screen formatting and help reference guides. Muse, 347 N. Charles St., Baltimore, MD 21201. $99.

Word Handler II. Elekman. Simple program with straightforward documentation. Allows folded paper printout for two-sided printing. 80-column with the IIe. Silicon Valley Systems, 1625 El Camino Real, #4, Belmont, CA 94002. $199. *11/82.*

WordStar. Screen-oriented, integrated word processing system in CP/M. Z-80. MicroPro, 33 San Pablo Ave., San Rafael, CA 94903. $495.



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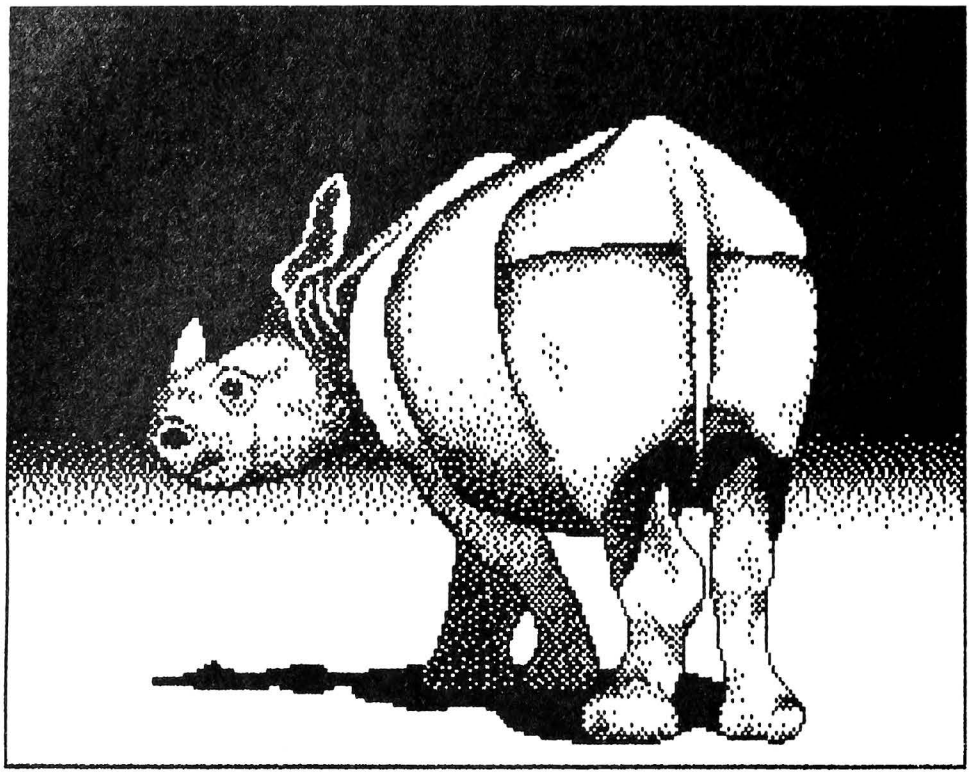
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Apple Writer III. Lutus. Uses WPL (word processing language) to automate text manipulation and document creation. Adjusts print format during printing; translates from typewriter shorthand to English or other language and back again. Apple, 20525 Mariani Ave., Cupertino, CA 95014. $225.

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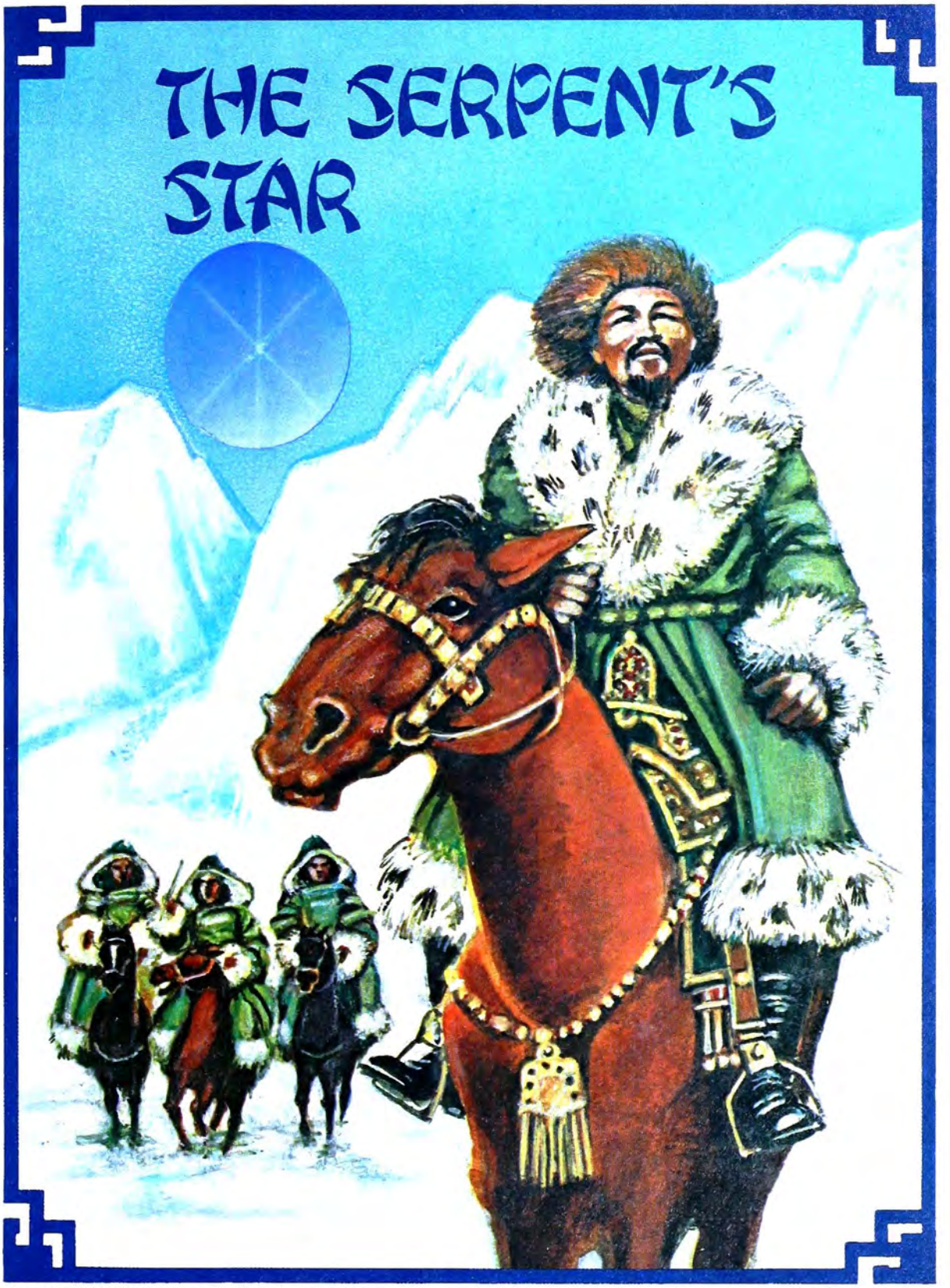
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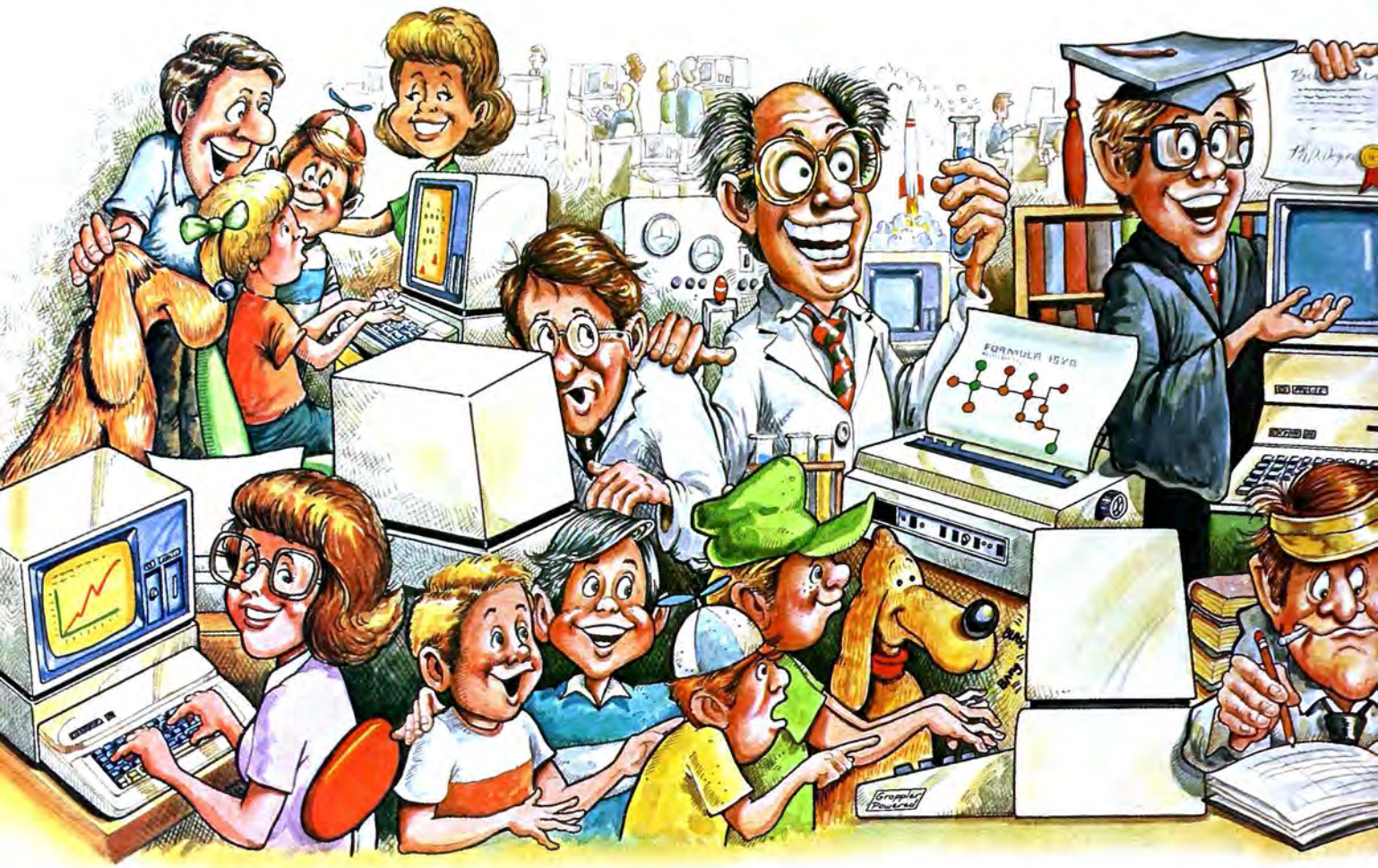
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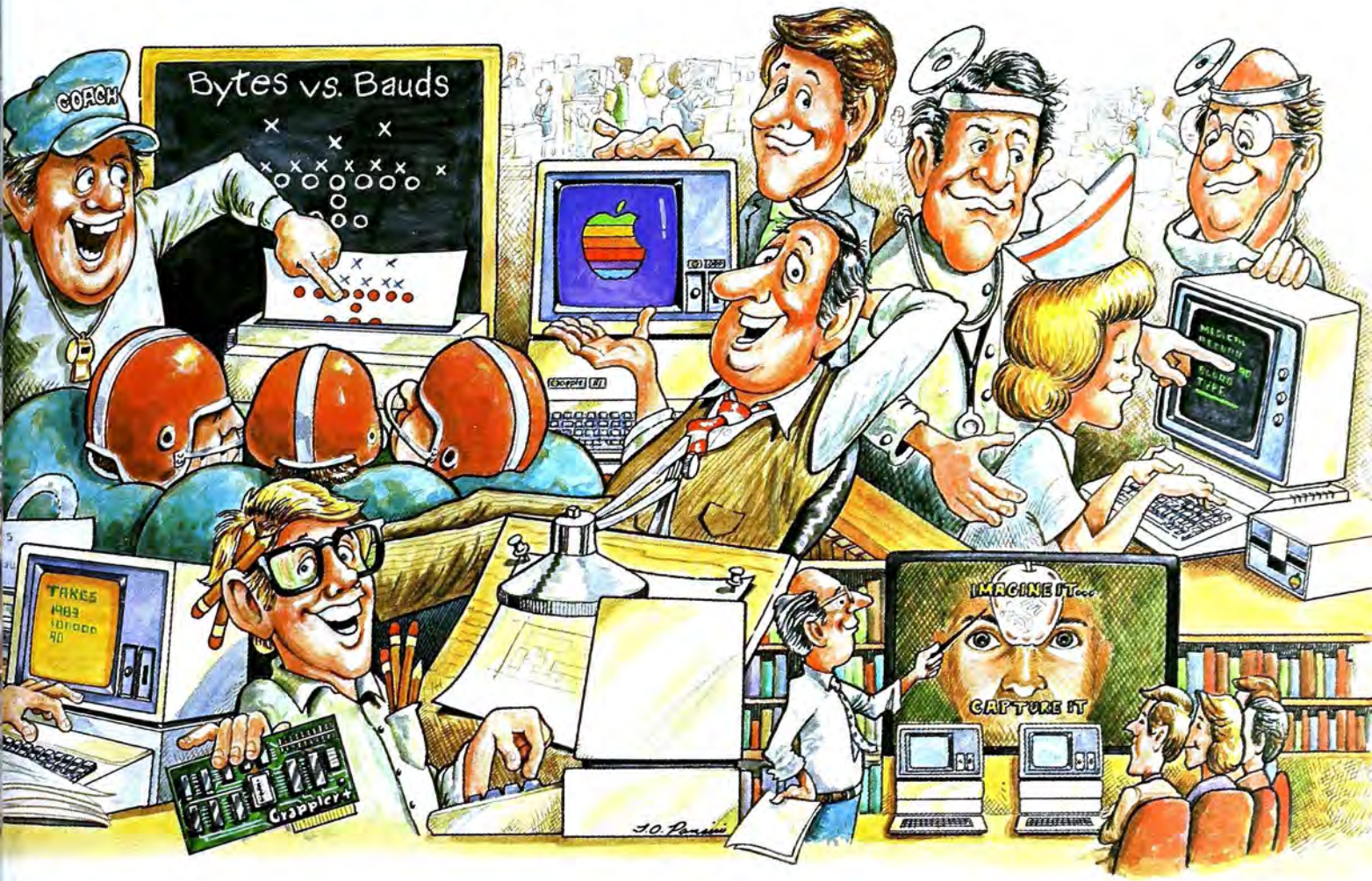
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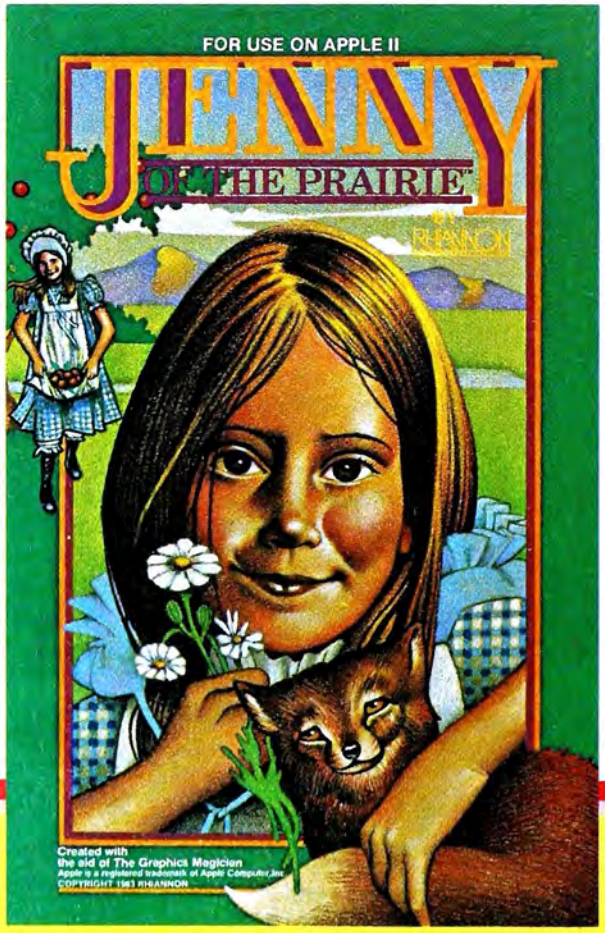
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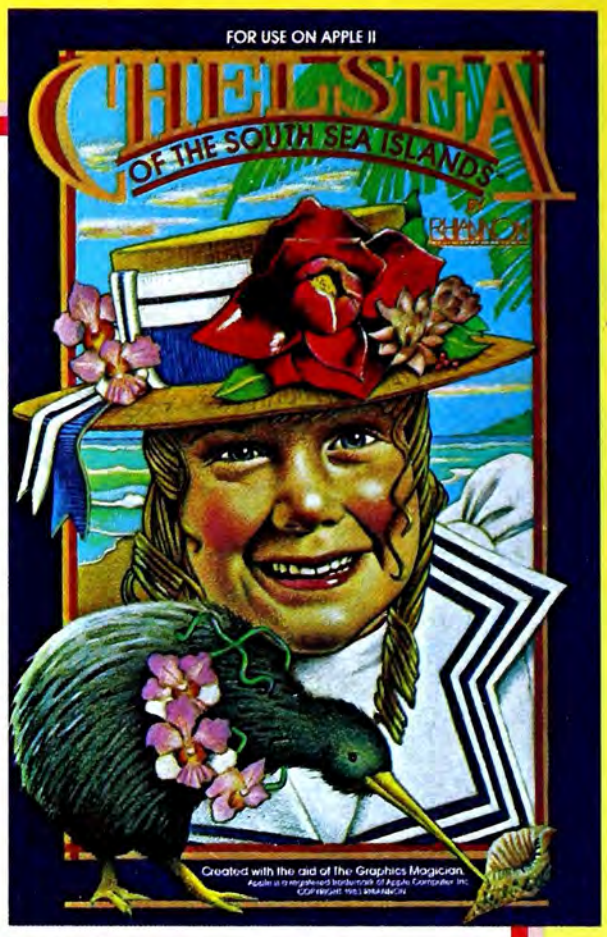
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COMPUTER GAMES FOR GIRLS



Open Discussion gives you the chance to air your views and concerns, to seek answers to questions, to offer solutions or helpful suggestions, and to develop a rapport with other readers. It's what you make it, so share your thoughts, typed or printed, and double-spaced (please), in Softalk*'s Open Discussion, Box 60, North Hollywood, CA 91603. To ensure the inclusion of as many contributions as possible, letters may be condensed and edited.*

The picture that appears at the beginning of Open Discussion this month, as well as those throughout Fastalk, is the work of Richard N. Tooker. As senior vice president of marketing for Customer Development Corporation in Dallas, Texas, Tooker has found the time in his busy schedule to satisfy his artistic urges with an Apple. Before he discovered computer graphics, his major artistic medium was oil and acrylic paint, with occasional forays into photography and stained glass. Now, he finds using the Apple as a means of self-expression more satisfying than anything else he's tried.

How about sharing your own Apple art with us? Send your masterpieces to Open Discussion—one picture is worth a thousand words, you know. (Just imagine the worth of 53,760 pixels!)

His User-Friend

Having been a North Star Horizon business computer operator and programmer for some time, I was excited to hear that my son was going to take computer courses during his junior year in high school. When we learned that the school used Apple II microcomputers in its classroom environment, that was all the justification we needed to go right out and buy one, regardless of our budget. Since that moment some eighteen months ago when we first brought our Apple home, we have spent many memorable hours with it playing the usual games, learning programming, and offering services for our job, church, and so forth. With this in mind, I would like to pass along some thoughts concerning the programs we utilize most.

For our electronic spreadsheet, we selected *VisiCalc* from VisiCorp. This program has been a delight to work with. Never once has it crashed or failed to perform as advertised. Although it appears a bit slow at times and somewhat lacking in advanced features offered by the competition, it has been a substantial performer for us.

When we bought our micro, our dealer suggested we try out a brand-new word processor he had just received. Since it gave us full-screen formatting without having to purchase an eighty-column board, it sounded like a good deal to us. Since that time, we have never been dissatisfied with our *Word Handler* from Silicon Valley Systems. Although there are a few things I would like to see changed, it has proven to be a very simple-to-use, solid performer. The folks at the main office had been most helpful when we were first starting out. And recently, when I had another question about the program, the customer service rep requested I call her person-to-person collect to resolve the problem! How many other software companies can you name that offer that kind of support?

Now here is a sore subject for us. Our first database acquisition was *The Data Factory* from MicroLab. For the past eighteen months we have struggled with the company to get the program to work properly. We had experienced bad program disks, missing program prompts for our single disk system, and a manual that quite often did not correspond to the updated programs. Although the people at MicroLab were most courteous about our requests for assistance, we finally gave up and went out to look for another program. With a little more savvy this time, we looked at *DB Factory, The General Manager*, and *PFS:File*, then finally settled on *VisiFile* from VisiCorp. It has one exceptional plus that we were looking for—user-friendliness.

For home accounting, we chose *The Accountant* from Decision Support Software. Among its outstanding features is its ability to automatically post a large number of fixed entries without our having to enter them separately each month. This feature alone significantly expedites our budget-posting procedure. The program is also relatively simple to use. I would recommend it highly to anyone who has need for a home or small business accounting system but who doesn't wish to mortgage the south forty to acquire one.

As a parting thought, most of the Apple software I have seen of late is professional in its execution as compared to the same just a few short years back. If I were to point out one weak spot that still exists, I would have to state that significant problems still abound with the term "user-friendly" as it applies to software documentation and machine-operator interface prompts. To my way of thinking, it is in these two areas that the next battleground for customers will be fought as the other differences between competitive programs diminish.

There you have my opinions in a nutshell. If someone were to ask me if I would buy a microcomputer again, my answer would be a resounding yes! Never in my life have I found an activity that would hold my attention for so long. If someone had told me five years ago that I would bring a computer into my home and stay up until the wee hours of the morning working with it, I would have thought them to be rowing without both oars in the water. But I have now experienced the euphoria that comes from interacting with such a demanding mistress. Her requirements are exacting enough, yet the rewards are exhilarating!

Ed Lisota, Afton, WY

Diversi-support

First and foremost I am writing about a software product I recently purchased called *Diversi-DOS*. I had been considering a DOS

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speedup package for some time and was prompted to try this particular product by several letters and reviews that praised not only the software itself but also the user support from the publisher.

The product has lived up to its advertising claims, and the support I have received in the three weeks since I bought it has been phenomenal.

I received *Diversi-DOS* in the mail on a Friday afternoon. After a full weekend of experimenting with it and several other programs, I discovered several incompatibilities between *Diversi-DOS* and Neil Konzen's *GPLE*. It seemed that there was no way to use these two programs together with either loaded into the 16K card. Also, the buffer utility that is part of *Diversi-DOS* would not function with *GPLE* installed. I wrote a letter to Diversified Software Research describing the problem and asked that the company let me know of a solution. I was surprised to find a reply in my mailbox one week later. The author, Bill Basham, responded by giving me the lastest version of the program, along with a new PLE.LC file that works fine with *Diversi-DOS*, plus a few other files—all on a new disk. His letter also explained why the buffer utility and *GPLE* will not work together, and gave a patch to fix this. Unfortunately, this patch did not work for me, but Mr. Basham and I are still corresponding on this matter and I fully expect him to solve the problem.

In short, the service and support offered by this company is unique in my experience.

To Nancy Stanger (May Open Discussion): The volume 3, number 8, issue of *Nibble* magazine has a program called *Apple Recipe Box* that my wife and I typed in ourselves. This program keeps all the data one would expect of a cookbook program, plus it will double, triple, or halve a recipe and print it out if desired. It will not decide what to have for lunch or anything else beyond simple data storage. If this is all you need, I recommend it highly.
Hal Scoggins, Lake Jackson, TX

Your Letters Count

A while back I happened to read a letter in Open Discussion concerning *The General Manager* by Sierra On-Line. Since I was shopping for a database program at that time, I decided to check it out. After a few months' experience using this program I would like to say that *The General Manager* is everything it promised to be and then some.

So far I've set up about six different databases using this program. They range from energy-conservation studies to a doctor's office accounting system. I'm convinced that the program is flexible enough to meet any small-scale database needs. To me, the main feature of the program is the user interface machine language routines that allow you to access the database from within a Basic program using the ampersand commands. These routines allow almost unlimited access to the data. Another good feature is its compatibility with hard disks and nonstandard floppies.

The General Manager is an excellent business package that I would certainly recommend to anyone needing database management. Thanks for printing letters like the one I read. Sometimes the experiences of users are the best product reviews.
Robert J. Divilio, Silver Spring, MD

Caution and Insistence

I'd like to warn Apple IIe owners to be very cautious when they buy any peripheral cards for their IIe's that require the use of cables to external devices such as printers. The IIe was designed with a new back panel with cutouts for the mounting of assorted connectors like the popular twenty-five-pin RS-232. Typically, a short cable will extend from the card to a connector mounted on the back panel and a second cable will be used from that connector to the external device. Older peripheral cards will function, but their mounting will not take advantage of the new mechanical stability and electronic shielding offered by the IIe. Make sure that the peripheral card you are buying has been designed to be mounted in the IIe.
Richard Steck, Lake Forest, IL

Are You Experienced?

As I was browsing my local library, I discovered the June '82 issue of *Softalk* that I had missed. I regularly follow the excellent articles and columns and thus immediately borrowed the issue. I really appreciated the interview with Richard Bach. The article was fun and allowed me to reflect, as I too went "barnstorming" around the country as a student.

I have noticed the quality of *Softalk* steadily improving. Just as I was thinking *Softalk* was the best Apple-oriented magazine available, it got better. I'm referring to the recent addition of science fiction, the new binding, and increased size. There seems to be a continual increase in the quality of the publication.

Another feature I find valuable is Open Discussion, where readers pass on their experiences with software, hardware, dealers, and manufacturers. I would like to share some of my experiences with fellow readers too.

I developed a malfunction in my Micromodem II from Hayes. My local dealer couldn't diagnose the problem but suggested I had blown a major chip, which they would replace for $42.50 with no guarantee it would solve my problem. By pulling each chip individually and installing it into a known working modem, I couldn't isolate the problem chip. So off to Georgia my trusty modem went. The personnel at Hayes were very attentive to me as a customer. They called me several times during the two weeks they were repairing my modem, if only to assure me that they were working on the problem. After a few days of testing, they discovered a loose edge connector. They promptly fixed the modem at no charge and I had it back within two weeks. Then they even called to see if everything was working okay!

I developed a problem while using Pascal one day. I couldn't load the system into my Andromeda 16K RAM card. After some experimenting, I called Andromeda. With the company's help I discovered I had a bad RAM chip. Two days later, UPS delivered two RAM chips (Andromeda even sent a spare). The firm's courteous personnel went to great lengths to help.

One evening at our monthly computer club meeting there were some new guests present. Since our meetings are unstructured there are many things happening at once among the twenty-five-plus in attendance. Often, disks are passed around and, as happens in many clubs, copies are made. Later in the evening one new participant called for attention as he chastised the club for allowing copying to go on. Later the next day, I discovered that my original copy of *Locksmith 3.1* had a cigarette burn through the disk! (I wonder how that got there?) I called Omega to ask about its replacement policy and was told to return the disk. I really didn't expect the firm to replace the disk free, but it did so promptly, with a version 4.1 too!

I think the above-named companies (by no means the only ones) deserve the support of us computerists, as they not only produce quality products but also care about their customers, as evidenced by my experience with them. Now for the other side of the coin.

The group I have had the most dissatisfaction and frustration with as well as the most complaints about are the dealers themselves. I bought my system (fifty-four hundred dollars' worth) back in January 1980 from a ComputerLand. The owner and salesmen were happy to



sell me everything "they" knew I wanted or "needed." Three days later, after much frustration, I went back to get some help on using *VisiCalc*. They didn't want to take any time for me, as they had other customers to sell systems to. Several times when I had questions about my new system, they didn't want to help. But if my question offered them the opportunity to try to sell me another piece of software or hardware, they seemed to have more than a few minutes. I usually had to find another user or look in magazines for the answers to my questions. The four computer stores in my area at that time all took the same attitude, except for Randy Sittel at Computer Things. Randy helped me through my learning experiences.

I have visited many computer stores across the country over the past three years, and I have found this attitude at many of them. When I moved from the West Coast to the East, I was told by my local Apple dealer that he wouldn't service my Apple because I hadn't bought it from him. Likewise, when I first bought my Apple I had the on/off switch go bad. The ComputerLand I had bought the system from charged me fifteen dollars to replace it, even though it was still under warranty.

Recently, another ComputerLand I've dealt with took over three weeks to send a lease form for a complete IBM pc system our office wished to buy. We knew exactly what we wanted and specified each piece of equipment by name, requesting that the lease form be sent to us for signing. We also stated that we would buy the software separately with cash. An easy sale, one would suppose, but no—four phone calls and three weeks later we received the lease form. The equipment wasn't as we had specified and the "thoughtful" salesperson had added several software packages she "knew" we would want. We didn't buy from them.

A couple of months ago, I had heard that a "computer shop" in Kingston, New York, was selling the Lazer Systems lower-case adapter at a special reduced price—just what I was looking for. I purchased one and later discovered I had not received the software to go with it. I went back to the dealer and requested the software. I was informed that this was the last adapter package he had, and that he didn't know where the disk was. In addition, when I had opened the box, I'd found several of the IC pins bent! The dealer said that that was too bad but that I had bought it "as is," and he wasn't going to give me a refund or adjustment. As far as he was concerned, I could just leave his store! Angry, I drove forty miles home, carefully straightened the bent pins, and installed the adapter into my Apple. Nothing happened. After much rereading of the documentation, I compared my unit with a photograph in the manual. To my surprise I discovered a chip missing from my "new" board! I called the dealer back with threats of going to the Better Business Bureau, and he quickly informed me that he had "found" another unit, and that I could exchange mine for it. I drove the forty miles back to Kingston, exchanged my board, and went home again. This unit looked new, complete, and had the disk. However, it also failed to work. This time I decided to go directly to the manufacturer, Lazer Systems. I called Randy Hyde in California. "No problem," he said and told me to just send it in. He said that my unit was an older board and had probably been on that dealer's shelf a long time. I received a brand-new, updated version as a replacement in no time at all.

Lazer Systems was not obligated to do this for me. The firm could have just said to go back to the dealer or offered to repair my old unit for a fee, as the warranty specifies. I think the company's actions deserve the highest commendation and my public thanks.

There are, I believe, many good dealers around. The problem is finding them. A couple I have found are the Computer Stores in Boston, Massachusetts, and in McLean, Virginia. Another is the Micro Age store in Portland, Oregon. I have visited other dealerships in Dallas, Atlanta, and Vermont, among others. They all had courteous and friendly personnel, even when they found out I wasn't going to buy. (The one in Dallas was a ComputerLand.) Often I have found that the best place for answers to technical problems is the manufacturer and software vendors themselves. Unfortunately, this often means calling all over the country.

In spite of my lengthy letter, I hope my experiences will be of interest to others.
Alan R. Fischer, Wappingers Falls, NY

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Elementary Service Policy

I purchased *Algebra I* from Edu-Ware thinking that it would be the equivalent of a first-year high school algebra course. Needless to say, the program was much too elementary for this purpose. My hat's off to the folks at Edu-Ware for their customer support. I wrote them about my disappointment, and within four days they sent me a letter offering to exchange the program for any of their other software. It's wonderful to know that Edu-Ware backs its product and guarantees customer satisfaction.
Drew W. Weeks, Barnwell, SC

Bugs Mar the Panorama

In a recently advertised program, *Personalities Panorama*, several bugs have been found and also a few improvements have been made. We therefore invite all purchasers of the utility to return their disks, along with $2.50 to cover postage and handling, and a new copy will be issued to them. The newer version works fine and has the feature of adding magic items to the character on the hard copy.
David Goldstein, president, Fantasystic Software, Elkins Park, PA

Cracks in the Ceiling

I would like to pass on to fellow *Softalk* readers my personal evaluation of *Choplifter* by Broderbund. This arcade game is a superb programming effort in graphic display and simulation. Dan Gorlin obviously spared no effort in programming the actions and reactions of each player of the game. My only problem with this game, and a few others like it, is its point ceiling. I saw the whole game before I came close to completing it. It may be Top Thirty material, but it's a good bet most of us *Choplifters* have hangared our choppers and are off slaying trolls or zapping aliens. If anyone else has had a similar experience with a popular game, pass it on and save me space in my disk file.
Jerry Gillard, Frederick, MD

The Better and the Worse

With Robert J. Levine's letter on the subject of *Easy Writer* (May Open Discussion), I am reminded again of how really bad some software can be. I, like Mr. Levine, bought *Easy Writer* as my first word processor. I thought it was reasonably good until I saw *Apple Writer II* in operation.

I thought that perhaps the Apple was responsible for the extremely slow operation of the *Easy Writer* program, but I soon found out that it is the software that drags the speed down in this case. The fact that it stores nonstandard files is another problem that I consider major.

Since becoming involved in Apple word processing, I have had an opportunity to try several programs. Included are *Easy Writer*, *Apple Writer II* (and *IIe*), *Screen Writer II*, *Executive Secretary*, and *PIE Writer*.

Take heart, Mr. Levine, *PIE Writer* is far, far worse than *Easy Writer*! After trying to use *PIE Writer* in a classroom situation for a few weeks, I gave up and bought another program. Not one of my adult students could manage the *PIE*

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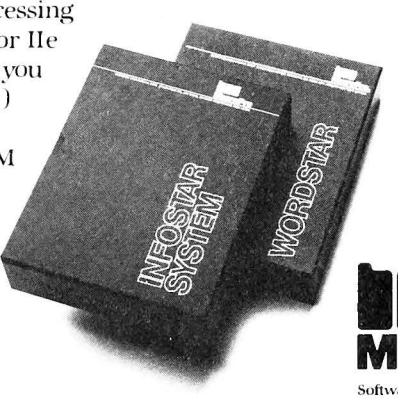
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Writer program, and it is so badly designed that I am amazed it is the tenth bestseller on the *Softalk* word processor list for May. I am certain that I could produce a finished document easier and more efficiently with a 1909 Oliver typewriter, some tape, and a pair of scissors!

As for salutations, *Apple Writer IIe* is the best I have tried; *Executive Secretary* takes a close second with the best manual I have ever read in Appledom.

Brian P. Lawler, San Luis Obispo, CA

Seeing Double Red

This is a sad story about copy protection and how it hurts not only the company whose software is copy-protected and the user of the software but also other people who may not even be aware they are being affected.

For the past two years, I have been using *Apple PIE* with my Doublevision video card. I think *Apple PIE* is by far the best and most complete word processor available for the Apple. When Hayden came out with the new version, called *PIE Writer*, which has so many new and enhanced features, I decided to change. However, when I called Hayden to ask when a Doublevision version would be available, I was told the company wouldn't be making such a version, since Doublevision was no longer a popular board. The person I spoke to suggested Hayden's Videoterm version. So far, so good.

Coincidentally I had been thinking for a long time about acquiring the Videx Videoterm card, which seems to be the new standard. A great deal of off-the-shelf software is now configured for the Videoterm or can be used with the Videoterm by first utilizing a preboot program. In addition, the Videx Enhancer II and Function Strip add a great many features to the Apple II that make it a much more powerful machine.

With all this carefully considered, I decided to take the big plunge and make the change. This would mean scrapping the Doublevision board and my old *Apple PIE* and purchasing the Videoterm, Softswitch, Enhancer II, Function Strip, and *VisiCalc Preboot* from Videx, plus the new *PIE Writer* from Hayden, a total of over $800. It's a substantial outlay, but I would finally have many of the features and functions I have always wanted.

Then came the kicker. I heard that *PIE Writer* is copy-protected. I have made a policy of staying away from protected software if at all possible, especially software that is used for important business matters. I have never given a copy of anything away, but I do use copies of *Apple PIE* in various boxes of data file disks; this way I only need to take one box of disks off the shelf with both the program disk and data disks necessary in it.

All is still not lost, I thought. By this time, I was hooked on the idea of having all those neat Videx products in my Apple. I will just move my Doublevision board into slot 4 and use my old *Apple PIE* there, while the Videoterm board in slot 3 will still allow me to use *VisiCalc* in eighty columns, plus all the other functions. But alas, my old *Apple PIE* will not work with Doublevision in slot 4. The program boots all right, but the command to enter the editor causes the program to hang with a blank screen. Anybody have any ideas?

Anyway, the whole point of the story is this: In the end, I decided to do nothing and stay with my old configuration. I now am dissatisfied with a system I have loved for over two years. Videx has lost a sale of over seven hundred dollars and Hayden (whose stupid shortsightedness caused the whole mess) lost a sale of *PIE Writer*.

Please accept this story as another plea for software companies to stop copy protection. It seems quite clear that the computer whiz kids can break copy-protection schemes as fast as they come out, while those of us who use our Apples for productive work are the ones harmed. With programs used for business functions, the documentation is at least as important as the program on the disk. *PIE Writer* is a perfect example. What good would it do to have a copy of the disk without the documentation? I am still learning things about the program after two years just by reading the manual.

Thomas E. Militello, Rancho Palos Verdes, CA

Compatible PIE

Regarding Frank H. Smith's plea for compatibility with the Corvus hard disk (April Open Discussion), I'd like to say that *PIE Writer* has been, since last August, fully compatible with the Corvus hard disk, with no additional software or hardware required. For more than a year now, users have been able to get questions like this one answered by calling publisher Hayden Software's toll-free number: (800) 343-1218.

PIE Writer is fully copyable, and may be copied onto the Corvus hard disk by the user, and there configured for transparent volume switching.

This seems like a good opportunity to address the issue of copyability versus fear of piracy. *PIE Writer*, along with its predecessor program, *PIE 2.0*, has always been fully copyable. We at Softwest, the designers of *PIE Writer*, believe that software tools should be fast, powerful, straightforward to learn, DOS-compatible, *and copyable*. We believe that tools should be copyable, for versatility, onto RAM disks and hard disks.

We also believe that tools must be copyable, for safety purposes, onto other floppies. Neither a power glitch to the disk drive nor a spilled cup of coffee onto a disk should be cause for anguish—not to the writer of occasional letters nor to the professional author. Providing a single backup of a copy-protected disk—or even two or three—is not enough, let alone providing none and requiring program owners to return their original for a backup.

Yes, we're concerned about piracy. The current version of *PIE Writer* is the result of several years of full-time work. The new Apple version runs on the Apple II, the Apple II Plus, and the Apple IIe. It supports forty columns, eight eighty-column cards, hard disks, a hardware/software spooler, 48K, 64K (making *PIE* and *Format* coresident), modem and network communications, and three types of underlining to support underlining for every printer made. We've just released an IBM pc version that is compatible with the Apple version in every way—files print exactly the same. Just keeping up with hardware changes, improvements, and advances keeps us busy full time. We're hard at work enhancing *PIE Writer* and designing new products that will complement it.

Earnings from sales of *PIE Writer* are crucial to this process. Thousands of people have bought *PIE Writer*. Without their dollars in exchange for our product, there would be no new versions, nor even the current version someone's just bought (or the one before that). Without earnings from sales, powerful word processing programs would not exist.

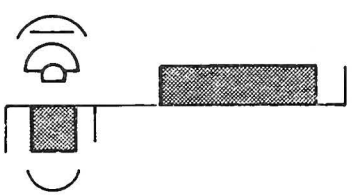
If piracy did not exist, we and other companies would undoubtedly have been able to finish and issue products that people could buy and use *now*, not six months or a year from now.

But copy-protecting disks is not an acceptable solution to piracy. We have insisted on copyability for *PIE Writer* (both the Apple and the IBM versions), and we'll continue to insist on copyability for *PRO/Format*, *PIE Spell*, and other *PIE* tools as they are published.

Tom Crosley, Softwest, Sunnyvale, CA

Economics Justifies the Teen

I agree with Norman Jonston's letter that appeared in the April Open Discussion. He expresses my opinion fully. Everyone copies



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something in their lifetime for their own use. Does that mean that everyone is a thief because he or she copied a page of music, or an article from a magazine?

I, like many other people, copy any program I can get my hands on. In fact, I own only two programs that I bought from a store. Everybody I know who owns a computer copies software. What about the schools? Do they have to buy six algebra programs because they have six computers in the school?

Perhaps I wouldn't copy so much if the price of a program weren't so high. I'm thirteen years old and I make only fifteen dollars a month. It takes me two months to save up enough money to get a decent program. If I copy programs, I can get up to fifteen good programs without paying a cent in one month! Face it, some programs aren't even worth their price. I'll admit there are some that are not only useful but a bargain at any price, but these programs are few and far between!
Ira Strum, Haworth, NJ

The Sorry Plight of the Albatross

I would like to begin by stating that I am vehemently against copy protection. I firmly believe that anyone should be able to back up any piece of software that is published *and paid for*. Kindly note those last three words, Norman Jonston. Copying a recipe from a book is not a fair analogy to pirating software. It is more closely akin to copying the whole book and then circulating the copy to all your friends, and their friends, and their friends. If you say you will copy something if you can get it, that is the same as saying you will steal any book if you think you can get away with it.

I was shown recently, by a friend, a catalog of pirated programs, all available from the same source. They were substantially cheaper than the original versions. After all, why not? The pirates don't have to pay the programmer, or copyright fees, or for the ads. They let someone else do that: the people who own the program.

There is one simple solution. If you can't afford it, don't buy it—or write it yourself. If you really need it, you'll figure out a way to afford it or become a better programmer and a more knowledgeable user. And shouldn't that be the name of the game?

Both as a musician (my livelihood) and as a programmer (an avocation), I feel that any creative work that is marketed should be respected and that its creator should receive compensation for his or her efforts. As long as some people are going to treat piracy as a game or a right, copy protection will remain the albatross around the neck of the honest users.
George VanWagner, Hyde Park, NY

Are We Not Sardines?

I have been following the piracy discussion and would like to add my two cents' worth. Basically there are two separate issues. The first is the practical one. Software makers will always be free to protect their products, and for consumers it will be one more factor—along with price, quality, usefulness—to be considered before deciding whether to buy or not to buy.



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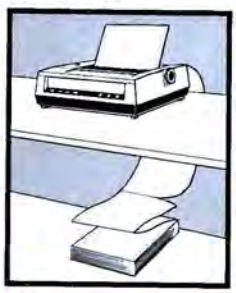
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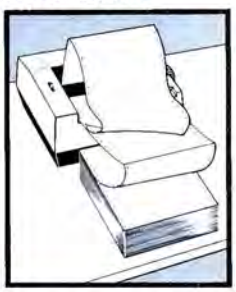
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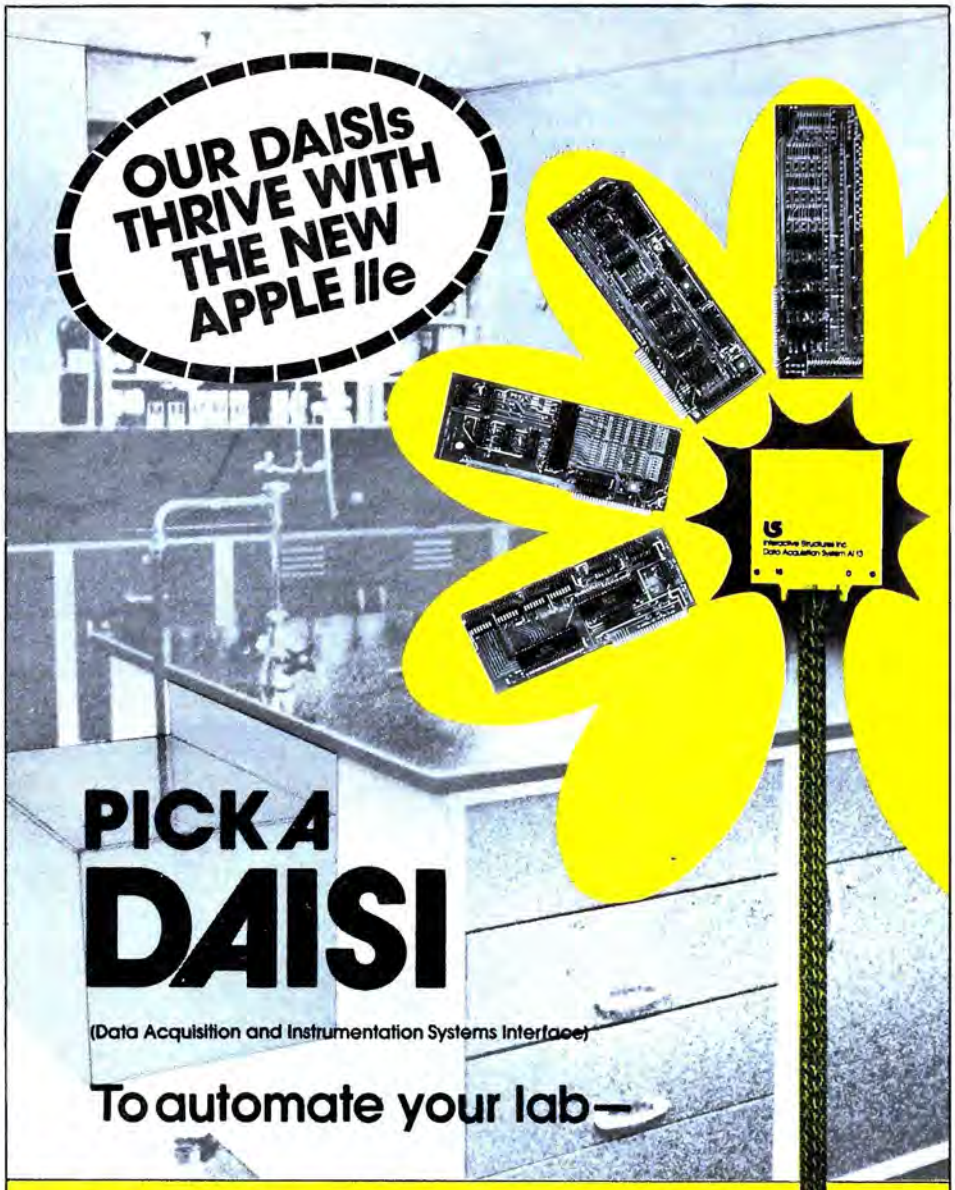
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The second issue is the ethical one. This seems to be reasonably close to a stand-off now, but in the long run the pirates will win. Their main weakness now is a semantic one, and much of the recent Smith-Pelczarski debate concerned semantics. What the pirates lack is a new word to describe what they do, one without the unpleasant connotations of piracy, rip-off, and so forth. They need to be able to say, for example, "We don't pirate software, we *frumple* it, and there is a difference." When they find that word or phrase, their case will be stronger.

On a longer time scale, the tides are also running with the pirates. Moral codes and ethical distinctions, at least as we have known them, are an occupation of a lightly populated planet. As we inexorably approach the sardine-can stage, this is changing—not toward barbarism but toward what seems right at a given time and place, as opposed to what is written in someone's visible or invisible book of rules. I don't think anyone really understands what is going on.

Daniel Shine, Cincinnati, OH

Your Buying Power and Its Effect

This is in response to the letter titled "Send Out the Clones" that appeared in the May Open Discussion. I believe that purchasing a clone is very shortsighted. We will eventually miss all that we refuse to pay for now!

The Japanese government has organized an economic system that soon will rule the world that it didn't capture in World War II. This system is financed by its own technology—which was developed using our money! We bought their cut-rate goods at cut-rate prices during the sixties and seventies. By making sacrifices in their standard of living and working conditions, the Japanese people allowed the financing of the R&D that now gives them a competitive edge.

What's this got to do with Apple clones? Supporting the copying of products makes R&D unprofitable, just as buying "cheap Japanese junk" (back when it was) made our manufacturing unprofitable. People charged with managing money for companies feel the pressure to maximize their return on investment. If we make the returns on R&D smaller, they have to spend less money on R&D. That means fewer improvements. Do you think that today's goods and services are good enough that improvement is unnecessary? Corporations do not watch only their own business, or industry, or country. If R&D becomes unprofitable anywhere, all R&D will be more severely curtailed. Nowhere is it written that corporate managers are any more far-sighted than clone buyers. Both groups are "just looking for the best deal." If you want proof, consider that they are also consumers, just as we are.

Beyond this, computer hardware requires a special consideration. It's worthless without software and vice versa. When you buy hardware that was built to run the software originally written for another machine, you announce to the world that the TRaSh folks were

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right in their approach: Keep your OS/DOS hardware secret; don't even allow users to see it.

The original machines and their systems were developed by someone. Treat that person just as you would like to be treated. Stealing the use of an idea, concept, or system is just the same as stealing a car, even though it may be harder to visualize. If people who think and create do not profit from doing so, few will have the time to think or create.

We're now in a world economy, so the point of origin of the goods and services that we buy affects only local unemployment levels and tax bases. (Do you enjoy being out of work indefinitely? Do you enjoy paying additional taxes necessitated by your neighbor's inability to pay taxes? How about those extra taxes that you see as price increases? They go to pay unemployment insurance.)

Sure, it's a free country. I don't want the right to force you to think my way any more than I want you to have the right to force me to think as you do. But before you buy something that undermines our (shaky) standard of living, THINK! Your dollars vote for the type of future we all will receive—not tomorrow, or next year, but a future that will evolve as the result of our purchases.

Allan Mahler, Terre Haute, IN

Echoes of Distress

Regarding Robert Marlowe's letter (April Open Discussion) in which he registers his distress with two computer games, I wish to state my agreement with his views. I commend *Softalk* for publishing his lengthy but pertinent letter.

Stephen Bach, Scottsville, VA

As a war gamer, a computer owner, and a military officer, I feel compelled to respond to the letter from Robert Marlowe (April Open Discussion). Mr. Marlowe decries two software offerings. He accuses Strategic Simulations and Southwestern Data Systems of being "flippant" in their presentations of *Germany 1985* and *Norad* respectively. His somewhat histrionic attack on these games stems from his belief that they propagate "dangerous misunderstandings and misconceptions" of the status of East/West relations. With all due respect to Mr. Marlowe, I find much of his letter silly, and some of it rather offensive.

First of all, I seriously doubt *Norad* owners have given any more thought to the actual ABM capabilities of the United States than they have to the reality of little missile-firing blockhouses that could repel *Space Invaders*, should they ever really arrive. *Norad* is an arcade game—nothing more and nothing less; any attempt to stretch it beyond that requires a logic tinged with paranoia. I doubt that Mr. Marlowe would argue that all shoot-'em-up games be removed from circulation, and I don't see the difference here.

With regard to *Germany 1985*, Mr. Marlowe's concern is the subject matter. I presume from his letter that it is okay to play war games that re-create wars of the past, but that it somehow violates his sense of morality to wage a fictitious war in a future setting. I fail to see the logic. If the logic is there, I wonder if it extends beyond war games. Should we also begin to question the propriety of certain printed material, or is it just computer games to which Mr. Marlowe objects? Mr. Marlowe also informs us from his tower of perfect knowledge that any conflict in Europe will certainly be nuclear in nature. Of course, if nuclear play were added to *Germany 1985*, he would object for the same reason he objects to *Norad*. Really, Mr. Marlowe, you can't have it both ways.

We are also treated to this gentleman's particular view of the world. What really concerns me is his characterization of the Soviet Union and its intentions, and, further, his subtle attack on the American military. Also, a "flourishing, capitalistic Western Europe is much more advantageous to the Soviet Union than an attempted military invasion." One must assume the Soviets hold that view from the way they've welcomed the initiation of economic and cultural freedom in Hungary, Czechoslovakia, and Poland. We are reminded that the United States refuses to renounce first use of nuclear weapons, while the Soviets, in their benevolent manner, already have done so.

Mr. Marlowe has much more faith than I in the same country that signed a nonaggression pact with Hitler on the eve of World War II, abrogated its promises (under the Potsdam agreement) to conduct free and open elections in



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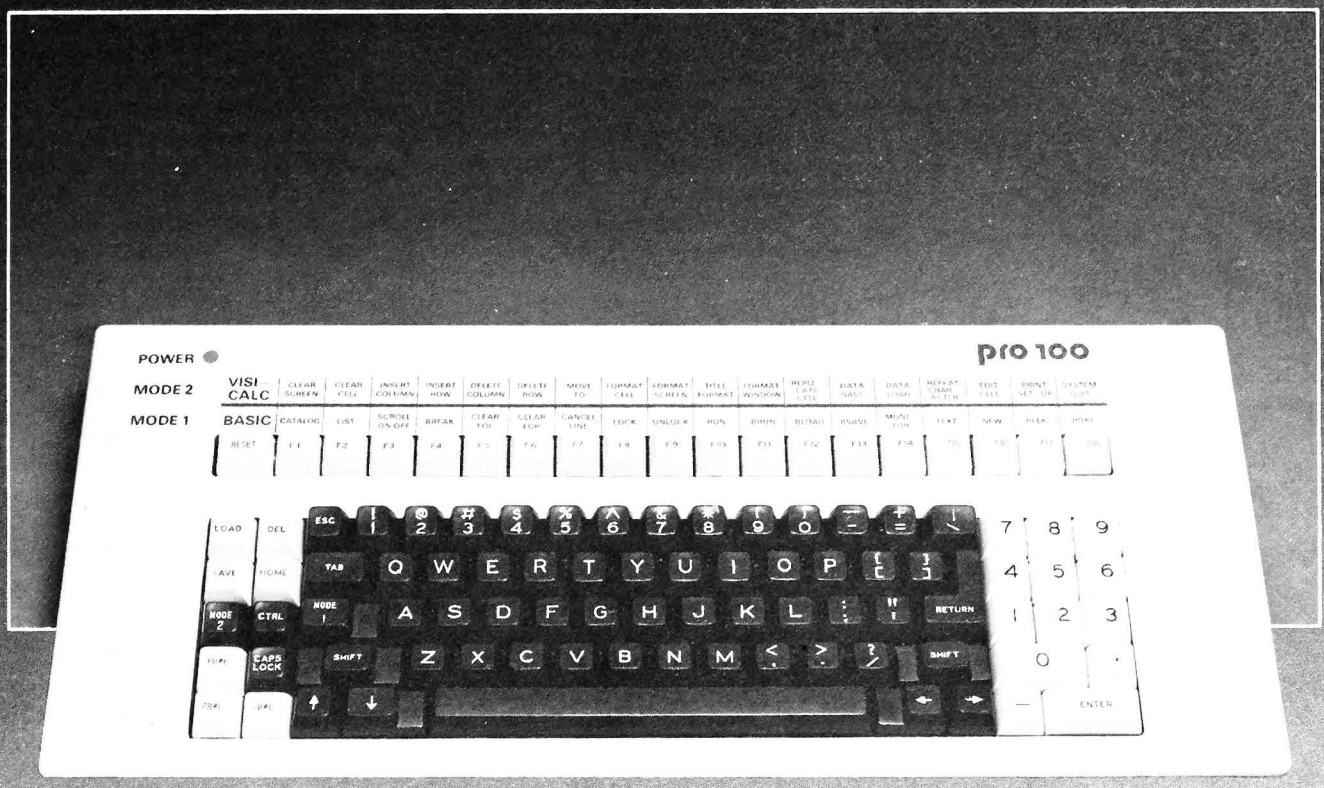


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Eastern Europe, continues to maintain domination of Eastern Europe by armed force in violation of international law, and, more recently, has been proved to be using lethal chemical agents in Afghanistan in violation of the Geneva Convention, an agreement that Russia signed. I'm sorry, but a nation with that kind of track record (not to mention the toll of internal carnage and repression), and whose perfidious conduct is a matter of history, tends not to evoke a great deal of my confidence.

Finally, it was vaguely implied that the Pentagon is a party to the "misunderstanding of the nature and degree of the Soviet threat to the West." (Mr. Marlowe, of course understands it perfectly.) It is a favored and much-used tactic in arguments like this to attempt to portray the Pentagon as a mindless bureaucracy, manned by Strangelovian madmen with the glint of mushroom clouds in their eyes. I, personally, am fed up with this characterization. Mr. Marlowe would be rightfully indignant if I chose to label him a pinko or a Communist just because I don't agree with his views. I am likewise indignant about the subtle smear contained in his letter.

The reality, Mr. Marlowe, is that we who come from a military background have much in common. We have families that we love, and the vision of a nuclear holocaust turns our stomachs just as it turns yours. We are frightened of war, maybe more so than you are, since many of us have seen death at close range. We come from all backgrounds and political views. We share with our countrymen an appreciation for the freedom that we enjoy. We also accept a responsibility to be prepared to defend that freedom, and it is in that regard that we are, by nature, suspicious. Our logic, our history, and our countrymen demand it. There can be no Pearl Harbor in the nuclear world.

I wish, as I know Mr. Marlowe does, that nuclear weapons could be wiped off the face of the earth. But wishing away tyranny doesn't solve problems or prevent wars. We all should have learned that lesson at Munich forty-three years ago.

Michael L. Chamberlain, New Orleans, LA

A Star in Mama's Dreams

I especially enjoyed the Newspeak article about the South Coast Repertory touring production (April *Softalk*) and would love to do something like that here in our beautiful hills of West Virginia. Computers are gaining momentum in our schools, but we'd love to get something started out in the rural areas, sponsored by the local Apple dealer, of course!

By the way, I have a daughter (an aspiring actress, what else?) who lives in North Hollywood. Maybe I could talk her into coming back home and starring in the production. (A mother can dream, can't she?)

Nancy Ricketts, Charleston, WV

Analysis of a Review

You have no idea how great it is to be avidly reading your favorite magazine, *Softalk*, turn a page, and come face to face with a review of one of your own programs. It puts one somewhere between terror and ecstacy. When you are a fledgling company, as we are at Psychological Psoftware, a review can make or break you. Taking a very deep breath, I began to read the review.

The reviewer was very attentive to detail and covered most of the aspects of the program, *Assertiveness Training*. There were, however, a few points about which the reviewer showed concern; I can perhaps clarify.

I have my Ph.D. in clinical psychology and have been a licensed psychotherapist in California for the past ten years. Previous to this I taught on the university and secondary levels. I am currently in private practice in San Diego. Although I write most of the programs produced by Psychological Psoftware, I don't sit back in my easy chair and crank them out. After considerable research on a particular subject, the program is designed and then written to disk. When I am satisfied with the look and function of the program, I give it to the psychotherapists at Intros, an institute for emotional growth and development in San Diego. The therapists critically examine the program, first for psychological accuracy and then for programming technique. The programs are then tested with a subject grouping. If the program is to have a school application, it then goes to several educators for evaluation and usually is given test runs by their students.

We want the programs to have the greatest possible validity within the context in which we are working. Though the reviewer seemed disappointed that the program relies heavily at times on common sense, we simply believe the problem with common sense is that it isn't all that common. We did not write the perfect program, but rest assured that we are working on it.

Patrick X. Nidorf, Del Mar, CA

Gratitude and Hope

I just had to write and say thanks for the article that appeared in the April issue of *Softalk* on building a desk for the Apple. Even though I have not built it yet, I am sure the finished desk will give me many years of use. The instructions and blueprints were very clear and well laid out. When faced with the high price of computer furniture, I had decided to get by with my present setup, an old Formica table. Your article has given me new hope; thanks again.

John Rowland, Yonkers, NY

Not a Minute Too Soon

I would like to call attention to the *Minute Manual* for *Apple Writer II* by Jim Pirisino of MinuteWare. This manual answers all the questions left by the *Apple Writer II* manual and is a must for anyone with an Epson printer. I have received excellent service from MinuteWare and recommend them and the *Minute Manual* highly.

Also, I would like to see a series of articles written as tutorials with helpful hints on the use of assembler-editors including examples of their usefulness to programmers and their programs. I have the assembler that comes with the *DOS Tool Kit*. I know that other assemblers are available that are easier to use for the beginner, but a little help goes a long way.

R.W. March, Houston, TX

Database Bugs Squelched

I was pleased with the database management program presented in the March, April, and May Basic Solution. The program, however, has a couple of minor bugs.

First of all, there is the error-trapping subroutine. As it stands now, it is designed so that an error, any error, causes it to ask you if you want to erase your data file. If you have made any mistakes in typing the program, you will have no idea what error message you are getting or what line it is in. To correct this, add this line:

```
951  IF PEEK(222) <> 6 THEN PRINT
"ERROR #:";PEEK(222);" IN LINE ";
PEEK(218)+PEEK(219)*256: STOP
```

This line checks to see if the error is a file-not-found error. If it is, it continues with the subroutine. It it isn't, on the other hand, it tells you what the error number is and what line it is in by checking the error flags in the Apple's memory. The DOS error codes and their corresponding error messages, and a discussion of them, may be found in Appendix B, starting on page 113, of the DOS 3.3 manual. The codes pertaining to Applesoft and their corresponding error messages are listed on page 81 of the

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Applesoft Basic Programming Reference Manual. The meanings and discussions of these error messages are found in Appendix C, starting on page 115. You probably will need to check both manuals to find your error message.

The second problem relates to the printing of data in columns. That part of the program, as it is written, didn't work for me. I corrected the problem by adding these lines:

```
6045  SP$="" :FOR I=1 TO
      80:SP$=SP$+" ": NEXT I
6060  O$="":REM NO SPACES
6100  O$=O$+LEFT$(A$(X)+SP$,40)
```

Line 6045 fills variable SP$ with eighty spaces. Line 6060 resets O$, the data to be printed, to nothing. Line 6100 fills O$ with what it is supposed to hold.
Brent Chapman, Kingman, AZ

Pascal's Possibilities

To Jim Merritt: Is it possible to put control characters into a Pascal text file from the keyboard? I know it's possible for such characters to be there. All you need do is transfer a DOS text file containing them to a Pascal text file. I'd like to enter them myself from the Pascal Editor. The solution to this problem would allow one to embed printer command codes into text, making underlining and so forth possible. I'd appreciate any help you could offer.
Bob Bragner, Istanbul, Turkey

To Jim Merritt: I've followed your Pascal articles in *Softalk* and am anxiously awaiting a presentation on compiler User option and p-code definitions. Please advise where I may obtain information on these items.
Joe Marti, Valencia, CA

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Jim Merritt responds:

To Bob Bragner: The Screen Editor permits you to enter any control-characters, *except* those that correspond to function-control or cursor-movement keys. The character codes from these special keys are intercepted by the operating system or editor, and are not passed on to the editor's text buffer. As shown in the list on page 208-209 of the *Apple Pascal Operating System Reference Manual*, Apple II Pascal normally intercepts the following codes: backspace (control-H); control-C; ESC, that is, Chr(27) or control-[; NUL, that is, Chr(0) or control-shift-@; control-F; control-S; control-X; control-L; control-U; and control-O. The rest of the control characters may be embedded in text files, and are normally displayed on-screen as question-marks. You may change the display symbol for an unprintable character to one that is less likely to occur in typical text files by using the set-up utility. In addition, setup may also be used to reassign the editor's control keys and cursor-movement keys, in the event that the standard settings conflict with your printer's command set.

To Joe Marti: (*$U−*) compilation was introduced in the last issue, and will be explained in greater detail in a subsequent column. I am somewhat dubious about a close look at p-machine architecture. This topic, while fascinating, seems to me to be of little practical use to applications programmers. It will also require several issues to explore. Still, if a reasonable number of readers feel that the p-machine is a worthwhile subject, I will do my best to satisfy their curiosity. In case we don't address the matter soon (if at all), you can find a wealth of information in Appendix A of the *Apple Pascal Operating System Reference Manual.*
Jim Merritt, Morro Bay, CA

Pascal on the Move

In the May Open Discussion there was a letter from John D. Ayer, who needs to move his Pascal text files to DOS so he can use them with *Apple Writer II*. Mr. Ayer indicated that he had heard of a translator program that required a Pascal operating system. RCM Software markets *File Transfer Utilities*, a set of programs that will do exactly what Mr. Ayer wants. The program requires only a Pascal operating system to transfer files into the Pascal environment, not out of the Pascal environment.
Robert C. Meltzer, RCM Software,
New Concord, OH

John D. Ayer requested a Pascal-to-DOS converter that didn't require a Pascal operating system. Apple Pugetsound Program Library Exchange (A.P.P.L.E.) in Kent, Washington, has published a very useful book entitled *All About Pascal*. A short Applesoft program, *Huffin*, was written by Dana Schwartz and appears in the publication *Call −A.P.P.L.E.* and should do the job for Mr. Ayer. As an aside, there is also a *Puffin* program to go the other way.

I am in dire need of a way for an Apple to read data files on cassette that were written us-

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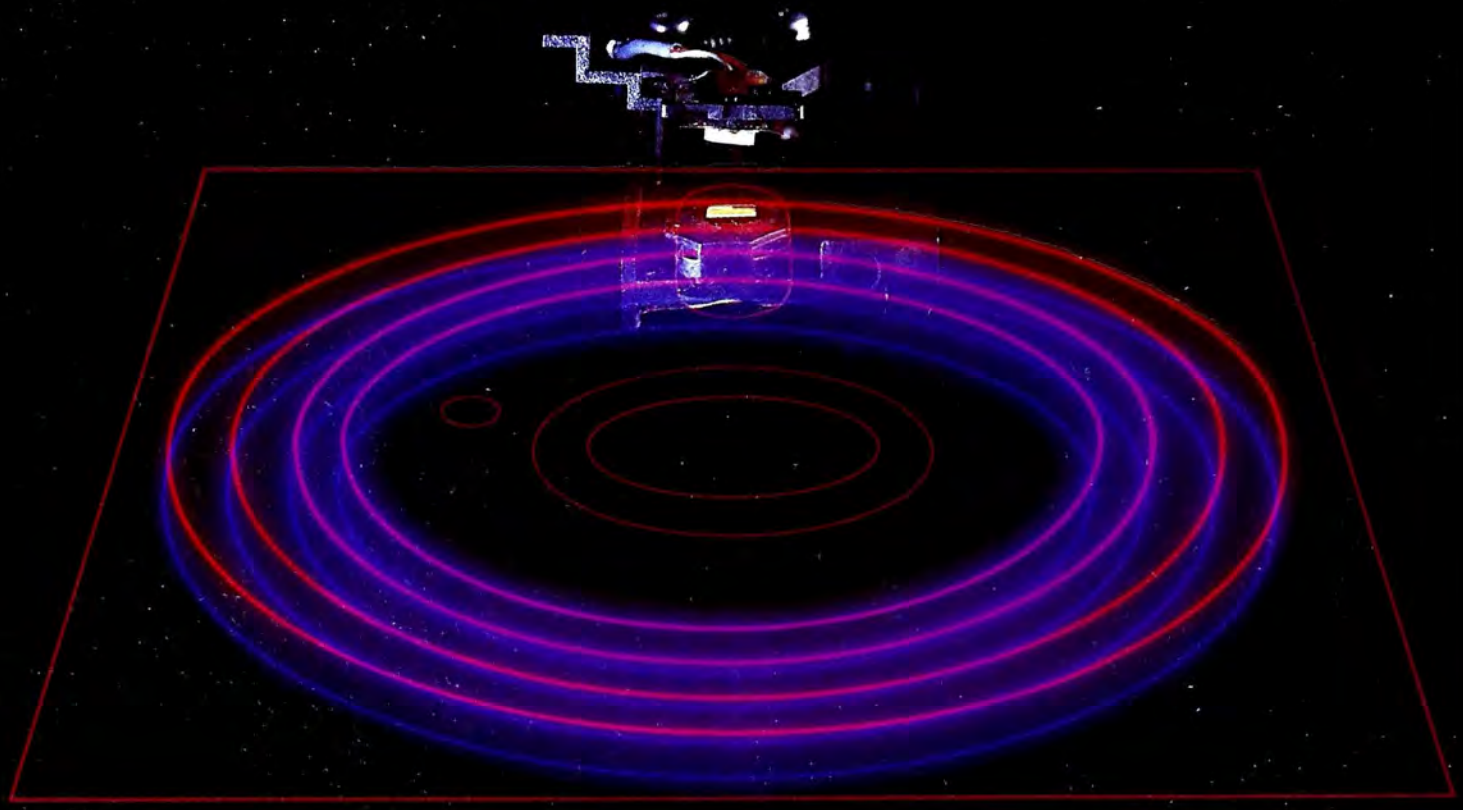
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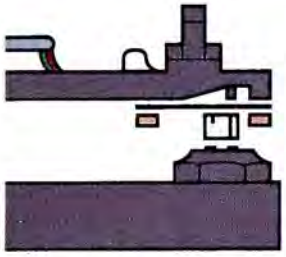
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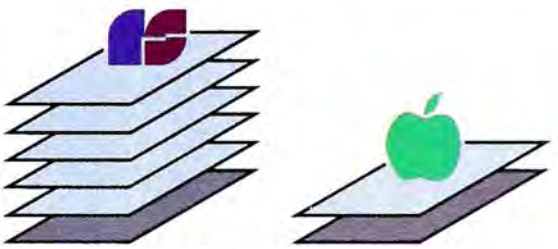
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ing an INS 8073 processor. Any advice out there on Apple cassette-reading modifications? Open Discussion is an excellent way to pull out the soapbox and ramble on about philosophy, bad bargains, gripes, and so forth. Let's remember that it can be a valuable forum for technical idea swapping as well.
Martin K. Collamore, Olympia, WA

John D. Ayer asks in the May Open Discussion for a Pascal-to-DOS text translator. Several are available.

In the April 1982 issue of *Byte* magazine I describe, first, a Pascal program that reads DOS text files and writes Pascal text files. Second, an Applesoft/assembly language program that reads Pascal and writes DOS is discussed. Since the latter runs under DOS, it may fulfill Mr. Ayer's requirement. Machine-readable copies of the software are available by writing to me through Open Discussion.
John B. Matthews, Dayton, OH

Exercises in Problem Solving

To Rodney Hixon: I also teach Basic and have had some thoughts concerning some of my advanced students. Creative Computing Press publishes a great book that comes in student and teacher editions called *Problems for Computer Solution*. Primarily math-oriented, ninety problems are presented and cover many different aspects of the subject. Sybex publishes *Basic Exercises for the Apple*, an excellent book of more than 250 pages crammed with information. This book, as well as all others I have from Sybex, is of superior quality. It covers flow charts, integers, geometry, data processing, games, financial and mathematical computations, statistics, and more. Each program is accompanied by a flow chart, and the appropriate mathematical formula is provided with an explanation where needed. Though the title may scare off many people, I also recommend Sybex's *Basic Programs for Scientists and Engineers*. The section on sorts alone is worth the price of the book. Sybex offers a fine selection of books on Pascal that are well worth checking out as well.
D. Stearns, San Luis Obispo, CA

Tools for Testing

To reply to Stephen C. Smith's letter (May Open Discussion) requesting test-writing software, I suggest that he look into *TeloFacts 1* and *TeloFacts 2* from dilithium Software. Both allow for making up tests and multiple-choice answers, as well as weighting the answers. In addition, the *TeloFacts 2* package allows the use of a mark-sense card reader, along with a few other bells and whistles not available on *TeloFacts 1*.

As for keeping gradebooks, attendance records, and the like, I've just been introduced to Microsoft's *Multiplan* and I am amazed at its power and simplicity. You would do well to check it out with respect to your proposed applications.
Art Cabot, Fort Myers, FL

What the Doctor Ordered

In reply to Guillermo Geisse's letter (April Open Discussion), I would like to say that I am in a similar position, searching for medical software. I can aim him in two directions. I've had no experience with the first, and minimal with the second, so I cannot verify the usefulness of the programs.

The first reference is Medical Software Company (Box 874, 88C Union Avenue, Center Moriches, NY 11934). This company basically consists of two physicians from Cornell Medical Center. They sell a book for $80 that has separate programs for scheduling, retrieval, billing, accounts receivable, utilization, and statistics. Please note that this book contains only listings of the programs. No disks are included. If you want disks, the "appointment-and-schedule-maker" program is available. All the other programs are also available on disk (or Medical Software will sell you the whole system—including all hardware—for a mere $5,500). As I say, I have not used this system, so I cannot vouch for its quality.

The second place to find medical programs is through the Source. Using SourceMail, write to TCP230, which will put you in touch with two Bethesda-based physicians who edit *AAMSI* (American Association for Medical Systems and Informatics). I just heard about them and asked to be included in their system. Would you believe that I received a reply within twenty-four hours and they (apparently) don't charge for use of the system! I have just downloaded some programs from them, but I

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don't have them up and running, so all I can say is they appear to be very friendly and inexpensive. If all medical microcomputer users joined this group, we could share the wealth of programs available without high cost to any single member. How about it, medical micros?
Scott Withers, Ithaca, NY

Biofeedback Feedback
In the April Open Discussion R.L. Cook wrote that he is interested in using his Apple II for biofeedback purposes. A few years ago, I attended a conference at which a guy was promoting a device called the Biocomp. This entailed an Apple II configured with assorted hardware and software to emulate twenty-eight feedback instruments, any four of which could be used simultaneously. The system was impressive. One can purchase it from Biofeedback Research Institute, 6399 Wilshire Boulevard, Suite 900, Los Angeles, CA 90048; (213) 933-9451.
Eli Camhi, El Paso, TX

Leads for the Layman
This is in response to D.G. Thomas's letter (May Open Discussion), in which he complained about the fact that the printer manual for the C. Itoh 8510 is not written for the average user. I have one, too, but it is called a Prowriter and is distributed by Leading Edge. I received the same manual, but Leading Edge included another one for the average user. It tells you about the printer in great detail and is written in layman's terms. The company also threw in a T-shirt with the Prowriter logo. I would suggest you call Leading Edge to see if you can get one of its manuals.

On the same subject, I was having great trouble with my Grappler+ interface card. When printing, it would suddenly stop. I could get it going again by taking the printer off-line and then on-line, but it would skip letters. I thought there was a bad ROM chip in the interface and was about to call Orange Micro, but I bought a System Saver by Kensington Microware and everything worked great! Now I can take advantage of the Grappler's excellent capabilities. So the moral is, if you have more than one card plugged into your Apple, you should get some kind of a fan to avoid troubles.
Eric Sorensen, Mount Clemens, MI

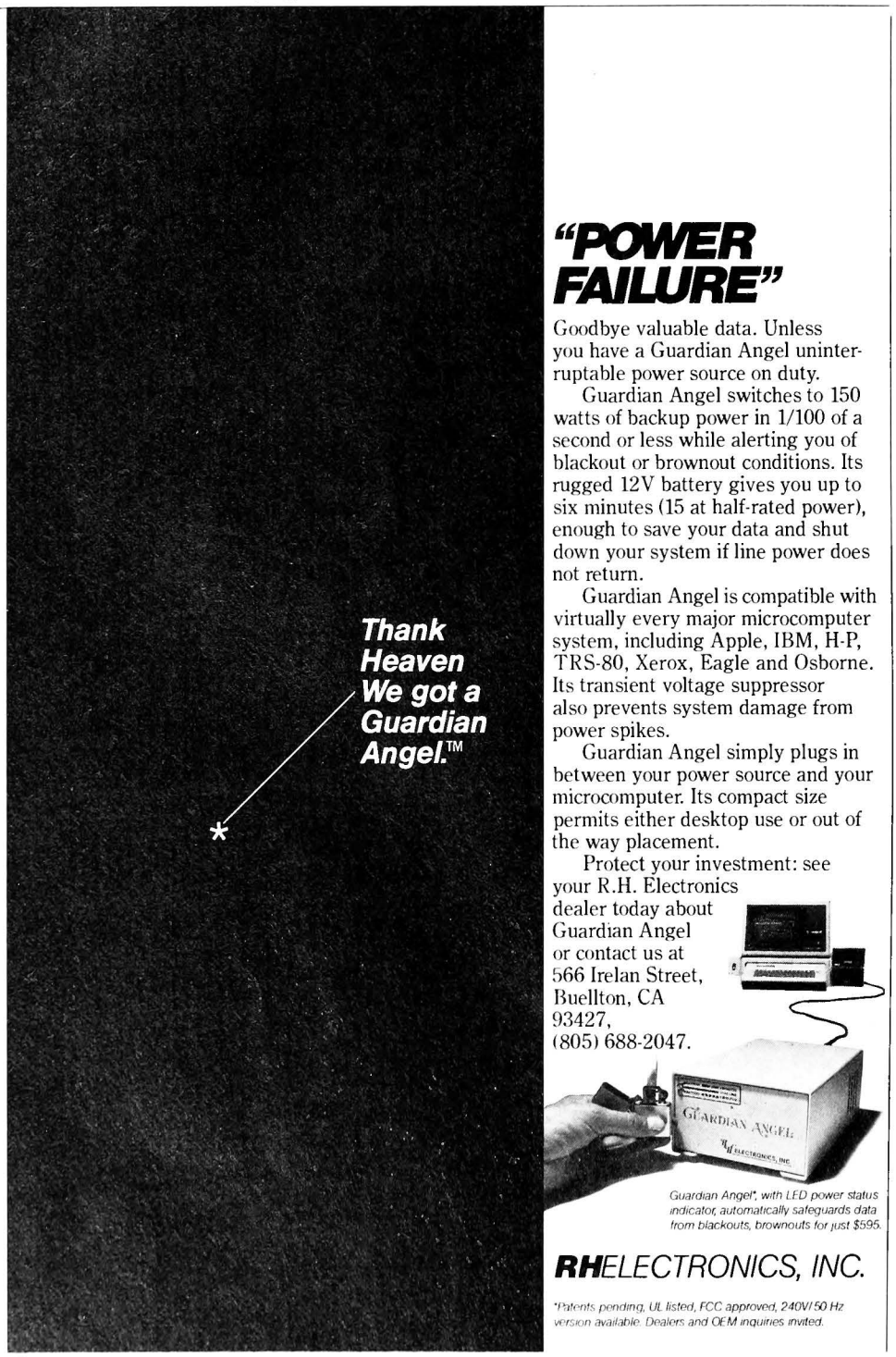
Not So Flashy
Annoyed by the flashing cursor? The following subroutine can be used in a program when user input is desired. If variable Q is set to 256, the cursor will not flash while the user is inputting data; if variable Q is set to 156, the cursor will be invisible while the user is inputting data. This subroutine could be further modified to allow for correction of mistakes by the user.

```
1 GOSUB 1000
2 REM REST OF PROGRAM
1000 POKE - 16368,0
1010 POKE PEEK (40) + PEEK (41) * Q +
     PEEK (36),32: REM SET Q EQUAL TO
     156 OR 256
1020 P = PEEK ( - 16384): IF P = 141
     THEN RETURN : REM USER
     PRESSED 'RETURN'
1030 IF P < = 155 THEN 1010
1040 PRINT CHR$ (P);
1050 POKE - 16368,0
1060 X$ = X$ + CHR$ (P): REM X$ IS THE
     STRING WHICH THE USER IS
     INPUTTING
1070 GOTO 1010
```

Andrew Cutler, Washington, DC

Apple in a War Zone
I am writing aboard ship, where I have my Apple set up in my office—it is used almost all the time. The program I use the most is *PFS*. The chief engineer is planning to purchase an Apple for his department when we arrive back in the States. We are currently stationed off the coast of Beirut, Lebanon, and I'd like to know how I can go about joining a user group. The ship's home port is Norfolk, Virginia, but my home is about forty miles north of Boston. In *Softalk* there is always talk about user groups, but there is no mention of how one can join. Being in the Navy and stationed overseas makes it a little hard for me to get information. Any help would be appreciated.
BTI Nichols, USS *Raleigh*

Ugh—or Rather, Udge
Can anyone out there explain why the word kludge (pronounced like huge, not sludge) is spelled with a d?
William J. Evans, Irvine, CA



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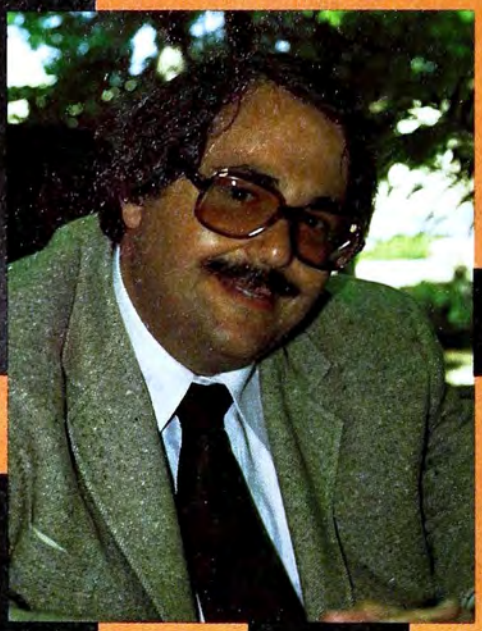
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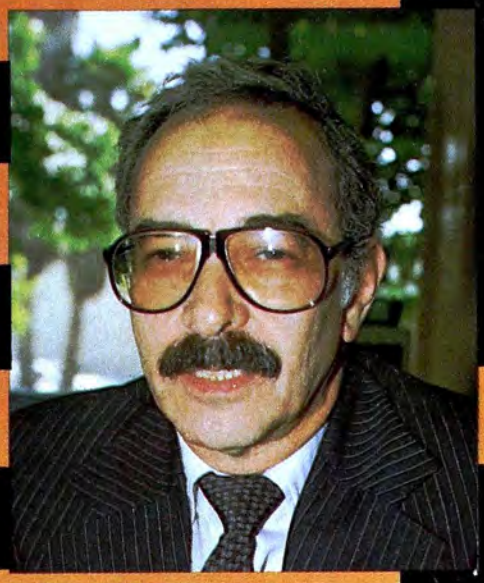








This page, clockwise from top left: Dave Gordon, founder and president of Datamost; Sandy Wiviott, vice president of sales and Datamost's first outside employee; Arlon Dorman, vice president of operations; Gary Koffler, director of new-product development; and Walter Weiser, Datamost's vice president of marketing. Opposite page: left, Abe Weiss, vice president of finance; and Bob Gottlieb, Datamost's tough new vice president and general manager.





EXEC

DATAMOST INC

Growing Up in the Software Maze

It's tough to forget the first time you meet Dave Gordon. Whether you like him or not, you can't help but be impressed by the strength of his personality—the infectious sureness that propels him through the fast-paced, mazelike world known as software publishing. He was born for the stage, or the pulpit, or the trading floor. Gordon wears you down and wears you out. He won't let you escape once he turns to the subject he loves so dearly—microcomputer software.

Dave Gordon talks fast, but is generally true to his word. You can tell deep down he's a nice guy. He's a slightly less severe case than Darth Vader; once upon a time, Gordon was seduced by the Dark Side of the Force and he followed that disastrous path for a while. One of the most controversial figures in the Apple software industry, Gordon is currently enjoying success as president of Datamost—the second software-publishing house he has founded—but it has been a long, mostly uphill battle.

Phasor Zap. Gordon is quite a character. Over the years he has brought Apple owners many hours of enjoyment, but he has also earned a few enemies and botched more than a few situations along the way. He's not a man of moderation. Almost frighteningly enthusiastic about the project of the moment, Gordon has tended to rely on his instincts and seemingly inexhaustible energy.

Boyishly playful one day and uncompromisingly stubborn the next, Gordon—like everyone else—is good at some things and lousy at others. The list of mistakes that Gordon has made since he left the accounting business and entered the software industry is not short. Still, most people forgive him his peccadillos and he remains one of the most likable and enduring figures of the Apple family.

He's been a familiar face at trade shows and industry gatherings, user-group meetings, parties, and rafting trips ever since there have been Apple computers. When Gordon's Programma International fell on bad times in 1980, it was generally missed. And later, when Gordon left Programma not long after the company had been bought by Hayden, more than a few people were anxious to know what, if anything, he would do next.

BY DAVID HUNTER



Gordon, who has helped many companies get started and encouraged many now-famous programmers, helps Datamost's vice president of marketing, Walt Weiser, with something easy.

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Super Starwars. Gordon would be the first to admit that it's inappropriate to concentrate only on him when talking about Datamost. Many other individuals have contributed to the success of the company. Still, to know Datamost you have to know Gordon.

For thirteen years prior to forming Programma, Gordon worked as an accountant and a computer controller for a number of large entertainment firms. A graduate of Cal State Los Angeles in 1964 with a master's degree in accounting, Gordon is originally from Brooklyn and graduated from a high school in New York City.

When Gordon was eighteen years old, his parents picked up everything and moved from Brooklyn to Los Angeles. The change of scene agreed with him and he's resided in the San Fernando Valley ever since.

Gordon undoubtedly could tell many interesting stories about his days in the motion picture and recording industries. During his thirteen-year accounting stint, he did internal auditing for companies like Warner Communications, Gulf & Western, and Paramount. His last full-time accounting job in 1977 was with ASI Market Research, which runs a theater in Hollywood that previews films and television shows for select audiences.

Micro Invaders. Gordon seemed to be pretty well settled into the accounting profession. He had met and married his wife Arlene and he had a steady job and a comfortable lifestyle. Then Gordon discovered microcomputers and his life's direction changed dramatically.

"I've always been a gizmo freak," says Gordon. Like others of his ilk, Gordon was fascinated by the early microcomputers, circa 1976–1977. He proceeded to put money down for a TRS-80 and a Commodore Pet, but before the machines could be delivered he saw an Apple and changed his mind. He got his money back on the other two machines and bought a spanking new Apple II, serial number 126, in early 1977.

In some ways, Dave Gordon has never grown up. He loves to play games. He loves to accumulate both valuable and near-worthless things in large quantities. He's a collector. And in the early days of the microcomputer industry—when much of the existing software was very primi-

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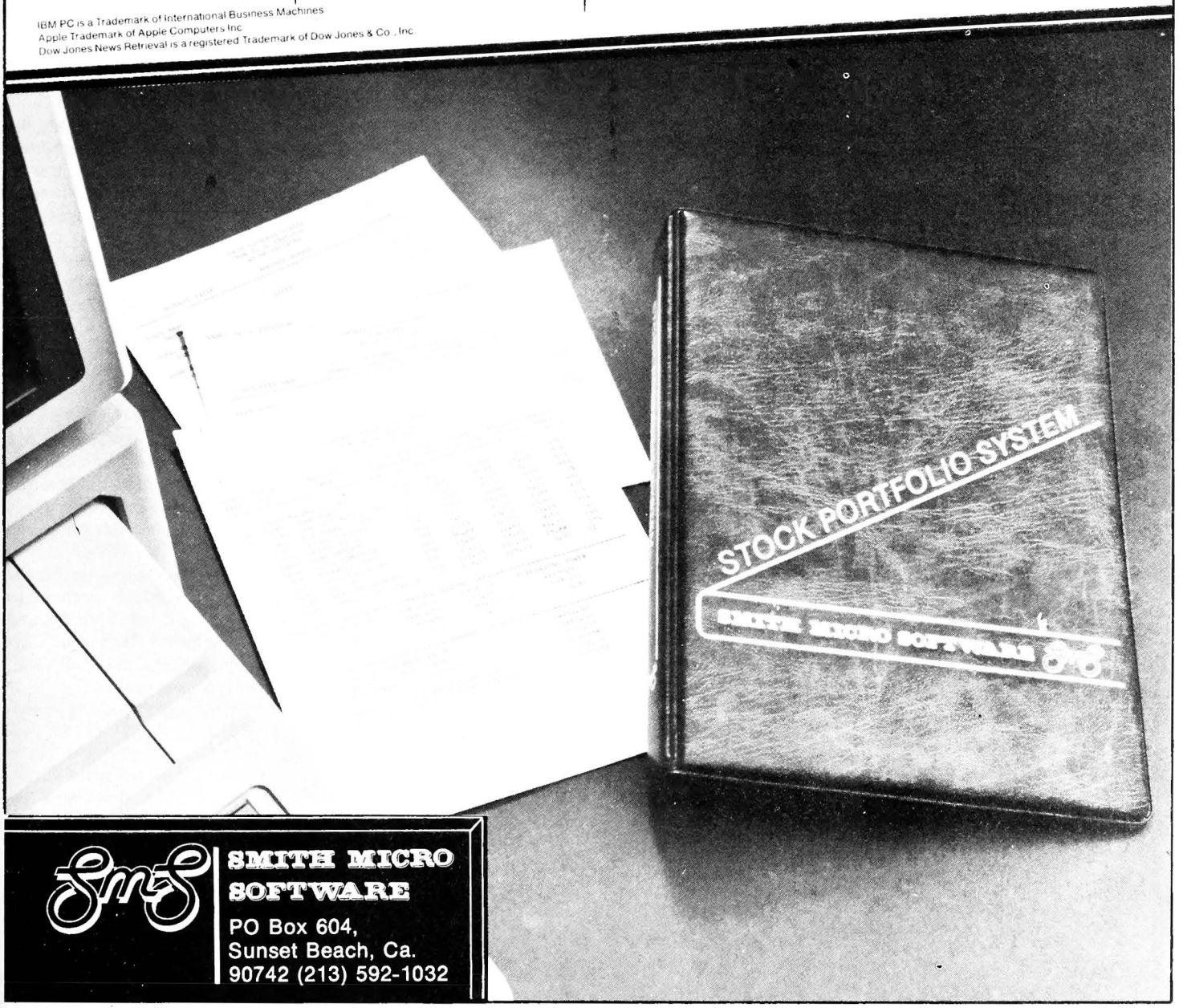
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tive and unprotected—Gordon earned a pirate's reputation.

From the first day he got his computer, Gordon seemed intent on acquiring every public-domain program written for the Apple. His enormous appetite for software drove him to user-group meetings, software stores, and the homes of fellow Apple owners. A hustler, a trader, a Brooklyn-turned-L.A.-bum, Gordon copied and traded software as if it were bubble-gum cards.

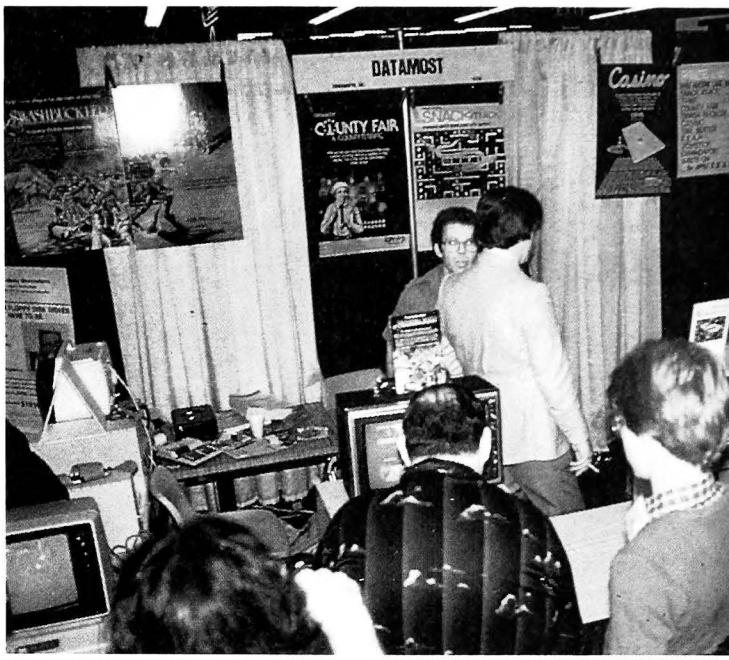
It must be said in Gordon's defense that in the early days of the Apple—when it was mainly a hobbyist's machine—copying and trading of software was fairly common. That notwithstanding, for years Gordon was known in the industry as one of the country's biggest pirates.

Gordon, who calls himself a pack rat, traveled far and wide to find programs. Eventually his travels led him to Apple Computer, which was suffering a software drought. He traded public-domain software with the folks in Cupertino—Gordon brought out the first Woz Pak from Apple in 1977 — and became friends with Wozniak and Jobs, Mike Markkula, and several others in those early days of the company.

Rise and Fall of the First Gordon Empire. Once he had caught software fever, Gordon couldn't and didn't want to shake it off. Fascinated by the growing number of companies starting up around the Apple, he toyed with the idea of starting his own company. Then he became chums with a gentleman named Mel Norell, who was running a small software business called Programma Associates that specialized in software for the Sphere computer.

In 1978, Gordon and Norell formed Programma International and became one of the first mass marketeers of microcomputer software. At its height in 1980, Programma offered hundreds of programs (most on cassette tape) for several different personal computers.

If you bought your Apple within the last two years, you may have only heard the name Programma International or seen some ancient-looking Integer Basic game in the collection of a long-time Apple owner. Programma was a Shakespearean tragedy in the form of a software-publishing company. It had a scene-setting first act, a bungled climactic act, and a bitter concluding fifth act.



At the 1982 West Coast Computer Faire in San Francisco, Datamost had an impressive showing for a young company. Its booth wasn't the biggest, but it was apparent the company had big plans for the future.

At first, Programma International did quite well; it was easily the most visible and well-known of the half-dozen fledgling software houses that started up in the late seventies. In those days, games were cheap in both price and performance. Nobody expected much and nobody complained much when a $9.95 game offered only a couple of hours of amusement and little more.

But Gordon's enthusiasm got the better of him and many of the programs he picked up for Programma were often embarrassingly inadequate—riddled with bugs or just plain crude. For one reason or another, Gordon and Norell had difficulties purging their product line of old, outdated programs. Programma's inconsistent and unwieldy product line created a lot of confusion among customers at the same time that quality programs from other companies were emerging by the dozen.

For every program like the *Lisa Assembler*—which Gordon picked up for Programma from Randy Hyde—or *Apple PIE*, Programma had dozens of others that just couldn't compete. The company got a lot of returns from purchasers of the less-than-adequate programs and began to have financial trouble. Adding fuel to Programma's smoldering problems was the fact that increasingly Gordon and Norell were not seeing eye to eye on specific strategies.

In October 1980, Norell and Gordon had two choices—selling the company or going out of business entirely. They sold Programma to Hayden Book Company and Gordon stayed on as vice president and general manager. But from that point on, personalities clashed and Gordon was not much liked by his new bosses. No longer in the driver's seat, he was still trying to impose his personality on the business.

Depth Charge. Gordon was ousted from Hayden's Programma division in a fairly bitter series of events in the spring of 1981. He left Programma heartbroken that he had lost the company. As it turned out, it may have been the best thing that could have happened. Hayden had no luck saving Programma and shut down the operation altogether a few months after Gordon left the company.

The lesson to be learned from the demise of Programma is that having many different products does not necessarily indicate a healthy product line. Publishing software requires selective acquisition policies, good quality control, adequate documentation, customer service, dealer support, and effective advertising. None of these things was consistently present at Programma. There were far too many products to give every one adequate attention.

Programma had to become a real business to survive, but it never got past the hobbyist-company stage. It's a common problem with young

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companies that Gordon now appears to understand and is trying to avoid with Datamost. How well Gordon and his mostly new management staff will handle the shift from a small to a big business won't be known for a while, though at this juncture they appear to be organized, efficient, and prepared for any and all challenges.

Gordon says he was at a "very depressed point" after leaving Programma. "After much soul searching," he decided to try forming another software-publishing company in the fall of 1981. He borrowed some money from friends, enlisted the aid of his wife Arlene, brother Allan, and sister-in-law Ina ("Family labor is cheap"), and set up shop in his living room. From the start, the company showed signs of becoming a far greater success than even Gordon had imagined.

Randy Hyde remained faithful to Gordon through the rough times after Hayden bought Programma and decided to let Gordon publish his book *Using 6502 Assembly Language*, which had been turned down by other publishers as "too machine-specific." To date, Datamost has sold well over thirty thousand copies of Hyde's book. That's not enough to make the *New York Times* bestseller list, but it's an impressive number in the finicky microcomputer book industry.

Hyde's book alone brought in enough money to make Datamost a going proposition, but Gordon made two other good moves at the outset. He picked up two arcade games, *Thief*, by Bob Flanagan, and *Snack Attack*, by Dan Illowsky. The latter game, one of the most playable and enjoyable *Pac-Man*-type games so far released for the Apple, really cleaned up.

Pandora's Box. Two games and one $19.95 book may not seem like a spectacular start for a new company, but they were enough. All three products enjoyed considerable success in the marketplace. *Snack Attack* appeared for many months on the *Softalk* Top Thirty, climbing to the number three spot for two months in the summer of 1982.

Datamost grew fast and Gordon hired Sandy Wiviott as his first outside employee. The former sales consultant for an engineering firm and former operator of a computer store met Gordon at a user-group meeting in late 1981. She had been thinking about working for a software company and gave Gordon a call a day or two after their first meeting.

"I told him I might want to come to work at Datamost," says Wiviott, "and he said, 'Are you kidding?' I said, 'No'; he said, 'Come in for an interview.' I could tell from the beginning that this man knew what he was doing and that the company would be a success."

As vice president of sales at Datamost, Wiviott has attended dozens of trade shows, made thousands of phone calls, and generally had the time of her life. She is the most friendly, visible personality behind Datamost other than Gordon himself.

Soon after Wiviott came on to work at Datamost, Gordon moved the business out of his house and into an office. He began to acquire more products, particularly the games he loves so much, and the company made impressive showings at the Seventh West Coast Computer Faire and the 1982 Boston Applefest.

Gordon's eye for spotting potentially successful software has only gotten better over the years. He was probably the only publisher with enough guts to bring out a Saturday-morning-cartoon-like game such as *Swashbuckler.* Despite its limited appeal to adult game players, the game reached the Top Thirty because kids could see in it what Gordon saw.

On the other hand, some of Gordon's old misguided zealousness came out briefly when he rereleased an old Programma game with a new title. *World Series Baseball* was not a great game when it was released as *Baseball* by Programma three years ago. As a Datamost product priced at $29.95, it was clearly not going to sell a lot of copies, despite the new name and a new advertising campaign.

Tubeway. For a moment, it seemed as though Gordon might be slipping back into his old ways, particularly when he had a falling out with Dan Illowsky. Ambition and politics were the main reasons for the breakup and it was not handled well by either side. The Dark Side of Gordon resurfaced temporarily.

The whole Illowsky affair reemphasized for Gordon a very important lesson: Relationships with authors and programmers are crucial to the success of a software-publishing company. Keeping communication open and friendly can make projects go more smoothly and can also help ensure future relationships.

Dave Gordon is learning. He's trying to move away from the areas of Datamost that don't fall within his particular area of expertise.

Beginning as an Apple software house exclusively, Datamost has recently expanded to cover other kinds of machines. The company did a cool two million dollars' worth of business in 1982. That kind of success and growth is hard to handle.

Pig Pen. In the last year, Gordon has hired a number of talented individuals to manage the myriad details that go into publishing game, business, and educational software products. One of these is Arlon Dorman, vice president of operations, who joined Datamost around seven months ago.

Before taking on the crucial job of overseeing Datamost's production efforts, Dorman worked for twenty-two years at Building News, a Los Angeles-based technical-book-publishing company specializing in publications for the construction industry. At Building News, Dorman was general manager and kept tabs on that company's three-thousand-plus publications—everything from construction code books to tabloid newspapers.

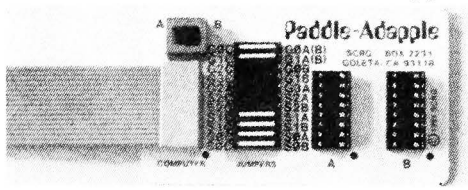
Dorman has had only a little experience with computers, but his job at Datamost demands other skills—such as meeting production schedules. "This industry is more than I expected," says Dorman. "It's a lot more dynamic than the construction industry. And we're growing so fast that meeting schedules is just so much tougher."

A little over a year ago, Gordon hired Ron Kelly as vice president of software. Gordon and Kelly knew each other from the Programma days, when the two unsuccessfully tried to publish a business program Kelly had written for the Apple. A professional photographer, Kelly had worked as a programmer at Storage Technology—a firm that dealt in mainframe peripherals—before he discovered microcomputers, Dave Gordon, and Programma.

When Kelly joined Datamost he initially helped with some programming and on Datamost's line of books. Most recently—before leav-

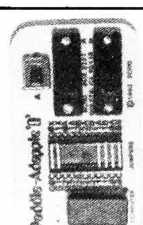
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ing Datamost about a month ago—Kelly worked closely with Gordon and Gary Koffler, Datamost's director of new-product development. All three, according to Gordon, were mainly concerned with A&R—a recording-industry term meaning artists and repertoire.

Koffler has only been at Datamost for a couple of months, but he has been active in the industry for as long as it has existed. He and Gordon have been friends for more than six years. "Gary is the one person here who knows more about this industry than I do," says Gordon.

A native of Burbank, California, Koffler was one of the three founding partners of Softape in 1977. That company joined only three other Apple software houses at the time. Koffler left Softape in 1979 for a stint with ComputerLand. There he performed a marketing survey to determine how particular products were being received by consumers.

After ComputerLand, Koffler's next stop was Datasoft. He worked there until he jumped ship to form his own short-lived software company. Koffler, who joined Datamost at the invitation of Gordon, was attracted to the vibrant, creative atmosphere of the company. He is currently taking charge of finding good non-Apple programs for Datamost's expanding line of products for other personal computers. He was involved with the same kind of diversification of Datasoft.

Gordon may be the president and the kingly figure behind Datamost, but he doesn't do everything himself. Within the last few months, he has brought on a couple of heavy-hitters to handle important facets of the business.

"I don't want to run Datamost. I'm too nice a guy," says Gordon.

Bob Gottlieb has only been with the company a month, but he supervises most of Datamost's staff. A twenty-six-year veteran of the computer industry, Gottlieb has held management and marketing positions at IBM, Olivetti, Lockheed, and, most recently, Pertec. Now he is Datamost's vice president and general manager.

"Do me a favor, don't like me. Do a job for me, but don't like me. That's the way it has to be," says Gottlieb. He's tough and should be a good person to steer Datamost's ship through the always turbulent waters of the software industry. He believes in Datamost's products and is excited about bringing Datamost out of the hobbyist-games-company stage onto the serious business level.

The Mating Zone. Walter Weiser joined Datamost about three months ago and is the model high-powered sales executive. He may not know much about the software industry, but his knowledge and expertise will come in handy. His eighteen years in the recording industry have given him a solid sales and marketing background.

"I'm a marketeer. I know how to make money," says Weiser. "I know how to make things happen—create excitement." Weiser is proud of the catch phrase he recently came up with to describe Datamost—"One step ahead." Like all who work there, Weiser is enthralled with the exciting, creative atmosphere at Datamost. "Every day there's a new challenge," he says.

Rounding out the main members of the Datamost crew is Abe Weiss. Weiss has eleven years' experience as a financial officer for large companies and is currently Datamost's vice president of finance. Gordon once worked for Weiss at ASI Market Research.

"I think Abe thinks I'm still working for him," says Gordon. "He's got me totally intimidated."

With almost sixty employees and close to thirty outside authors, Datamost has become quite a business; Gordon believes the firm will have sales of $10-15 million in 1983. The company occupies a handsome suite of offices in a Chatsworth industrial park on the western edge of the San Fernando Valley. All production, shipping, package design, and business is carried out there.

Currently, the company has three main thrusts—games, business software, and educational books. Gordon has also struck up a deal with Reston Publishing, Prentice Hall's technical-book division, to distribute Datamost's books in general bookstores. Gordon believes the company will rack up book sales of $5 million this year—almost as much as its projected software sales.

With many more games and books in the works, Datamost may be on the verge of truly taking off. Gordon and his crew are firmly convinced that the industry is shifting fast toward even greater mass-marketing for everyday, computer-illiterate consumers. Almost as important as putting out a good product is creating an image for the company that is accessible and will appeal to the largest amount of people.

"Few people seem to realize it, but we're in show business," says Gordon, speaking of the microcomputer industry as a whole. Those who attended last month's Consumer Electronics Show in Chicago saw Datamost at its flashiest—as evidenced by Captain Sticky (the crazy consumer advocate and fighter of evil seen several times on *Real People*) riding up to McCormick Place in an army half-track to carry attendees to Datamost's party.

The introduction of a line of educational games for the Apple featuring the adventures of Captain Sticky links Datamost with the larger entertainment world. You can be sure they'll try more such ventures in the future.

Missing Ring. All in all, Datamost seems to be a very healthy company. Dave Gordon has a right to be proud. His twenty-month-old company is becoming more of a factor in the market with every passing month. And Datamost's situation should keep improving, now that Gordon can do what he does best—search for and acquire software. This is not to say that Gordon won't occasionally slip up and put out a less-than-spectacular game.

Gordon is not perfect, but who is? He encourages friendship among competitors; he looks out for his authors and gives new authors a chance; he strives to help people experience the same excitement he feels when he takes a new program and flips it in a disk drive for the first time. He believes in the power of the microcomputer to change lives.

This past May, at Microsoft's NCC party in Newport Beach, California, Bill Baker of Information Unlimited walked up to Gordon, put his arm around him and said, "Welcome back."

Gordon has been good to many people in the industry because he honestly cares about it.

Welcome back, Dave Gordon. ■

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VENTURES WITH VISICALC

BY JOE SHELTON

Now that tax season has been over for a couple of months, think back on what you went through when you were trying to figure your deductions. If you were like many people, you went back through your checkbook and sorted out each deductible expense. Or maybe your approach was to throw your deductible receipts into a box or folder during the year to be sorted out when tax time came.

Surprise! *VisiCalc* could have saved you lots of time and aggravation. (You knew that was coming, didn't you?) A few months back, we created a simple check-register and statement-balance template. This month we'll do something similar, only this time we'll incorporate additional capabilities for computing tax deductions.

If you have no interest in recording tax deductions, try using this model as an aid to working out your budget. Instead of using it to compute deductions, you can easily put it to work computing expenses; for example, you can have food and auto categories in place of charitable-donations and interest-expense categories. And even if you have your own accountant and you don't care about budgets, this model may interest you; the principles we'll use in constructing it could apply to any type of model in which you're entering information that you want to separate into categories.

Many Ways To Solve a Problem. This model takes another in-depth look at logic functions, an important part of what makes *VisiCalc* as powerful as it is.

If you read last month's column, you know already that there are often numerous ways to solve a problem. In the course of completing this template, we'll get a number of opportunities to work through specific problems; this is your chance to try out a problem-solving strategy or two and then compare your results to the one given here.

There are two basic ways to go about solving a problem. The first is to dig right in and see if you can figure things out as you go. The second is to analyze the problem, understand the factors, define the variables, and then work through to a solution. *VisiCalc* pays dividends to users who determine ahead of time exactly what they want to do. So let's begin by thinking about what we want to accomplish.

First, we want to enter into a template the basic information that is entered into a checkbook (date, payee, check amount, and deposits). We then want to keep a running account balance, be able to determine outstanding checks (for statement balancing), and key each check that's a deductible. Sounds simple so far.

Boot *VisiCalc* and let's get started.

First, enter the titles as shown in figure 1. (If you have *VisiCalc Advanced Version* you'll want to set different column widths for some columns. For example, Payee and Subject probably warrant extra characters, while Tax Code and Checks Cleared warrant fewer.)

Columns A, B, D, and E are where you'll enter the date, payee, check amount, or deposit from your check register. In column C you'll record the subject of (or use for) each check. It's especially important to enter this information on deductible expenses; it will help you determine later why each expense is in fact deductible.

Looks like it could be difficult to convey the information on the subject or use of a check in nine characters, doesn't it? And it is. But this situation also provides a chance to try out an interesting and rarely used text capability that *VisiCalc* offers.

Once you've entered a key word in a cell, enter spaces until text is no longer visible in the cell. Now enter a more lengthy description of the deductible if you need to. *VisiCalc* allows you to enter approximately 125 characters in each cell. Unless you change the column width, only the part visible in the cell will print on a printer. Then, if you have questions about the deduction later on, you can simply go back to the cell and read your description. Doing so is simple. If you've entered more characters than are visible on the edit line, simply press /E and use the cursor keys to scroll through the complete text horizontally. If by chance you don't have the /E command in your version of *VisiCalc*, make certain you don't enter more text than is visible on the edit line; without the /E command, you won't be able to read the extra text.

Column F will hold the running balance of your checkbook. Column G is where you'll indicate the tax-deductible code you've selected; we'll talk more about this later. Columns H and I will contain the check-off for cleared checks and the dollar amounts of all outstanding checks.

Now that we've set up the basic model, it's important to consider cell formatting. We'll be entering quite a few cash values in this model. Because most checks will require both dollars and cents, and because we want consistency in the display of values, we might want to format the complete worksheet for dollars-and-cents display (for example, $12.34). But there will be at least two columns (G and H) in which values will be entered that shouldn't be in dollar format.

There are two ways to go from here. The first is to set up the format of the complete sheet to dollars and cents (/GF$) and then to enter integer format (/FI) into G5 and H5. If you then replicate G5 and H5 down both columns, the template will display values in a consistent manner.

The second way of proceeding is the inverse of the first. You won't use global format here. First, enter and replicate dollars-and-cents format (/F$) into the columns where it's required. Only in columns D and C will you need to replicate the values throughout the columns immediately. You'll be entering values into these columns as you work with the template. The other columns in which values will be displayed (F, I and later K, L, and M) will also contain formulas. So enter /F$ into F5, F6 (you'll understand this one later), I5, K5, L5, and M5 first. Then, after you've entered formulas and replicated each cell, the formatting will be complete.

Now choose one of the options we've just described and enter it into the template.

Now it's time to consider what should go in each column. Columns A through E will contain information from your checkbook or canceled checks. You'll be entering this information on an ongoing basis. Col-

	A	B	C	D	E	F	G	H	I
1									
2							TAX	CHECKS	CHECKS
3	DATE	PAYEE	SUBJECT	AMOUNT	DEPOSITS	BALANCE	CODE	CLEARED	OUT
4									
5									
6									

Figure 1.

umn F will contain a running balance of your account after each check or deposit (*VisiCalc* will calculate this balance for you).

Let's start with the running balance and your first exercise. Assume that the starting balance in your account is entered in F5. Calculate the formula that should be entered in F6 and then replicated down the column. What must be considered in order to determine a running balance? (Enter your formula before reading the next paragraph.)

Done? Then let's talk about it. To begin with, we have to start with the balance at the end of the prior transaction. From that amount we must subtract the amount of the check for the current transaction, remembering to add any deposits. To write the solution in English, we must take the prior balance, subtract the current check amount, and add the current deposit. Assuming that "prior" means the row above and that "current" means the same row, the formula in F6 should be +F5−D6+E6. Since you've already set the dollar-and-cents format in F6, replicate F6 into F7 through F27. Later, of course, you'll want to change the end of the range to an appropriate range for your use. Should you use relative or no-change references? Each cell reference should be relative.

Here's an additional challenge for *Advanced Version* users. After the last check or deposit entry has been made, the remaining cells in column F will all contain the same balance until the next entry is made. The *Advanced Version* exercise is to have all of the remaining cells after the last check or deposit display a blank. Before you continue, try to make this happen.

It's obvious that we're dealing with a problem that requires a Boolean (logic) solution—that is, the problem involves a choice between two possible results, and this choice requires the comparison of specific factors. In our problem, we must compare the balance in the prior cell in column F to the balance in the current transaction cell. Are the two balances equal? If not, that means there has been either a check or deposit entry in the current cell. If the amounts displayed are equal, then the prior cell is the last one that contains a check or deposit transaction and the current cell should be blank.

The procedure used to make the cell blank might not be obvious. The @IF function requires two statements after the comparison. So you can't make the cell blank by leaving a statement blank. If there is no other value or result (for example, if a blank cell is being referenced), a 0 will be displayed. The trick is to get the cell to believe that in certain cases the 0 isn't a value. Then the cell can display nothing—a blank. The problem is that once a cell has a formula in it, *VisiCalc* considers it a value.

Advanced Version offers an alternative, however. *VisiCalc* considers its @LABEL function to be a special type of value whose numeric value is 0; this value can be included in a formula or in another function.

An @LABEL function can be included as a statement in an @IF function. It can then reference a cell containing text and the text will be displayed. Or it can reference a cell containing nothing, *and the cell will display nothing*!

The *Advanced Version* solution can be stated as follows: If the value in the prior cell in column F equals the value in the prior cell minus any check in the current transaction plus any deposit in the current transaction, then display a blank; otherwise, display the new balance. Or in F6:

```
@IF(F5=F5-D6+E6,@LABEL(BK200),F5-D6+E6)
```

where BK200 could be any blank cell.

As we've said before, there's usually more than one way to solve a problem. It is now time to prove it. The course we just followed was based on the comparison of the two running-balance formulas in successive cells. That gave us a comparison by which to determine the solution. But the real difference we can identify is the fact that no values have been entered in the cells in column D or E in the current transaction. We could use two @IF statements tied together with a plus for the solution, but there's a simpler method. Take a look at your reference card or manual and see what you can come up with.

What we're asking *VisiCalc* to do is this: If there is no value in D5 or E5, then display nothing; otherwise, display the correct balance. The solution in this case is the @AND function. The @AND function takes a list of comparisons, and if and only if *all* the answers in the list are true, the @AND function returns TRUE. So our comparison could be @AND(D5=0,E5=0). Thus the formula in F6 would be:

```
@IF(@AND(D5=0,E5=0),@LABEL(BK200),F5-D6+E6)
```

Replicate this formula into F6 through F27.

Let's ignore column G, the Tax Code, for the moment and complete our check-register template.

The next thing we want to add is the ability to note checks that have not cleared the bank. We also want to be able to total the outstanding checks each time we have a check-reconciliation statement to complete. Column H is the place to indicate checks that are still outstanding. We have two options here too. We could enter an indicator in column H for each check that has been returned (just as you usually make a mark in your check register to indicate which checks have been included in your statement). The alternative is to indicate only the checks that are still outstanding. That saves having to make an entry for each check. We'll make entries for outstanding checks and then blank them when the checks clear.

Time for the second exercise. Using the second option for handling outstanding checks, determine what formula should be entered into column I so that the check amount (from column D) is displayed only when a value of 1 is entered in the corresponding cell in column H. If there's no entry in the corresponding cell in column H, column I should display 0. (If you're a *VisiCalc Advanced Version* owner, try this—but make it display a blank cell, instead of a 0.)

Have the solution? The first thing to do, of course, is to lay out the problem in English. It should read something like this: If the cell in column H contains a 1, display the contents of the corresponding cell in column D. If it doesn't, display a 0.

Or in I5:

```
@IF(H5=1,D5,0)
```

By now you should know the answer for *Advanced Version* also. Simply substitute @LABEL(BK200) for the 0.

The third exercise should be simple for you by now. The task is to change the formula to show the check amount only when no value is entered in H5. Again, a 0 should be displayed if a 1 is entered in H5. Using the @LABEL function, *Advanced Version* should once again display a blank cell.

The comparison in this case is either H5=0 or H5>0. The remaining statements in the @IF function in this example are the reverse of one another because the comparisons ask for opposite results in order to be true.

For example, in I5 you could enter either

```
@IF(H5=0,D5,0)
```

or

```
@IF(H5>0,0,D5)
```

In the first case, if H5=0 then nothing has been entered in H5 and the result should be the check value. In the second case, if a value has been entered in H5 that is greater than 0 (that is, if a check has been recorded in H5), then display a 0. Otherwise, there's been nothing entered in H5 and it should display the check amount.

There is a danger in the second method. If you don't test for exactly the comparison you want, you leave open the possibility of incorrect answers. For example, what happens if you accidentally enter a −1. Seeing that −1 is *not* greater than 0, the comparison returns FALSE. As a result, the check value is then displayed incorrectly.

Figure 2 shows an example of our working check register with some sample checks, deposits, tax codes, and cleared checks. In this example, we are using a 1 entry in column H to indicate that the canceled check has been returned. You'll also notice that no check value is displayed in column I for checks that have a 1 entered in column H.

Now enter the sample information to see if your results are the same.

Tax Time. It's time to think about recording tax deductions. Column G is the column in which we'll enter tax codes. We'll use a different tax code for each tax-deduction category, and each tax code will require a separate column. We'll refer to each column as a Deduction Account or simply an Account. After completing the rest of the template you'll have approximately fifty columns free. Thus, you can track approximately fifty different types of deductions. You can have even more if you're willing to total or sum more than one deduction in the same column.

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	C	D	E	F	G	H	I
1							
2							
3	SUBJECT	AMOUNT	DEPOSITS	BALANCE	TAX CODE	CHECKS CLEARED	CHECKS OUT
4							
5			1000.00	1000.00			0.00
6		100.00		900.00	1	1	0.00
7		25.00		875.00			25.00
8		300.00		575.00	3	1	0.00
9			200.00	775.00			0.00
10		67.50		707.50		1	0.00
11		22.37		685.13	2		22.37
12			25.00	710.13			0.00
13		100.00		610.13	1		100.00
14				610.13			0.00
15				610.13			0.00

Figure 2.

The first thing to do is to determine how many different types of deductions you require. In our example, we'll use three types of deductions. Once you see how it's done, it should be easy to add as many additional deduction categories as necessary.

Enter the title shown in figure 3.

	K	L	M
3	CODE 1		
4			
5			

Figure 3.

In each of these columns (we'll add more later) *VisiCalc* will display the deduction amounts.

An entry in column G determines which column the check amount should be displayed in. For example, column K is labeled CODE 1, which could stand for charitable donations, for example. The title CODE 1 is our shorthand to indicate that a 1 entered in column G causes the check amount for that transaction to be included as a deduction in the corresponding cell in column K. No other types of deductions can be included in column K. Entering a 2 or any other number in column G would not cause an entry in column K but could cause an entry in a column that has been set up to recognize the account number 2.



You will want to enter a more descriptive account title in your own template. Remember that you can use the hidden-text capability to include additional comments. When you change the titles, you should enter a number at the top of each column indicating the account number for that column. For example, the first account column (column K) might have a 1 entered in row 1 of that column, the second column a 2 in row 1, and so on. You can simplify the entering of these numbers by entering a 1 in K1, +K1+1 in L1, and then replicating L1 across using relative reference.

Identifying the columns in this manner will help you find a specific account later. When you want to look at an account, you just scroll across the columns until you find the number at the top of the appropriate column.

Don't feel that you're limited to account numbers of 1 through 50. Each account number is discrete. That is, each account number is distinct from any other account number. That means that you can have accounts with numbers like 345.43079 if you need to. The numbers don't even have to be sequential. So you can use numbers specific to each deduction if you wish.

You'll probably want to use short and succinct numbers, however. Remember, every time you want to charge a check to a specific deduction account you have to enter the proper account number in column G. If you use an account number like 345.43079, you have to enter that number *every time* you want to charge a check to that account. If you make a mistake in typing that number (for example, 345.40379), then that check won't be included. So use short account numbers. The old axiom continues to hold true—keep it simple!

Your next exercise is to determine what formula should be entered into K5 to achieve the results just stated. Specifically, if a 1 is entered into G5, the check amount D5 should be displayed. Otherwise a 0 should be displayed (*Advanced Version* users: a blank again). Try it before you read the answer in the next paragraph.

This one's relatively simple. It requires another @IF statement. The comparison is done to determine whether or not G5 is a 1. No other value matters. In English: If the value entered in G5 is 1, then display the check amount; otherwise, display 0 (or blank). Sounds easy, and it is. In K5 enter @IF(G5=1,D5,0). For *Advanced Version*, in K5 enter @IF(G5=1,D5,@LABEL(BK200). Replicate the appropriate formula through K27.

In order to finish our template, we want to complete two additional columns, L and M. The code for column L is 2; for M, 3. You could begin with column L, entering the title and then entering the correct formula. But there may be an easier way. Remember, if you have a very complex formula you'll have to enter it correctly in each column. If you have fifty accounts, you'll have a difficult and time-consuming task ahead. So, before we move ahead, let's consider a couple of alternatives.

First, how is the formula in K5 going to be different from the one in

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L5? In both cases either the check amount or 0 is to be displayed. The only real difference is in the comparison statement. In K5 we compared G5 equal to 1. In L5 we should compare G5 equal to 2.

If we only have a few columns that we're going to use (say three, as in our template), you could replicate the formula in K5 (and even the title in our example) into L5 and M5, using no change. Next, edit the comparison statement to G5=2 and G5=3 in L5 and M5 respectively, and then edit the titles.

Naturally, even the course of action we've just outlined would be time-consuming with fifty accounts. For your next exercise, determine how to simplify the completion of the formulas in forty-eight more columns. Use our account numbering system (1 through 50). This exercise is more difficult, but you have enough information to solve it. (No peeking!)

The solution to this exercise can be a bit confusing even though it's very simple. Remember that the only difference between each formula is the second half of the comparison statement (for example, the 2 in G5=2). So all we have to do is find a method of incrementing that value in each column.

Remember the numbers we talked about entering above the titles to assist in the identification of each account? These numbers correspond to the values in the comparison statement! Are things beginning to make sense? The solution is to use the value at the top of each column as the comparison value. In other words compare G5 to K5, L5, M5, and so on. The formula in M5 could be either

```
@IF(G5=M1,D5,0)
```

or

```
@IF(G5=M1,D5,@LABEL(BK200)
```

N5 would compare G5 against N1, and so on.

Simple and elegant, and quite easy to replicate across the remainder of the columns using no change, relative, no change (with an additional no change for the @LABEL reference in *Advanced Version*).

Figure 4 shows the completed deduction section using the example entries from figure 2.

	K	L	M
1	1	2	3
2			
3	CODE 1	CODE 2	CODE 3
4			
5	0.00	0.00	0.00
6	100.00	0.00	0.00
7	0.00	0.00	0.00
8	0.00	0.00	300.00
9	0.00	0.00	0.00
10	0.00	0.00	0.00
11	0.00	22.37	0.00
12	0.00	0.00	0.00
13	100.00	0.00	0.00
14	0.00	0.00	0.00
15	0.00	0.00	0.00

Figure 4.

In addition, *Advanced Version* users might want to make the values in row 1 invisible on the worksheet by using the /AH command before replication. The *Advanced Version* deduction section would look like figure 5.

	K	L	M
1			
2			
3	CODE 1	CODE 2	CODE 3
4			
5			
6	100.00		
7			
8			300.00
9			
10			
11		22.37	
12			
13	100.00		
14			
15			

Figure 5.

The End (Almost). We have now completed the template. All it needs are a couple of additional operational notes. At least once a month and once each year, you're going to want to determine specific information from the template, and each month you're going to want to balance your checkbook. That means knowing the ending balance (to check against your check register), the total value of deposits, and the total value of the outstanding checks. At the end of the year you'll want to total each deduction-account column.

In both cases, you could find empty cells and enter the appropriate formulas. But doing that isn't always easy, and it doesn't make for a professional-looking printed report. The solution is to insert rows (/IR) below the final transaction for the period. It is then a simple matter to @SUM the required ranges in the necessary columns. Figure 6, row 11, shows an example of a monthly account justification entry. There are @SUM entries in columns E and I.

When you continue to the next period, you can be certain that the values are correct because all formulas are automatically adjusted to account for any inserted rows or columns. The only thing that might cause a problem would be trying to insert rows before the model was complete. If you did this, you'd have to edit by hand any formulas that continued beyond the inserted row or column.

As you enter new transactions, the column titles will eventually scroll off the screen. Moving the cursor to cell A5 and entering /TH (setting horizontal titles) locks the titles so you'll always be able to see the column titles.

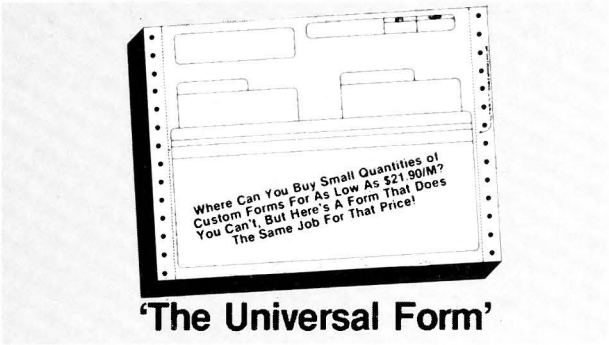
You've now completed a template to use in balancing your check register and in figuring your taxes each year. And now, of course, you no longer have an excuse for having problems in figuring your taxes next year. . . .

More important, you have had more opportunities to see how the @IF and @AND functions work. And you should now have a clear picture of how logic functions can be extremely useful in almost any template. As we said at the outset, the more you know about logic functions, the more you will use them.

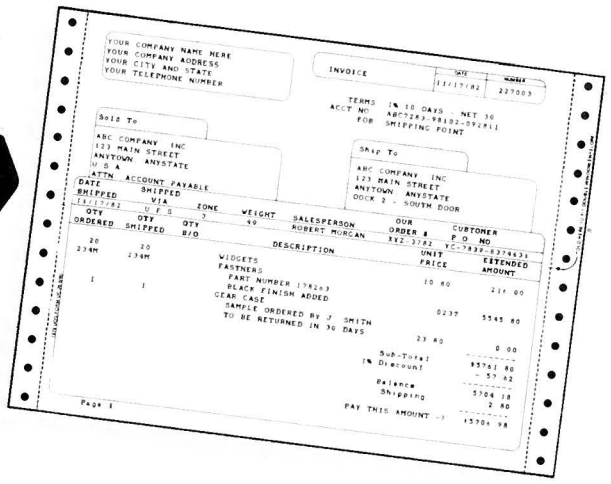
	C	D	E	F	G	H	I
1							
2					TAX	CHECKS	CHECKS
3	SUBJECT	AMOUNT	DEPOSITS	BALANCE	CODE	CLEARED	OUT
4							
5			1000.00	1000.00			0.00
6		100.00		900.00	1	1	0.00
7		25.00		875.00			25.00
8		300.00		575.00	3	1	0.00
9			200.00	775.00			0.00
10		67.50		707.50		1	0.00
11	JUSTIFICATION TTLS		1200.00				25.00
12		22.37		685.13	2		22.37
13			25.00	710.13			0.00
14		100.00		610.13	1		100.00
15				0.00			0.00

Figure 6.

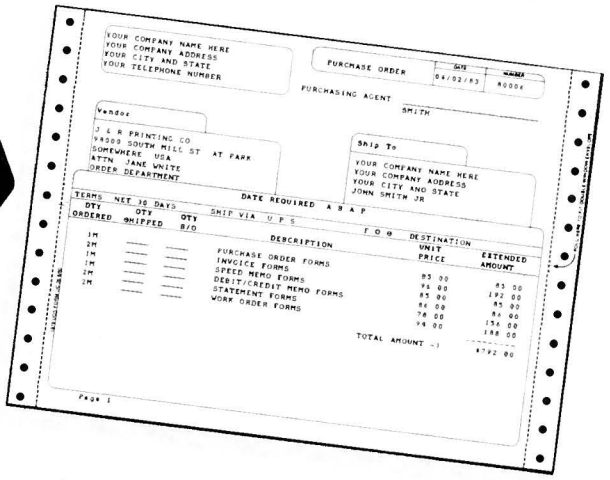
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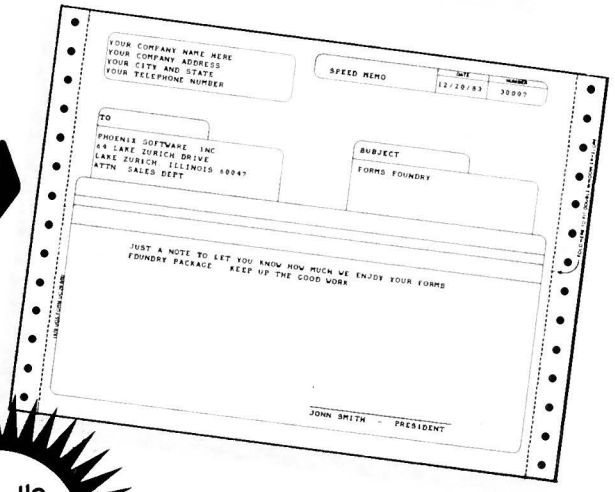
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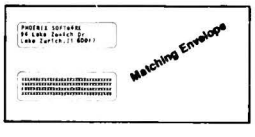
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It's entirely possible to have your Apple system consist of nothing more than the Apple and a screen. You could program, perform calculations, create graphics, and do all sorts of interesting things. Unfortunately, you wouldn't be able to save anything you created. That's why we have disks. Disks give us a place to put our stuff.

A well-known social satirist once remarked that our houses are nothing more than "a place for our stuff," and that if we didn't have so much stuff we wouldn't need houses. A house is just a big container with a lid.

That's sort of what disks are like. If we didn't have so much data, we wouldn't need disks or disk drives. Well, that's not too realistic. Computers do generate stuff, and we do need places to keep that stuff.

The operating system that allows us to use disk drives is called DOS, which stands for "disk operating system." There are several types of DOS, and the one we're using is specifically known as Apple DOS. But for simplicity, we'll refer to it as plain ol' DOS.

The purpose of this month's gathering is to find out the fundamentals of DOS. Everything we'll cover is documented in detail in Apple's *DOS Manual*, but the next few pages should give you enough knowledge to impress your computer-illiterate friends. If you need more information, the *DOS Manual* is the place to find it.

The first thing we ought to take a look at is how the disk is organized. Even though we don't need to know a thing about disk organization to use one, having that knowledge will help us understand how things work and how to get out of trouble if things go wrong. If nothing else, you'll be able to impress the neighbors with jargon and computer jokes—unless your neighbor happens to be Tom Weishaar, in which case you should talk about baroque music, your Rodin collection, and other cultural junk.

Divvying the Disk. DOS divides disks into thirty-five tracks and sixteen sectors. It's just like cutting thirty-five concentric circles in a pie and then cutting the pie into sixteen slices. The result is that we have a pie divided into 560 pieces, or sectors (too small to eat, but you get the idea). However, not all those sectors are available for us to store things on. DOS is located on tracks 0, 1, and 2; the disk's catalog and VTOC (volume table of contents, which tells the disk drive where the catalog is located) reside on track 17.

The thirty-five tracks are numbered from 0 to 34, with track 0 on the outside edge of the disk and track 34 on the inside.

Questions that should be buzzing through the brain right now include, "Why is DOS on the first three tracks?" "Why is the catalog on track 17, of all places?" and "When will the next *Star Wars* trilogy start?" Let's examine the first two questions.

A typical answer to why DOS is stored on tracks 0, 1, and 2 is, "Why not?" Actually, there's no really important reason; it's just neater to have DOS at the beginning.

And now, the second question. When we use computers, we like things to happen fast. The time required to move the drive's arm from the catalog to a file location and vice versa is not really productive; it's overhead. If the catalog were put on track 3 (toward the outer edge), the drive's arm would have to travel a whole thirty-one tracks to reach track 34 (on the inner edge). Having the catalog smack in the middle of the disk means that the drive's arm never has to go more than seventeen tracks in either direction to get someplace from the catalog.

So, with DOS and the catalog taking up four 16-sector tracks, that leaves us with thirty-one tracks, or 496 sectors, left for data storage. With all those sectors, where do we start writing data?

Write on Track. When you initialize a disk, the first file to be saved to it is the greeting program. DOS puts it on track 18, right above the catalog. The next file goes on track 19, right above the previous one. The process of storing files like this is carried on until the highest-numbered track, 34, is used. After that, DOS begins writing files on track 16, just below the catalog, and works its way down to track 3 (remember, 0, 1, and 2 are already spoken for by DOS; thou shalt not covet thy DOS's tracks).

From this description, it's clear that when you begin filling up a disk, each file gets its own track, no matter how small it is. If a file is just three sectors long, it's stored on a track, and the remaining thirteen sectors of that track are left empty. (Files longer than sixteen sectors work similarly. If a file is forty sectors long, it occupies three tracks, filling two completely and taking up eight sectors of the third.)

At first, storing one file per track doesn't seem very efficient; that would mean we could store only as many files as there are tracks, maybe even fewer. Well, that's not exactly true. Before we get into how many files will fit on a disk, let's find out why each file gets its own parking space.

The practice of storing only one file per track is mainly to let us have some flexibility when we edit files. Suppose you're using a word processor to write a letter to Watusi Electronics, complaining about the stereo you just bought (it seems the receiver was defective). When you're done griping, you save the letter to disk under the file name Gripe, and the Apple puts it on the disk, filling just five sectors of a track (you're a very concise writer). The next morning, you discover that not only was the receiver bad, but the turntable, tape deck, and speakers of your Watusi were defective also! It's time to revise your letter.

Gripes of Wrath. You load the text file, add a few more gripes, and then save it as Gripe again. Obviously, this file has more gripes and is going to be considerably longer. When you execute the save command, the Apple sees that a file called Gripe is already on the disk, so it saves your current, longer Gripe at the same location as the previous, shorter Gripe. As it's saving data, when it reaches the end of the fifth sector (the original Gripe was only five sectors long, remember?), it continues writing data on the same track until the whole file has been stored. In short, files are given their own tracks, regardless of length, so we can edit and expand them without having to hop from track to track, looking for unused sectors.

If it makes things any easier, think of the disk's tracks as a series of sixteen-page notebooks you're using to store short stories, each page representing a sector on the disk. Every story (file), be it a few sentences or a

few pages, gets stored in a separate notebook. When you want to add to it, you just keep writing in the same notebook you started the story in. Just to give you an idea how much time this saves when you're storing files on disks, try to do your bookkeeping with each ledger entry in a different book. Then wait until you're audited.

Because there are only thirty-five tracks on a disk, you might get the impression that you could have a maximum of thirty-five files on disk (one file per track). We weren't lying when we said each file gets its own track, but that's only until all the tracks have a file on them. When that happens, rent goes up, and files have to begin sharing tracks with each other.

After you've edited several files, added some more, and deleted some others, disk storage isn't as tidy as it was in the beginning; DOS starts looking for any available sector to write stuff, even if it means putting data on a part of the disk that's far away from the rest of the file it belongs to.

Sometimes DOS will tell you there's no more room on the disk, even though there is. It's not being snotty; it's just confused. Here's what's happening. On track 17, the VTOC takes one sector, and the catalog takes the other fifteen. Each sector in the catalog can hold seven file names, which means you can have as many as fifteen times seven, or 105, files in the catalog.

It's unlikely that you'll ever have that many files on a disk; but if you do, once you try to save the 106th file, you'll get a message that the disk is full. Even if all 105 files are just three sectors long—which means you should have more than 100 empty sectors available—there is no more room on the catalog, so DOS tells you that the place is sold out. Liar, liar, pants on fire.

Speaking of the Catalog. When we look at the catalog, all we see is the file name, type of file, and its length. What the catalog tells the computer, even though we can't see it, is where each file is located on the disk. So when you want to load a file, the Apple looks at the catalog, checks to see if such a file is there, and, if it is, checks the catalog to see where on the disk the file is stored. In this way, the catalog could be thought of as an index, since it tells not only what files are available but also where to find them.

Loading and saving files is fine, but that's just scratching the surface of DOS commands. Suppose you get a full refund from Watusi Electronics for the defective stereo you bought. David Horowitz and Ralph Nader will tell you that it would be a good idea to keep a copy of the letter you sent them, but after a while you might need the space on disk that your gripe letter is taking up. When that time comes, you can get rid of the file containing the letter by using the delete command. Like load and save, delete requires that you use a file name with it. In this case, you'd type *delete Gripe.* Presto! No more Gripe.

Another useful command is rename. Let's say you've saved your 1984 budget under the name Spending and Saving in 1984. After a few loads and saves with this file name, you realize that it takes just too darn long to type. Never fear; you can change the name of the file with a simple rename command. Rename requires you to enter the old name and the new name in the format *rename oldfile, newfile.*

Don't Touch That Data! Executing delete and rename commands takes just a few seconds, even though the file you're working with might be extremely long. That's because delete and rename don't do anything to the data in the file but only to the file name, which is in the catalog.

When you use a delete command, for instance, the Apple goes to the catalog, finds the file name you want to delete, and deletes it. Notice that we say it finds the "file name." All the information in the file is still on the disk; only the name has been erased. As a result, when you delete a ten-sector file, for example, the file name is taken off the list. The ten sectors still have data written on them, but in the catalog it's as if you put a piece of masking tape over the file name. DOS sees those ten sectors as available for saving information. It's similar to when someone checks out of a hotel. The front desk sees the room as vacant, even if the maid hasn't cleaned it up yet.

So, in case you've accidentally deleted a file, it should be possible to "undelete" it, since the actual data is still there. Getting the file name back in the catalog is all that needs to be done. Some utility programs make it possible to do just that. They don't resurrect dead files; they just peel off the tape that was put over the deleted file's name, and it comes back.

DOS tries to minimize the number of places that files are stored in. Suppose you have twenty files on a disk. When you delete the fifth file, the next new file you save won't go at the end behind the twentieth one; instead, it will be saved in the same spot where the fifth one (the deleted one) was. That's why you can't recover deleted files that have been replaced, no matter what. The room has been cleaned, and there's a new hotel guest staying there.

Before we go any further, let's talk about file names. We've used them with load and save, lock and unlock, delete and rename. But so far we haven't even touched what makes a good file name. Actually, file names can be anything you want them to be (sounds like a line from a Shirley Temple movie), as long as you follow three rules: File names all have to begin with letters (*1984 Budget* is no good); you can't have any commas in a file name (*Budget, 1984* is no good); file names can't have more than thirty characters (*Household Budget for the Year 1984* is out of the question).

Any file name that begins with a letter, contains no commas, and has from one to thirty characters is perfectly legal.

Double Your Pleasure, Double Your Fun. So far, we've been working with just one disk drive. Many times you'll find that a second disk drive would be quite handy. A second drive is like air conditioning: You don't have to have it, but it sure makes life more comfortable. When you're using *CopyA* to make backup copies of your data disks, for instance, a second drive means you can get *CopyA* running and then go make a sandwich while the disk is being copied. No more of that "insert original disk ... insert duplicate disk ... insert original disk ..." nonsense.

Other, more obvious uses for a second drive (if you're using your Apple for almost any applications program) would include word processing, business forecasting, database management, and so on. Having two drives means you can keep the program disk in one and the data disk in the other. Some programs actually require that you have at least two

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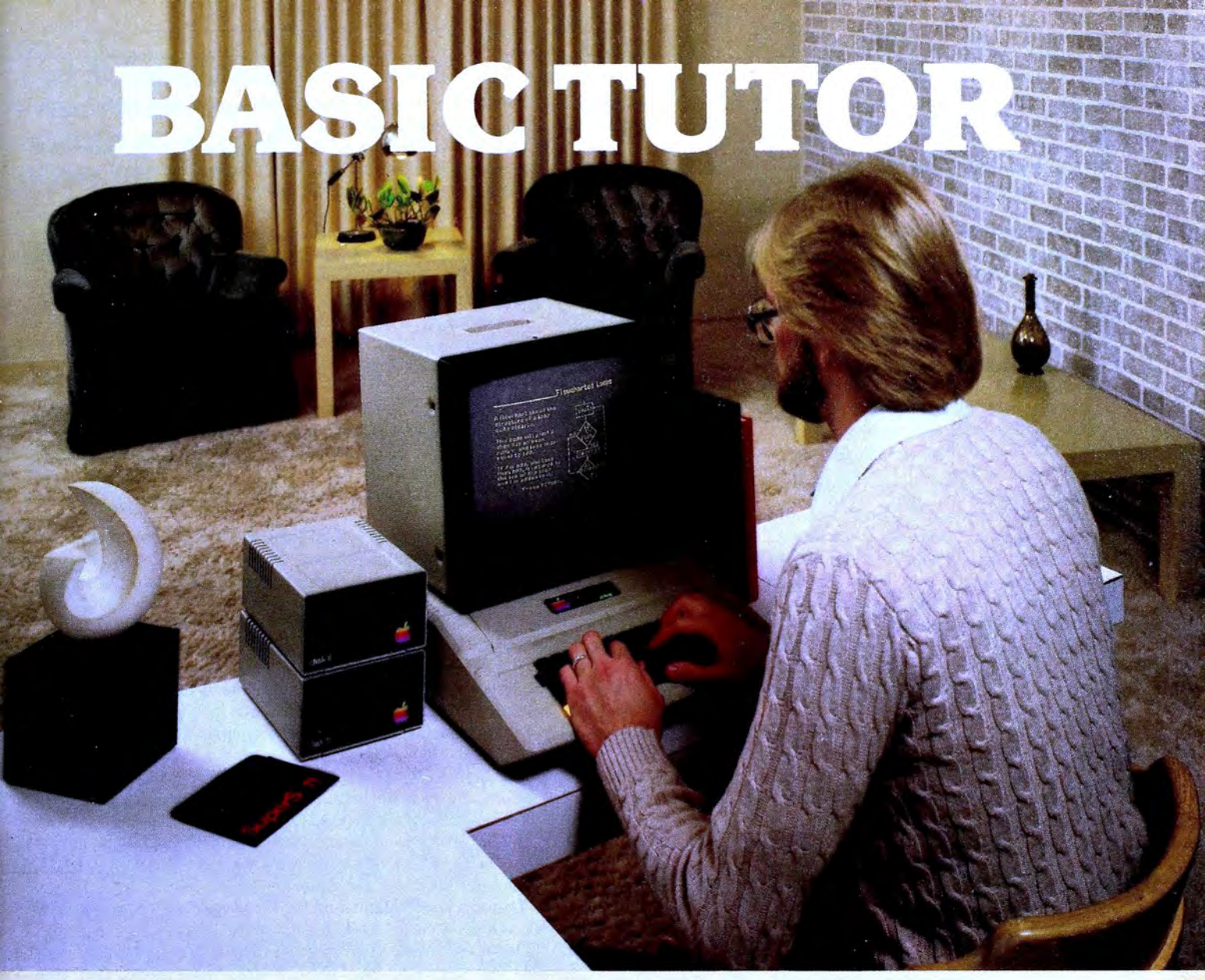
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drives, but most software publishers can empathize with us and our limited budgets, and they make programs that require only one drive, with an option to use two.

You Talkin' to Me? When you're working with more than one disk drive, you have to be more specific with your DOS commands; you have to let the Apple know which drive you want to use, and if you have more than one controller card you have to let the Apple know which slot the one you want is plugged into. Suppose we have two drives plugged into one controller card. To catalog drive 1, we can simply type *catalog*. But if we want to catalog the second drive, we have to tell the Apple that the second drive is the one we're after. You do that by typing *catalog,d2* (catalog drive 2). Likewise, if you've been working with drive 2 and want to catalog drive 1, you'd type *catalog,d1*.

The same goes for the rest of our disk commands: run, load, delete, and so on. If you're using drive 1 and want to run a program from drive 2, you type *run Second Drive Program,d2* (or whatever the program name is). Once you've specified a certain drive, all DOS commands will assume you're still working with that drive until you specify otherwise. In other words, after you type *catalog,d2*, you don't have to specify drive 2 with future DOS commands. You only have to specify the drive you want when you switch from one to the other.

You can also specify which slot you want DOS to work with. Just like using more than one drive, if you're using more than one controller card, you have to tell DOS which one you want to use. For example, let's say you have two disk drives; one is plugged into a controller card in slot 6, and one is plugged into a card in slot 5. To catalog the first drive, you'd type *catalog,s6* (slot 6). To catalog the other, you'd type *catalog,s5* (slot five). The same goes for other disk commands such as load, unlock, delete, and so on.

It's also possible to combine disk and slot specifications. If you wanted to load your cookbook program from the second drive in slot 5, you'd type *load Recipes,s5,d2*. The order of slot and drive doesn't matter; as long as you have them separated by commas, you're in good shape.

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Very briefly, the s and d (followed by numbers) tell DOS which slot and drive you want it to work with.

Once you've specified a slot and/or drive, you don't need to do so again as long as you're working with that slot or drive. If you've typed *catalog,d2,s6*, all disk commands will act upon drive 2 in slot 6, except pr# and in#, which always act upon drive 1 of the specified slot number.

Some Nondisk DOS Commands. In case you're wondering why we say "DOS commands" sometimes and "disk commands" other times, it's because not all DOS commands activate the disk drive. Most do, but not all. A little background is in order first.

There are several modes the Apple can be in. The first is the Monitor (in ROM, not the television screen), which lets you look at what's stored in the Apple's memory and examine assembly language listings. To get into this mode, you type *call −151* from Basic. When you see the asterisk at the left-hand side of the screen, you know you're in the Monitor.

Next is Applesoft Basic. Unless you have an early Apple II (no Plus) with Integer Basic built in, Applesoft is the mode you're in when you turn on the machine; the square bracket prompt (]) tells you you're in Applesoft. This is the mode we have been in and will be working in most of the time.

Finally, if you have 64K of memory or an Integer ROM card installed, you can have Integer Basic. Most of the things you can do in Applesoft you can also do in Integer—that is, execute DOS commands, write programs, and so on. Integer Basic mode is shown by the greater-than sign (>) as a prompt instead of a square bracket.

Two DOS commands that don't do anything to the disk are FP and INT. From the Monitor or from Integer, typing FP will put you in Applesoft. AS or AP would have made a much better abbreviation for Applesoft than FP, but there is a valid reason for choosing FP. FP actually stands for "floating-point Basic," one thing that distinguishes Applesoft from Integer.

Applesoft is a better language than Integer to write Basic programs in when you require mathematic calculations because it understands numbers with decimal points (3.14159, 4.444444, 1.2345678 . . .). Integer doesn't allow such complicated numbers; it deals strictly with integers (3, 26, −7, 666 . . .), hence its name. So that's why we type FP to get to Applesoft from Integer or the Monitor.

To get to Integer Basic from the Monitor or from Applesoft, we type INT, which is short for—you guessed it—Integer.

Repeating ourselves, even though FP and INT don't have anything to do with the disk drive, they're still DOS commands.

Controlling Data. The last part of DOS we're going to look at before we head off to the beach, hamburger stand, amusement park, or whatever is text files.

Text files are nothing more than clumps of data. A program is created by someone sitting down at the computer, typing in all the program lines, and then using save or bsave to put the whole mess to disk. Text files are created a little differently. The DOS commands to create text files are *open*, *write*, and *close*. And just like load, save, and run, they must be used with a file name after them.

The open command does just what it sounds like; it "opens" a file, much like the way we open a notebook. Write tells the Apple that we're going to write stuff in that file, and close means just what it sounds like—close it up. That's for creating files. You follow the same procedure to get information from an existing file, except that you replace write with *read*.

Well, that *sounds* simple enough, but it's not quite that easy. Try creating a file called Info. When you type *open Info*, the Apple responds with that obnoxious beep and the message, "Not direct command." Well, *open Info* seems about as direct a command as any of the other DOS commands, but that's not what the Apple means when it says, "Not direct."

You see, DOS commands, like Applesoft commands, can be executed two ways: in immediate mode and in deferred mode. When you type commands into the Apple from a prompt (Monitor, Applesoft, or Integer), that's known as the immediate mode. You type them in, and they're executed immediately. That's what the Apple means by "direct." The open command can't be used in this way.

A DOS or Basic command in deferred mode isn't executed right away. Once you learn how to program, you can use DOS commands

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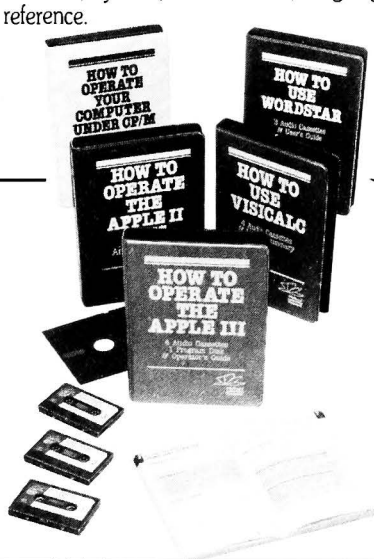
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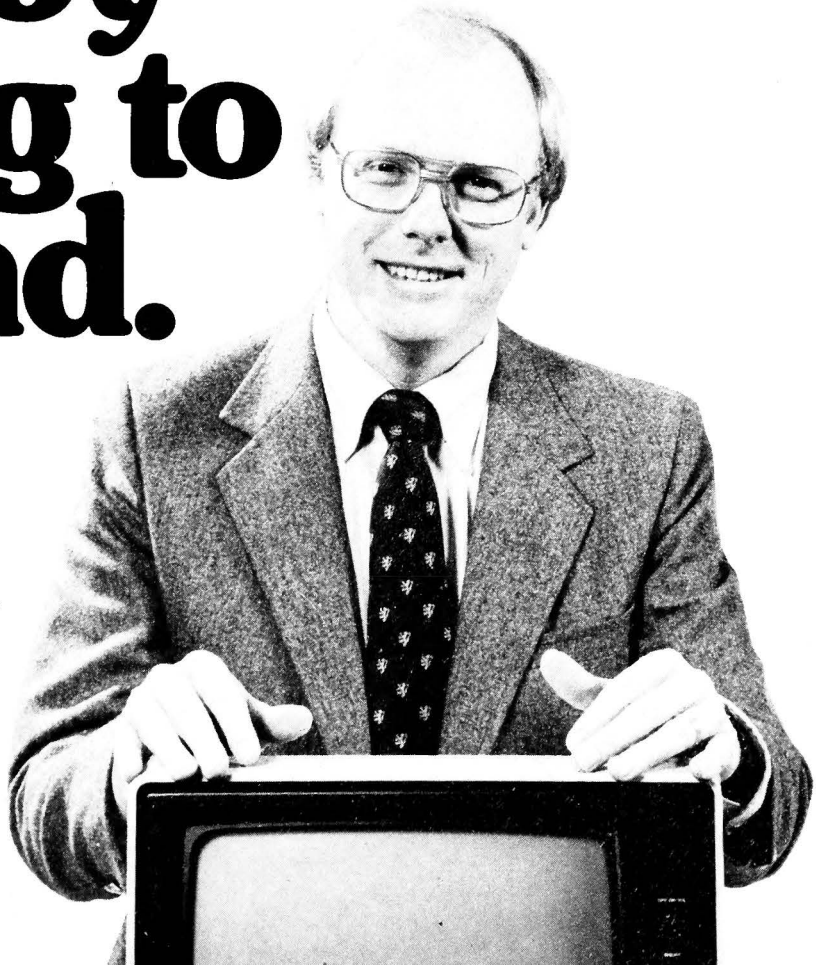
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from within your programs. For example, you might want your program to load a file. To do this, you would include *load Tadpole* or *bload Pictures* as part of your program. In this case, you type in the DOS commands, but they're not executed until the program is run; they're deferred.

Most DOS commands can be used in immediate and deferred modes; however, those commands having to do with creating or looking at text files (open, write, read, append, position, and close) can be used only in deferred mode. You can't type them in and have them work right away. They have to be executed from within a program.

But Wait, There's More. Now that we know how text files are made, let's find out what they are. There are two kinds of text files: sequential and random access. Both hold nothing but data; how they hold and treat data is the difference.

To illustrate the two, we have to play make-believe. A sequential text file is like a book that allows you to see only one page at a time. You can only read it from beginning to end, and if you want to find something in the middle you first have to examine all the stuff that comes before it. Thus, if you want to see the second to the last page in the book, you have to read practically the entire book before getting to that page. In other words, you can only look at them in *sequence*. Not a very efficient way to make books, is it?

Sequential text files let you add data to them, too. The only restriction is that you can add data only to the end of the file. In this respect, it's comparable to adding pages to the back of a notebook when you want to write some more.

A random access file can be thought of as a set of binders on a shelf. If you want to find a piece of information, you can just pull out the appropriate binder without having to look through the ones that come before it. Unlike sequential files, random access files let you examine any part of the file without having to look at the stuff in the beginning; thus, you can examine data in the beginning, middle, or end, without wading through the muck that you're not interested in. You don't have to go through the whole thing in sequence; you can pick what you want at *random*.

The reason you can do this is because when a program creates a random access file, it divides the file into records of certain lengths, much like the way a doctor's file cabinet drawer is divided up by patients' records (except this doctor's patients all have the same size records).

An even better way to think of a random access file is to picture it as a phone directory (not the kind the phone company gives you; the kind you buy at a stationery store). The directory is divided into sets of four lines: one line for the name, two for the address, and one for the phone number. Each record (set of four lines) can be empty, it can hold just one piece of information (name, address, or number), or it can be complete with all the information.

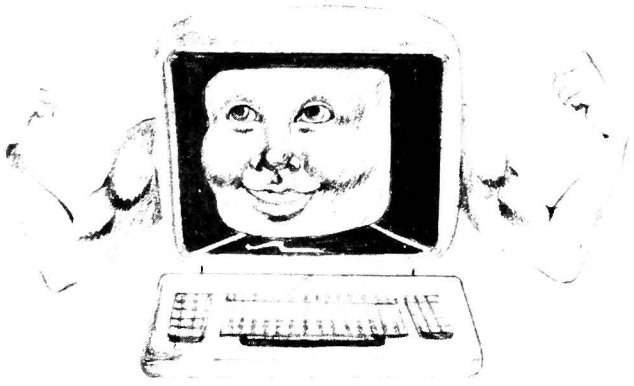
When you add data to a random access file, it's like adding the phone number to a record that previously held only the person's name; the space in the file (phone directory) is already there, so you don't have to create it. If you had to, it would be like pasting in extra paper in your phone directory—a real hassle.

The doctor's files and your phone directory are pretty good analogies because both are typical ways that database programs, which create random access files, are used.

Anyway, the point to all of this rambling is that text files are pretty complicated to create, but since they're handled mostly by databases, word processors, spreadsheets, and other applications programs, we don't have to worry too much about the technicalities. Leave that to the programmers.

Now Go Home and Practice. That's about it for DOS. For us beginners, there really isn't much more we have to know. If all this DOS talk has made you more curious about how things work and you're anxious to find out more, that means you're evolving into something called "a hobbyist" (genus hackus appleitis). In extreme states of evolution, these little creatures can be found camping out in university computer rooms, living on Fritos and Coca-Cola.

Fortunately, if you have an Apple at home or at work, living conditions are a bit more civilized, and such advanced evolution (or maybe mutation) is less likely. ◨



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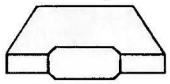
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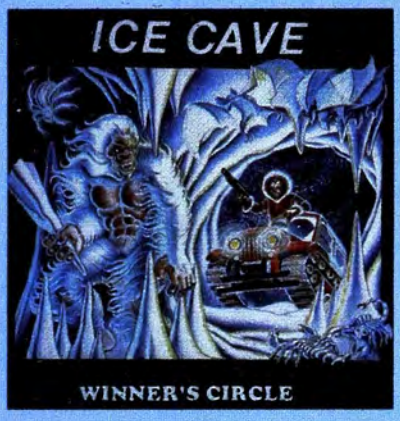
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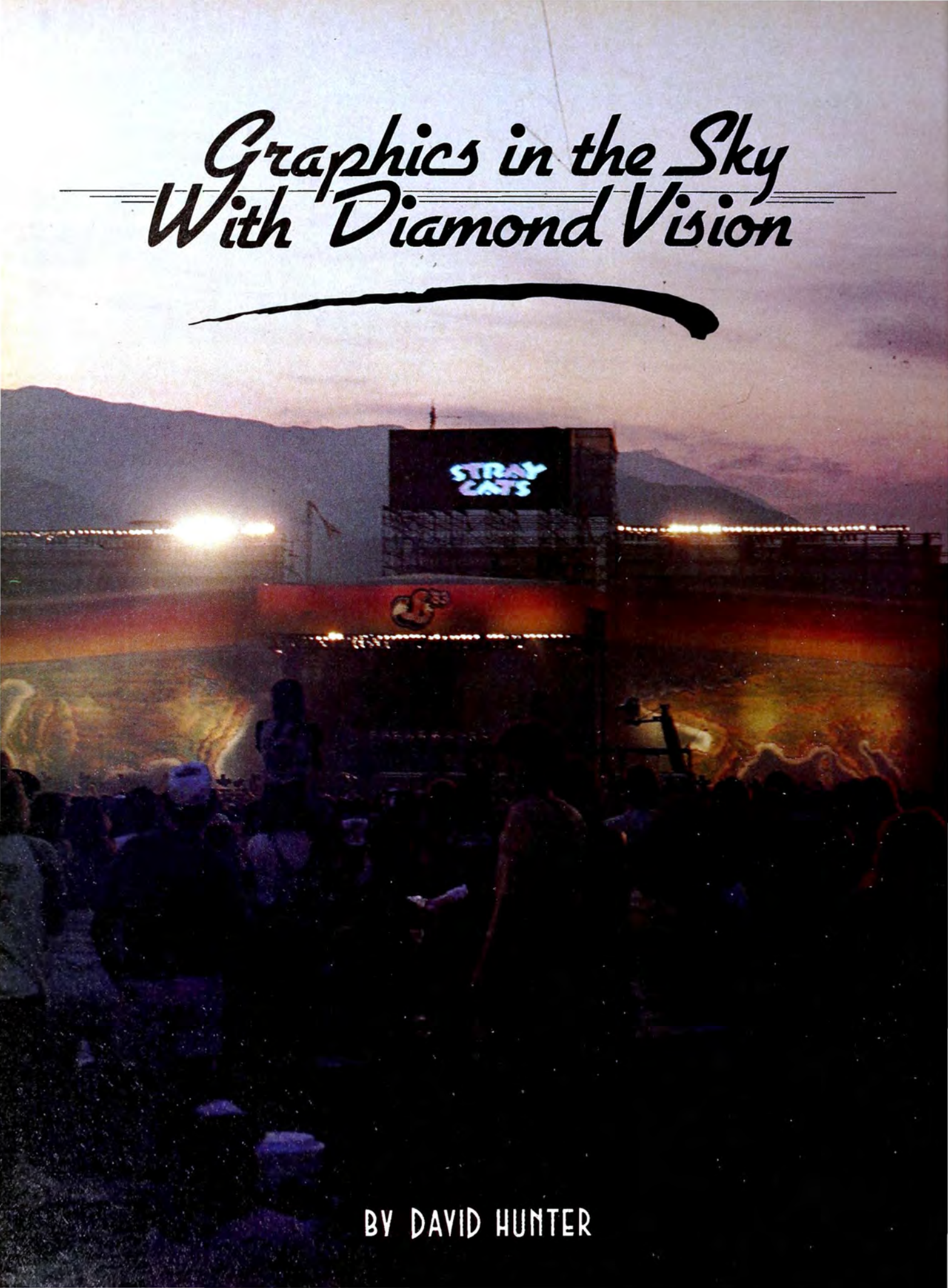
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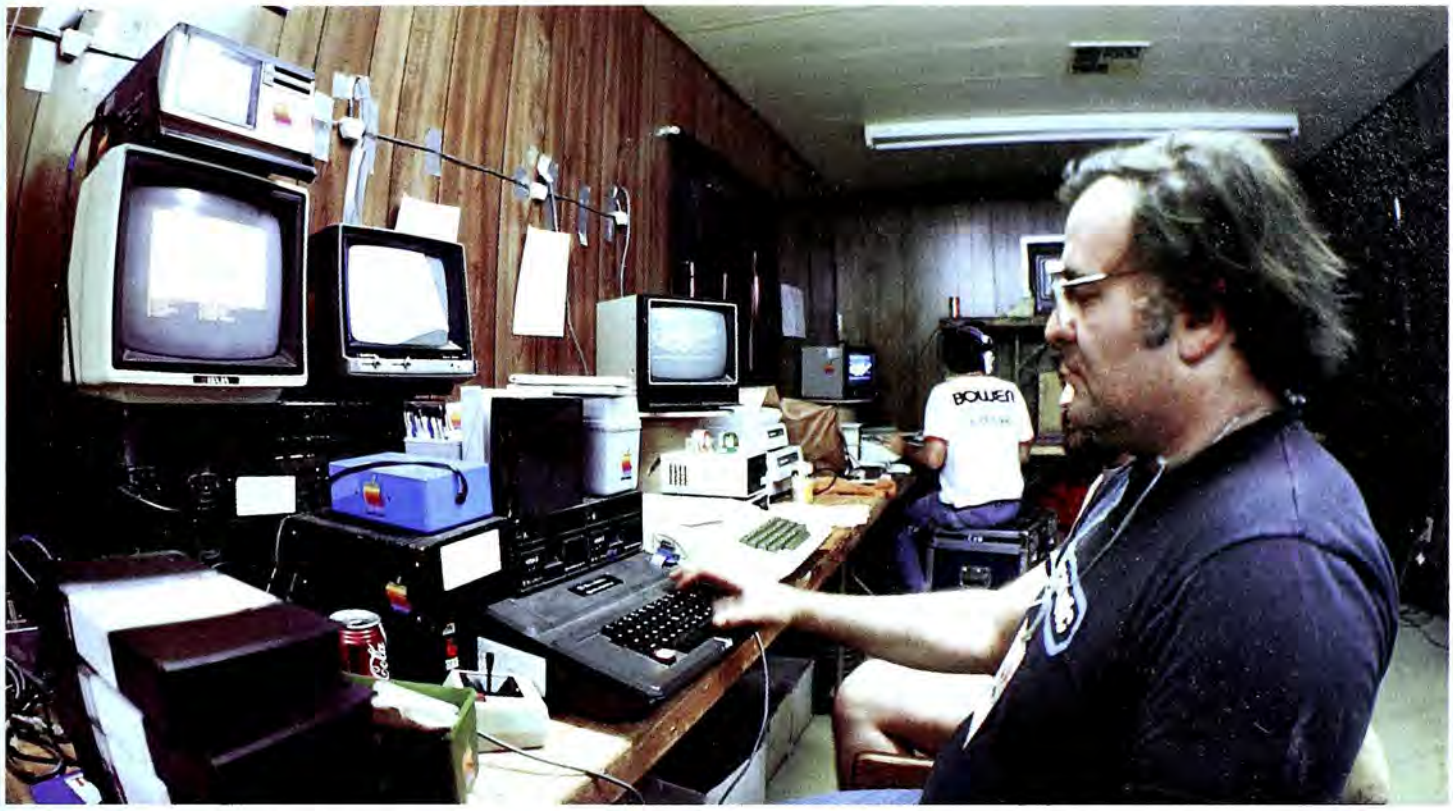
WINNER'S CIRCLE

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Graphics in the Sky With Diamond Vision



BY DAVID HUNTER



It was Sunday, May 29—"Heavy Metal Sunday" at the 1983 US Festival. By early afternoon, this day was well on its way to being the most successful of the four-day music-and-technology festival held this past Memorial Day weekend and June 4.

Well over two hundred thousand youthful concertgoers jammed the US Festival amphitheater to capacity on that long-to-be-remembered Sunday. Some who were there will remember it positively for the parade of popular musical talent and the multimedia in-between-acts entertainment. Others will remember it as a nightmarish scene of sporadic violence, stifling crowds, dust, and varying weather—too hot during the day and too cold at night.

It was scary that Sunday afternoon, particularly between the hours of 2:00 p.m. and 4:00 p.m. Dozens of sweaty, dazed fans, some of whom were bloodied, came pouring over the shoulder-high wall in front of the stage. Some were trying to reach heavy-metal superstar Ozzy Osbourne, while others who needed to escape the maddening crunch were helped over the fence by fellow concertgoers.

Lying in a Bed of Fire. Unuson was scared. Peter Gerwe, the twenty-four-year-old production director of the event, helped US Festival staffers in the photographer's pit in front of the stage sort out the injured from the merely dazed. For two hours all who were aware of the crowd problems held their breath and hoped the wall in front of the stage would hold against the crush of bodies. If the wall had come down, the backstage area would have been inundated with people and that would probably have caused a premature end to the festival.

It was a heck of a time to be in an air-conditioned trailer—a very uncomfortable seventy-five feet from the stage wall—creating graphics on the Apple computer. The calm, cool scene inside the "Apple FX" (pronounced Apple effects) trailer was infinitely saner than the large-scale pandemonium raging outside.

Programmer/engineer extraordinaire Janek Kaliczak, free-lance designer George Madarasz, and the other occupants of the ten-foot-by-forty-foot Apple FX trailer had no idea that the crowd situation was so explosive. They worked cheerfully on, oblivious of the outside world. Other than glancing periodically at a television monitor feeding the Diamond Vision image currently being displayed to the audience, the occupants of the Apple FX trailer hardly seemed to notice that there was a concert going on.

"Don't Try To Stop Me till the Good Is Gone." Careful attention to the comfort of the attendees was apparent throughout the weekend, and every day but Sunday went fairly smoothly. It'll probably be a long time before Wozniak and Unuson consider holding another heavy-metal rock-music concert, after the problems encountered this year. Commercially it was a roaring success. In terms of prestige and credibility, Unuson was hurt by this one day and came close to losing the good graces of local law enforcement agencies and city officials.

But other than the few horror stories (mostly occurring early Sunday morning and late Sunday night) relayed in the general media, the 1983 US Festival was successful and groups like the Apple FX crew made it happen.

This year, as last, the US Festival site was filled with exotic food stands, carnival attractions, and other services and entertainment, proof that Unuson was committed to making this a huge, friendly party.

As one might expect, the concert area and its legions were given the most attention. Using a bigger overall stage than last year, festival organizers kept the same basic setup of big video screens—one large Diamond Vision screen above the stage and an Eidaphor screen on either side. Throughout the three-day rock-music weekend and the one-day country-music concert, everything from the multicamera video coverage of the music to a short film in tribute to John Lennon was shown on the big screens.

During the day, the Diamond Vision screen was the only one used; the Eidaphor screens resemble those in drive-in movie establishments and are quite useless when the sun is up. One major improvement that Unuson realized this year was the ability to display three different images (three different camera angles) on the three screens for the big evening acts (Men at Work, The Clash, Scorpions, Van Halen, Stevie Nicks, and David Bowie).

Gray Matter. Another improvement was the setting up of a separate Diamond Vision screen far to the right of the stage, facing a huge area that planners felt would fill up with people, even though the actual stage was far away. They were right. A lot of people watched that set-off-to-the-side screen on Sunday, May 29, probably keeping the situation in front of the stage from getting worse than it was already.

Between acts, the large screens were used for displaying messages,

Opposite page: Apple FX's digitized Stray Cats logo as it looked on the Diamond Vision screen above the stage. This page: Janek Kaliczak is cool but works hectically in the Apple FX trailer digitizing band logos. (*Softalk* photos by Dave Hunter and Neil Britt)



The scene in front of the stage before Ozzy Osbourne played. Though the crowd was smaller than expected, Heavy Metal Sunday at the 1983 US Festival courted disaster a number of times. Most people backstage, like the Apple FX group, were unaware of how explosive the situation was.

showing films and video shorts, and throwing up anything else that seemed good at the time. One thing members of the audience especially liked was seeing themselves up on Diamond Vision; several mobile camera units wandered the festival site all four days.

The job of the Apple FX crew was simple enough—create brief messages and other graphics for use between acts. The group was also given the job of creating logos for each of the bands to be used before, during, and after each performance.

Kaliczak, who has been a familiar figure in the Apple world for years (see "The World's Largest Apple System," December 1981 *Softalk*), was given barely a week's notice before the first US Festival last Labor Day weekend. This time things were supposed to be different.

"Last year, with only a few days' notice, everything went fairly smoothly. This year, with several months to prepare, things were still rushed up to the last minute. We had equipment failure, whereas last year the Apples never broke down, even at the hottest times."

The system Kaliczak used this year was a bit more impressive than the one he used at the first US Festival. And there is at least one good reason that the preparations didn't go as smoothly as they might have. The system went through some last-minute changes, keeping Kaliczak up until all hours transferring files onto a hard disk.

Shake It. The configuration of Apples and attendant video hardware Kaliczak had envisioned only three weeks before the festival changed radically by the time the system was up and running. Originally, both the two Apple II Pluses and the Apple IIe were to be equipped with VB-3s, a video-imaging board put out by Video Associate Labs. Two more Apple II Pluses were needed for creating super-hi-res graphics, using Number Nine's graphics board—one Apple to create the 475-line-by-512-pixel images and another to control a three-quarter-inch VCR that would record the nondirect-broadcast signal from the super-hi-res Apple. The output from the two Apple II Pluses, the Apple IIe, and the super-hi-res Apple via the VCR was then to be fed through another Apple II Plus acting as a video switcher.

The system that was finally used consisted of a total of five Apples, a graphics tablet, a Corvus twenty-megabyte hard disk, a VCR, and a digitizer. Taxan helped out by lending Apple FX several of its RGB vision-III color monitors.

Two of the Apples were equipped with VB-3s and set up as delivery systems, sending output to the director of the video portion of the show. Kaliczak's own Apple was set up as a digitizing station where all the band logos were generated. Another Apple was hooked up to a graphics tablet where the logos were cleaned up. The fifth Apple was used to create the super-hi-res graphics.

All five Apples were linked to the Corvus by Omninet, Corvus's local-area network. The decision to use a hard disk caused the last few days before the festival to become even more hectic than one would expect. But it was a decision that Kaliczak and Madarasz are glad they made.

"Last year there were a couple of times when floppy-disk files wouldn't load properly," says Kaliczak, "and it was very embarrassing, to say the least."

Let's Dance. The Corvus seemed to eliminate that problem handily. With its sixty-two volumes of space for data—approximately one hundred twenty-four disks' worth—the Corvus offered more than enough room to meet the group's needs. At one end of the trailer, operators would be pulling stuff off the Corvus to be displayed, while at the other end programmers would be sending graphics to it. There were hardly any instances of interference among those accessing the Corvus, which is remarkable because Kaliczak decided against implementing Corvus's management system. Rather than contend with time-wasting procedures, such as entering passwords, Kaliczak decided to go with the simplest setup possible.

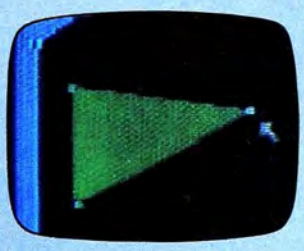
Working with Kaliczak—Apple FX's producer—and Madarasz—Apple FX's director—were programmers Barry Wood and Joe Silva, artist Dick Bruton, and general trouble-shooter Greg Voss. Mike Dyer, a manufacturing representative for Video Associate Labs, provided technical support and usually manned the two Apples set up as the delivery system.

The process used in digitizing the band logos was as simple as cooking a hard-boiled egg. First an artist drew out the logo on paper. The handmade logo was then set on the floor of the trailer, and a camera set on a table pointing down at it digitized the image. Once the framing and contrast of the digitized logo were agreed upon, the image was sent to

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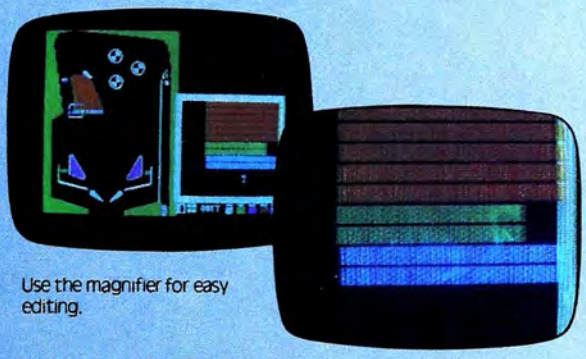
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the Apple equipped with the graphics tablet for finishing. This process included touching up the edges and adding spiffy routines like slipping down images and simple animation—causing different parts of the logos to flash in different colors, for instance.

Kaliczak, who says he isn't satisfied with many graphics-tablet programs on the market, ended up choosing Steve Dupier's *Edu Paint*, mainly for its ease of use.

"It's always been my belief that if an artist has trouble understanding how a program works, he can't use it. It's no good to him," says Kaliczak.

Diamond Vision Strut. The band logos created by the Apple FX trailer were used liberally throughout the weekend. Often they were part of elaborate fast-cutting montages when a group finished a song. Mike Dyer, who helped Kaliczak last year at the US Festival, even drew a mangy cat to include with the Stray Cats logo.

Before Stevie Nicks performed on Monday, May 30, the Apple FX trailer treated the crowd to an educational and enriching introduction to the philosophies of Buckminster Fuller and his World Game concept. Bucky's World Game Map was displayed on the Diamond Vision screen with symbology and several brief philosophical messages explaining his encouraging approach to unifying the peoples of the world.

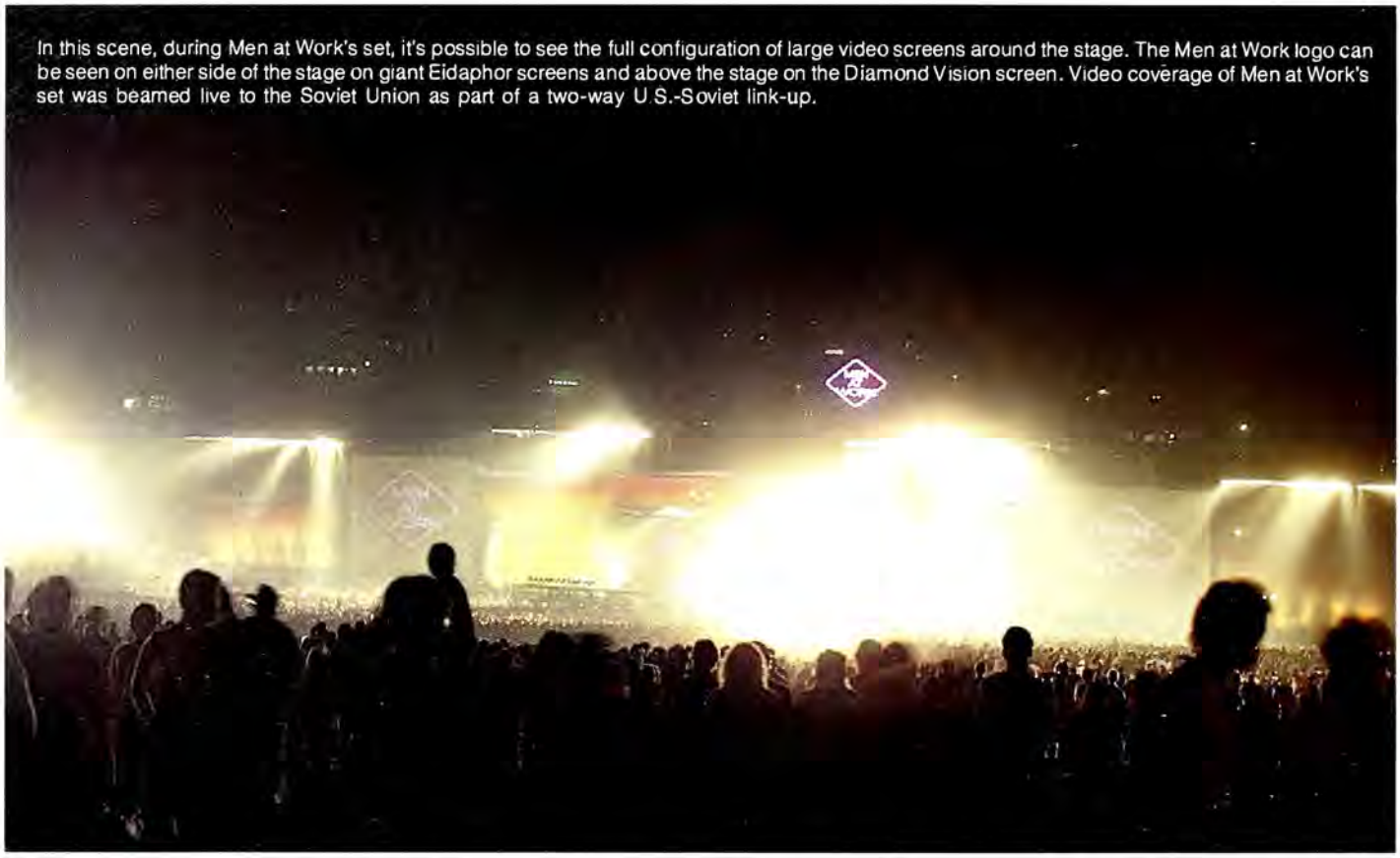
Kaliczak says the response of the crowd to Fuller's ideas was favorable, though it was always tough to know for sure from inside the trailer how strong the reaction was. Still, it was a triumphant moment late in the festival and made up for some of the problems encountered by Kaliczak and his group earlier. The Apple FX group was the victim of some equipment damage caused by unpredictable power surges. One of the VB-3 boards lost its horizontal input; the group lost one disk drive; and a couple of boards malfunctioned. The greatest loss was an Axlon Ramdisk, which started to smoke and had to be taken outside the trailer and put under a metal stairway.

"We were assured that we would have a stable power supply," says Kaliczak. "The problem is one person's idea of stable is not necessarily stable for computers. The regular video unit had several problems with power surges as well."

The tragedy here is that several graphics routines were already loaded onto the Ramdisk and were irretrievable for the weekend. They included a special Bowie tribute, some special graphics sent down by Wozniak, and other routines that Kaliczak was sorry to lose.

Another project that never quite panned out was digitizing personalities for display on the big screens. This was one of the most popular things they did last year, Kaliczak says, and he was looking forward to doing it again. Unfortunately, this year the Apple FX trailer was just far enough away from the main backstage area that it was never convenient to bring people over long enough to have their mugs electronically interpreted. Besides, the trailer was sitting in mud.

So the Apple FX folks picked up some of last year's digitized portraits and used them. It was a bummer not to be able to do what they'd planned, but the crowd appreciated last year's graphics anyway. In fact, a lot of material from last year was used, both by Kaliczak's group and by the video crew who coordinated all material shown on the big screens.



In this scene, during Men at Work's set, it's possible to see the full configuration of large video screens around the stage. The Men at Work logo can be seen on either side of the stage on giant Eidaphor screens and above the stage on the Diamond Vision screen. Video coverage of Men at Work's set was beamed live to the Soviet Union as part of a two-way U.S.-Soviet link-up.

Tell Me Why. Many brief messages and a map of the festival area were generated on the Apples and displayed during the weekend. Kaliczak says the regular video people were quite impressed by the speed with which the Apple FX crew delivered graphics on request.

Kaliczak and crew kept the best for last. Using the Vision Effects GRFX-A2 board—which is based on the NEC 7220 VLSI graphics-display controller—the Apple FX group created some of the super-hi-res graphics that attendees at the recent Applefests in Boston and Anaheim have marveled at. The graphics board, which is produced by Number Nine and distributed by Vision Effects, allows heretofore unheard-of resolution for the Apple—512 lines by 512 pixels with sixteen colors, 724 lines by 724 pixels with four colors, and 1,024 pixels with two colors.

Working feverishly with the super-hi-res system, Eric Popejoy and Barry Wood put together a three-minute-and-twenty-second graphic routine that was shown before David Bowie's performance the final night of the rock-music weekend. The routine featured multiple rotating MTV and US logos in 3-D, as well as other 3-D shapes. The crowd responded enthusiastically and the showing of the tape was definitely the Apple FX team's artistic high point.

Technical and human problems kept the super-hi-res graphics from being used earlier in the festival. The signal coming from the board was

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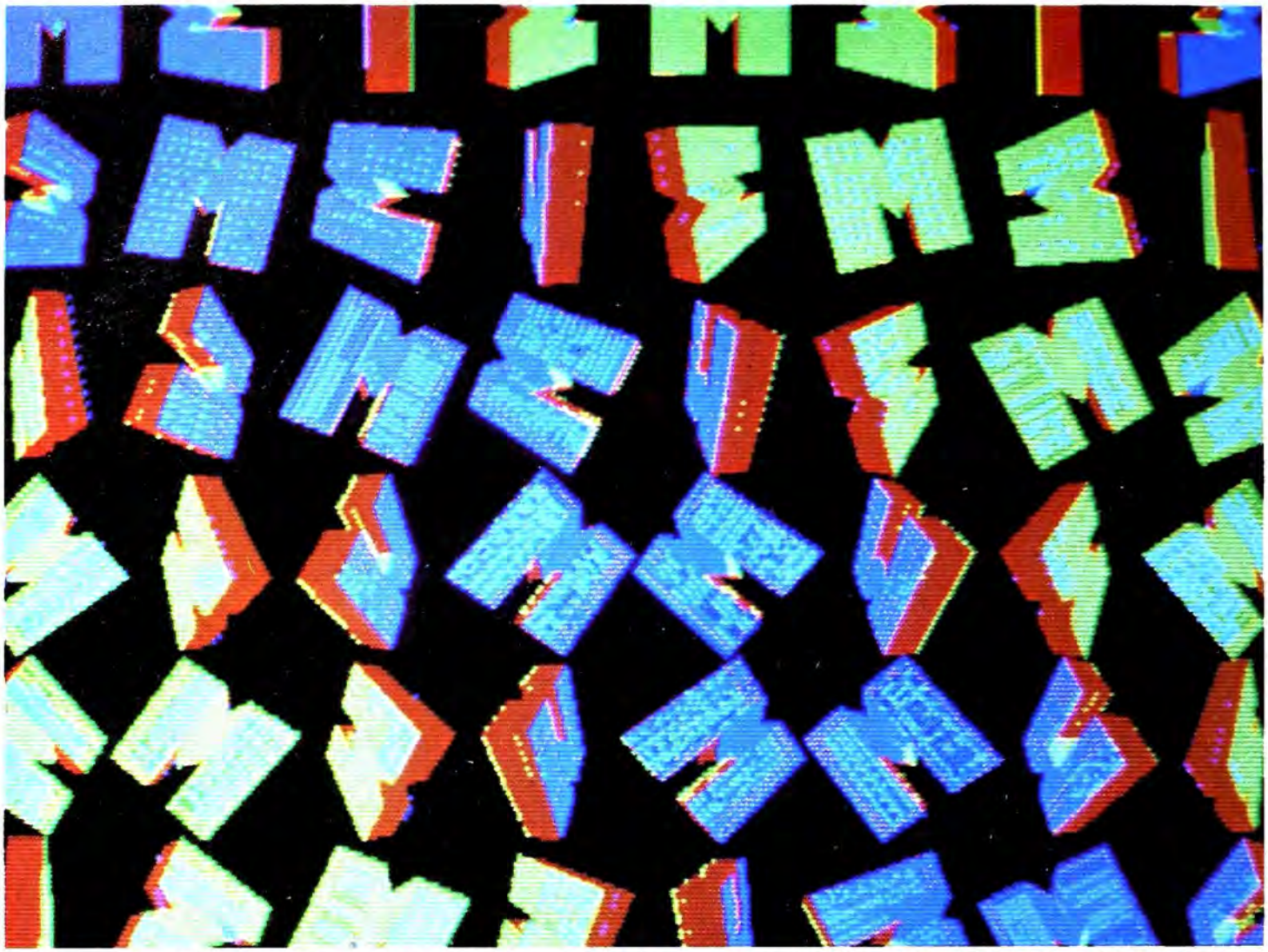
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These rotating, 3-D MTV logos were photographed off a Taxan RGB monitor, but were part of the three-minute-and-twenty-second tape of super-hi-res graphics shown before Bowie. Utilizing Vision Effects's GRFX-A2 board that provides 512-line-by-512-pixel resolution, Kaliczak and crew also used the US logo and other shapes in the show.

not NTSC (standard composite video output) compatible, and the routine had to be recorded directly onto video tape and hand-carried over to the regular video trailer.

A tape of the rotating logos and shapes was made Sunday, but the video crew "lost it." With only twenty minutes' warning on Monday, Kaliczak edited a new tape from the graphics already created by Popejoy and Wood.

"If I had to do it all over again, I'd put more time into the hi-res graphics and less into the Video Associate Labs VB-3 system," says Kaliczak. "Based on the crowd response when we showed the tape before Bowie, I'd say people really want to see more motion and unusual things."

Kaliczak is excited about the Number Nine board and its capabilities—excited enough to form Vision Effects with Nick Pavlovic, Will Frentz, and several others. They have great ambitions and are now generating software programs and acquiring hardware add-on products for the board.

As vice president of hardware and production for Vision Effects, Kaliczak has contacted many talented graphics programmers in an effort to drum up some support for the super-hi-res board in terms of utilities and other software. Vision Effects believes that the market for super-hi-res graphics can only grow as more practical applications are developed.

Ricochet. As did last year's US Festival, the 1983 US Festival attracted a diverse group of talented individuals and groups. Just listing all of the artists and contributors who gave the event a friendly, human side—from a traveling troupe of crazy guys on stilts to the "movement therapy" folks in the Trager Institute's psychophysical integration and mentastics tent—would require a good-sized article. The efforts of Kaliczak, Madarasz, and their group comprised only a small part of a gigantic effort which—despite what you may have heard to the contrary—suggested that many people seriously believe in and practice the US Festival philosophies of peace, cooperation, and world community.

"This year it was much more complex and there was a different crowd," says Kaliczak. "We were constantly under pressure, though on the whole I think we were given better direction and definitely added something extra to the musical performances."

A fan of some of the music acts, Kaliczak enjoyed this year's festival as much as last year's. "I think Bowie is a fantastic artist and he was the musical high point for me. I also liked Oingo Boingo and Stevie Nicks."

Clearly, hard work does not always get in the way of having a good time.

Pleasure Victim. Wozniak and Unuson were lucky on Sunday, May 29. Everything they worked so hard for could have ended in disaster. On the other hand, luck had nothing to do with the thousands of little things that went off without a hitch at the four-day festival.

Janek Kaliczak, the Han Solo of the Apple world, is used to lending his time and energy to important tasks, particularly those involved with improving the world we live in. It was not luck that brought him and his particular kind of magic back to the sleepy little town of Devore, California. It was belief in a guy named Steve Wozniak and his dream of bringing people together. ■

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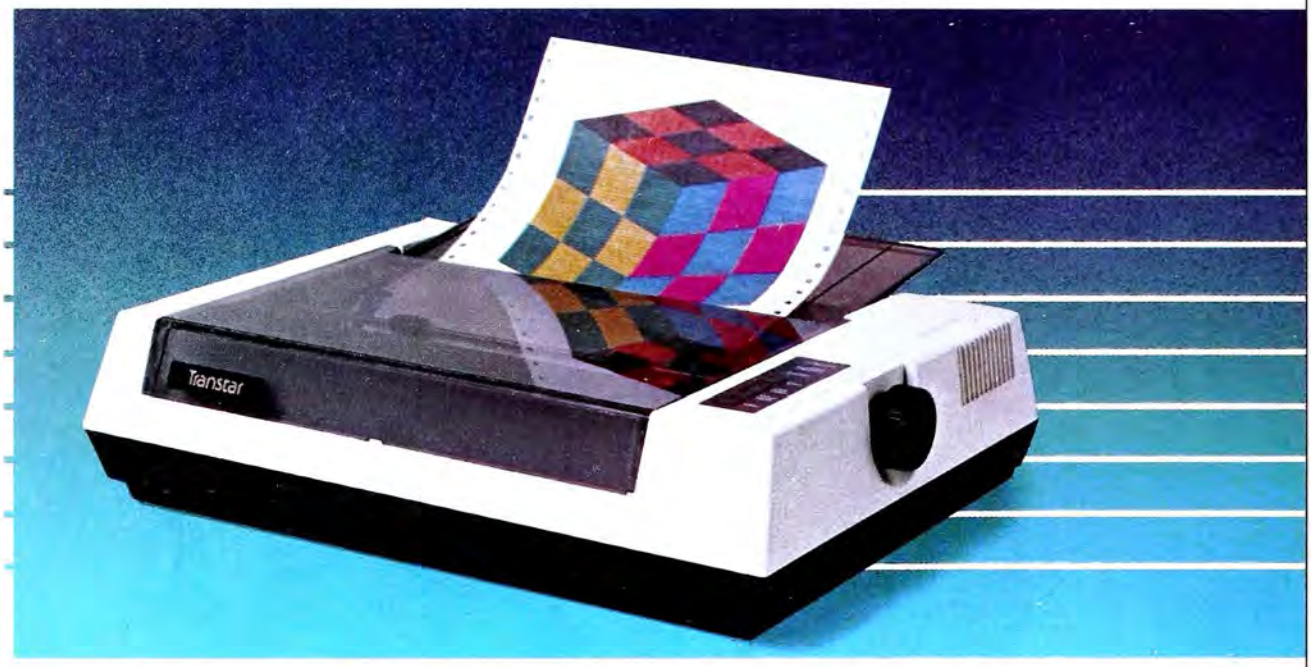
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BY KEN LANDIS



In past installments of this column, we've examined a host of technical analysis and charting programs. Many of these programs have represented the state of the art in both Apple programming and technical analysis. But state of the art is not cheap. Aren't there any reasonably priced technical programs written for people who aren't sure they want to spend $300, $400, or $500 for software?

In this issue, we'll examine one such technical analysis program, created with both the novice and the experienced investor in mind.

Market Illustrator, N Squared Computing (5318 Forest Ridge Road, Silverton, OR 97381; 503-873-5906). $195.

Backup policy: copyable.

System requirements: 48K, Apple II Plus, IIe, or Apple III (in emulation mode), one disk drive. Optional: printer, modem, graphics card, graphics-capable printer.

Market Illustrator is a market timing aid that plots, smooths, and displays ratios and differences of broad market data. The package comprises two complementary yet distinct interactive graphics analysis programs (or versions), both of which are accessible from the main menu. Version one charts and analyzes market indicators and statistics for use in developing basic technical indicators, while version two plots individual stock and/or futures data for use in technical securities analysis. (Note: Version two has recently become available separately under the title *Stock Illustrator* for $125.)

Right after you boot the disk, *Market Illustrator* asks you which program version you want to use and which disk drive your data is in.

The heart of version one is a series of databases containing the major market indicators and statistics. Purchasing the package entitles you to one free update of these databases; after that, there's a $20 fee per update. These databases can also be updated manually with information from *Barron's* or by using the program's auto-update feature. Auto-update transforms data you've captured from Dow Jones or CompuServe with a separate communications program and posts the information to the *Market Illustrator* databases.

The features and functions of version one enable users to create and plot almost any technical indicator that relies on difference or ratio analysis (and there are quite a few indicators that do). Along this line, the documentation contains a well-written, fluid example of how to create an advance/decline oscillator. This discussion guides the investor through the keystrokes for this analysis, as well as serving as a good first step toward learning how to use the program in doing sophisticated analysis.

When the version you've selected has been loaded and you've indicated the number of the data-file disk drive and the time period to be analyzed, you'll be presented with a catalog of the disk. In version one, you're prompted to choose two databases you wish to analyze during the session. (In version two, you'd choose two securities you wished to evaluate.) Version one comes with twenty databases, including market trends (advances, declines, and so on), stock indexes (such as NYSE industrials, utilities, and transportations), and financial and money rates.

After your two databases have been loaded, you must choose the data sets to be analyzed. So what is a data set? Basically, a data set is a collection of data pertaining to a database. The options-statistics database, for example, has eight data sets: calls up, calls down, calls unchanged, calls total, puts up, puts down, puts unchanged, and puts total.

For purposes of example, let's assume that we chose to consider the options-statistics database and the market-trends database. If we were plotting options statistics against the overall market-trends database for the calls up, we would enter 1,1 (the first database, first data set in that database) and 2,3 for advances (second database, third data set in the database). By the way, the error-checking capability is very weak here. If you input the wrong thing, the program reverts to the Basic language response for a string (character) input—two question marks appear on the left-hand side of the screen. Then, no matter what you input, the program will revert back to the data-drive question screen, and this means waiting another minute and a half for the databases to reload.

The data sets for the first database you choose will be displayed on the left side of the screen; the second database and its sets will be shown on the right. The first database and set chosen are plotted on the top half of the screen, the second selection on the bottom half. Just a few seconds

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after you've made your selections, the plotting menu (of whichever program version you're running) is displayed. From here you can change plotting parameters, list or print the data sets, select new data files or sets, display the hi-res screen, plot the data sets, or quit the program.

Most of the inputs you're required to make in *Market Analyzer* are single-keystroke entries; ordinarily, you don't have to press return in order to execute a command. When an entry calls for more than one keystroke, the software toggles the Apple speaker, which emits a soft beep to signal the investor. This is a useful feature.

In analyzing the files being charted during a session, the first thing to do is to chart the data sets. After this option has been selected, the first data set chosen begins to plot on the upper portion of the screen, and the date of each point being plotted flashes in the upper right-hand corner of the screen. After all data has been plotted, a dotted line is drawn across the screen automatically. This line is a graphic representation of the arithmetic mean of the data set. Next the second data set chosen is plotted on the lower portion of the screen.

When both charts are complete, five function (or command) choices become available. One, the hi-res-screen command, returns you to the plotting menu. (If you ever return to the main menu and then decide you want to see a chart again, employing the hi-res-screen command will put you back where you want to be.)

The second function on the hi-res plot-screen menu is the display command. This command shows the high/low/close mean, the standard deviation, the names of the charted data files, and the free memory remaining in the computer.

The third choice on this submenu is used in exponential smoothing of the data sets. Once you've supplied the number of periods to be used for the smoothing and indicated whether or not the existing plot should be erased, the smoothed line is plotted. This smoothed data line is commonly used to show trends within the data set.

The fourth command on this screen, the cursor command, will paint a vertical cursor line on both plots. You move the cursor back and forth by means of the left and right arrow keys. As you do so, the data indicator shows the date of the data point directly beneath the cursor, and the statistics of that covered data point (price or volume, depending on the type of data) are displayed.

The last option on this screen is the index function. This function generates a ratio or a difference plot of the two data sets being considered. Difference or ratio indicators are the major technical tools that can be produced with version one.

The procedures that must be followed in exiting from different function sections are not standardized. To exit the display function, you must press the space bar; to exit the cursor function, you press any number key. Remembering which key to press and when to press it is not easy. Standardizing the function exit key to the space bar, escape key, or any other key not otherwise used by the program would simplify matters.

As mentioned earlier, it's possible to view and change the printing and plotting parameters from the print/plot section of the plotting menu. Investors have a great deal of control over how and where information is plotted. Examples of the flexibility of the program can be seen in the types of charts—bar, line, or dot—the sizes of the charts, and in the top plot, which can use the whole screen or share space with the bottom plot. These default values can be changed (and the new values stored to disk) by means of a menu that appears right after program startup; if these parameters are changed once the version has been activated, the changes made will be in effect only for the duration of the current session.

Market Illustrator supports the Grappler or an equivalent graphics interface (check with the publisher before you buy) and the Apple Silentype printer interface. The data sets may be listed to the screen or to the printer. If you're using a printer that can do graphics, the graphics plot may also be printed out. The plot may also be saved to disk as a binary file for future use.

Twice upon a Program. Program version two operates almost exactly the same way version one does. Where the two versions differ is in the investment analysis functions they perform—version two plots price data (in the form of high/low/close bars) on the upper portion of the screen; volume, a net positive volume indicator, and open interest information are displayed in the lower portion. If you've run version one during a session, it's a good idea to reboot the program to set the necessary

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memory parameters. If you don't, you risk having the program "blow up" later in the session.

The data files used by the two versions of the program are different but compatible. Whereas in version one the various statistics are stored in separate databases, in version two a single database can store up to thirty different securities; one database per disk is allowed.

Once you've chosen the security to be analyzed, the data is loaded into the computer and displayed in numerical form. The minimum and maximum high, low, and close are shown. The *Market Illustrator* then computes the net positive volume indicator and displays it on-screen.

The options available on the version-two plot screen are similar to those in version one. The index feature is not applicable here, and the smooth function operates slightly differently. In version one, choosing smooth gets you the smooth line drawn top plot first; in version two, the smoothed data is plotted only on the top plot. Multiple plots can be overlayed to show crossover points, such as fifteen and thirty day moving averages.

A useful and powerful feature of *Market Illustrator* is its auto-run mode. Activated from the main menu screens of either version, auto-run instructs the machine to plot selected databases and their individual data sets. The value of auto-run is the fact that it frees the investor from sitting down at the keyboard and feeding the computer instructions; while the auto-run feature is active, the Apple can be left unattended. The database and set selection procedure in auto-run is menu-driven.

Market Illustrator also offers an auto-update feature, but it is not truly automatic; it is at best semiautomated, and it is time-consuming. The securities information required for updates must be retrieved manually from Dow Jones or CompuServe, using a program such as *Data Capture 4.0.* Once stored on disk, the quote files are run through the auto-update program, which formats the data in an input form that *Market Illustrator* understands. The utility then posts the new information to the databases. The total time required to update one database, including data retrieval, can be upward of twenty-five to thirty minutes.

Market Illustrator comes with a full set of data-manipulation utilities. These utilities can be used to convert daily data to weekly charts, edit databases, change or delete files, truncate long files to free up disk storage space, and verify the validity of data within a file. There's also a utility that allows the investor to select data sets from different databases and merge them into one database. These utilities are comprehensive, and they are well documented in the *Market Illustrator* manual.

Also included in the package is the excellent pamphlet, "The ABC's of Market Forecasting," from Dow Jones and Company. This pamphlet contains a great deal of valuable information and, when used in concert with *Market Illustrator*, is a very good learning aid.

Market Illustrator is certainly a powerful program, boasting such excellent features as auto-run, verification of data through statistical analysis, and clear, concise charts. On a less positive note, however, the program's error-checking leaves a good deal to be desired, and the auto-update feature requires the purchase and use of an additional program.

As mentioned earlier, the display command can be used to find out how much memory remains in the Apple; knowing how much memory remains helps prevent you from blowing up the program by performing data analyses or manipulations that exceed the available memory space. But the display-command option is not enough; the program should automatically issue a warning when memory space is short or, better yet, should deny the user the functions that would blow memory. Also, the documentation is difficult to read (it's printed single-spaced on a dot-matrix printer) and may also be confusing to some; in attempting to document the program as fully as possible, the author has gone into more depth than some users will want.

Overall, *Market Illustrator* is a good technical charting package. A built-in single-step update process would be preferable to the semiautomatic update process that's now in the program. The documentation format could be improved; it would be best if the more technical information were relegated to an appendix and the operational section expanded to cover more situations and uses.

As it stands, the program is reasonably priced and highly functional. And, once the deficiencies we've identified have been remedied, *Market Illustrator* will be a program well worth having. ◨

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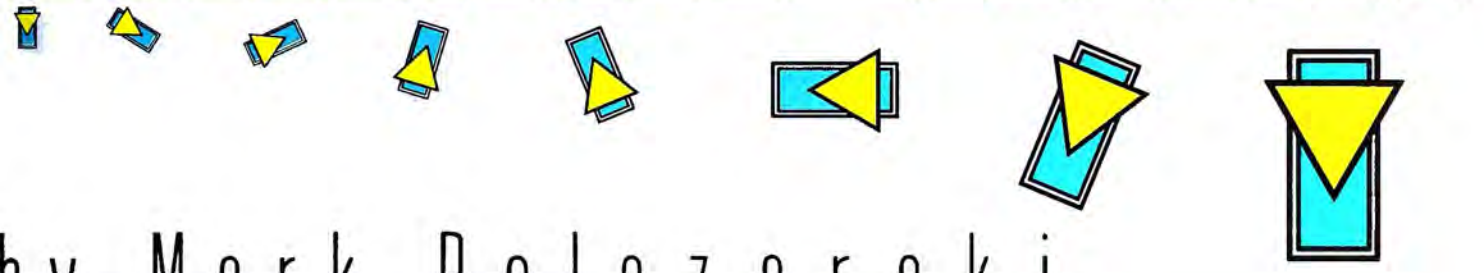


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GRAPHICALLY SPEAKING



by Mark Pelczarski

There are a few ways to make graphic images on your Apple screen appear to have three dimensions. Obviously, they all require some tricks, since we are working in a two-dimensional medium. The idea is to fool the eye, to create optical illusions incorporating elements of those things we see in the real three-dimensional world that give us the perception of depth.

Most of the tricks of making computer images look three-dimensional are borrowed from techniques that artists have been using for centuries. The first and perhaps most obvious of these tricks is varying proportions of an object. As an object moves away from our eye, it appears to become smaller, and vice versa. The second trick is to show the object from different points of view. If an object can rotate, or if your eye can move around it, you will see that the object has different sides, and you will perceive a third dimension even if none exists.

The third trick is related to the first: linear perspective. The most common illustration of this concept is the view down a railroad bed: Although the tracks are parallel, they appear to meet in the distance. The hypothetical point of intersection is called the vanishing point. The fourth trick is considerably more difficult than the others to execute on an Apple. That is the variation of coloring and shading between objects that are close and those that are distant. This variation is called chiaroscuro, which comes from the Italian words for *light* and *dark*.

When we see movies we tend to take these things for granted. Things in the distance are naturally smaller than things that are close up. Being photographic records of real objects, objects in films can be rotated at the director's whim. With the camera acting as the eye, vanishing points are completely natural. Even shading is natural—objects closer to the lens will be brighter and clearer than distant objects, given the same level of ambient light—although lighting in film is usually artificial. These are things the director doesn't have to think about when filming natural scenes. At this point, however, there's no such thing as a natural scene on the computer, so the programmer qua artist must consciously incorporate these elements to create the illusion of depth.

The perceptions listed are given generally in order—from the easiest to execute to the most difficult. Each of these techniques can be effective on its own, but the illusion can be even more striking when they are combined. Let's look at some examples of using each.

A couple of games that strictly use size for 3-D appearances are Larry Miller's *Epoch* and *Hadron*, published by Sirius. Both are space-type games that use the 3-D size perception very well. Because the other techniques aren't used, Miller accomplished two very nice things graphically: color and speed. Each of his shapes has its own colored detail and moves fast enough to make the game play succeed.

Turning an object to see its sides and back requires something more than scaling a shape. The problems of vanishing-point appearances require similar solutions. The programmer's choices are to store one shape and do a series of calculations to determine its appearance at various angles (generally slow and not allowing much detail) or to store a different shape for each of many points of rotation of the object (very, very space-consuming). The first option, calculations, is the one usually used. Examples are arcade games like *Battlezone*, as well as Bill Budge's 3-D games and utilities. To minimize calculations and complexity, the shapes are usually line drawings only, and usually vanishing-point calculations are omitted for speed's sake (SubLogic's *Flight Simulator* is an example of one that does use vanishing-point computations also). The helicopter in *Choplifter* is an example of storing different shapes for rotation points. The programmer, Dan Gorlin, designed several shapes that are drawn to the screen for the helicopter at various angles. As you turn the copter, it moves from one shape to the next in sequence, and you visibly turn. Other games will use this technique more fully in the future. While we're on examples, though, an example of using only vanishing points to give a 3-D effect is the titling in the *Star Wars* movies. One can almost imagine it rolling down the railroad tracks.

The fourth quality, that of shading and shadowing, is perhaps the least used because of complexity. Only in very sophisticated graphics machines, like those used in making *Tron*, do you see it used well. You could conceivably use shadowing if you were storing different shapes for rotations of an object. You'll probably see that technique used to some extent soon. An interesting, neat, and relatively easy application of shadowing is used in *Zaxxon* to give a stronger 3-D image. The shadow of the plane you control is seen on the ground below you, giving a nice illusion of height. Anyone who's seen previews of Mattel's newer baseball game for the Intellivision will recognize the same technique in use.

As you can see, the most promising avenue for animation and game play is to create multiple shapes and use a lot of tricks to fool the perceptions. Oddly enough, with these techniques it is the programmer, not the computer, doing all the work by predesigning all the shapes. Here, we'll pursue ways to get the computer to do the work. We'll try designing a 3-D shape and let the computer show us what it will look like from different views (actually, a lot of programmers who do the 3-D effects by hand start with a computer-design program to generate the views, then select the views that they want to save and use in their animations). To do this, we'll limit ourselves to line drawings, the so-called "wire-frame" 3-D graphics.

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Simulating 3-D line graphics is not too difficult if you know a few formulas and understand a couple of basic concepts behind using them. ("Know" may be too strong; let's say "use." "Know" implies an understanding of exactly why they work, which may take a while.)

First, how do we take a 3-D object and put it on a two-dimensional screen? There are a few ways to approach it, but let's take the idea of a window placed between you and an actual 3-D object—the house across the street, for example. Figure 1 shows how, in tracing the house onto

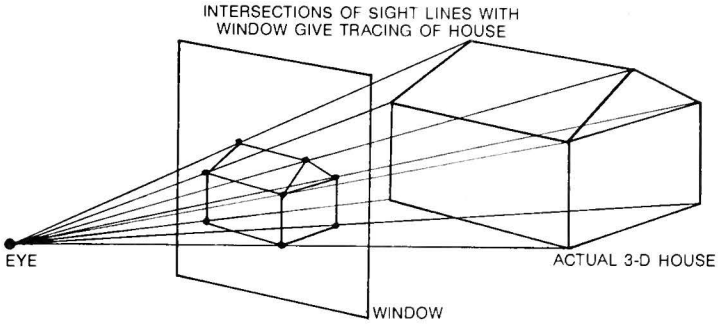


Figure 1. A three-dimensional image projected onto a flat surface.

your window as you view it, you actually create a 3-D projection. A very important point is that only the endpoints of lines need be projected. A projected line will always connect its projected endpoints. What that means for us is that in a program we'll only have to worry about endpoints of lines. The fewer things we have to rotate and manipulate, the better.

Next, we need a way to describe the points that we'll have floating around in space. 3-D coordinates, in the form (X,Y,Z), are typically used, so that's what we'll use. Figure 2 shows how we'll use these coordi-

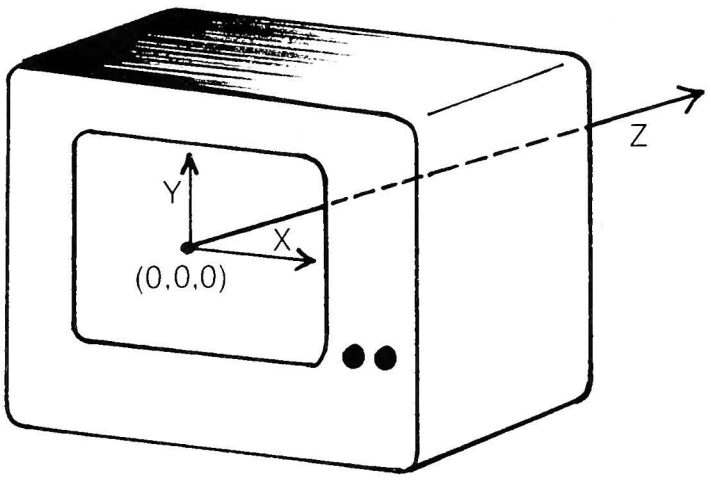


Figure 2. Orientation of three-dimensional axes.

nates to describe points. For convenience, we'll put the X and Y axes on the screen and use Z to describe depth. The point (0,0,0) will be in the middle of the screen *on* the screen. X will increase to the right, Y will increase as you move up, and Z will increase as an object moves away from you (into your monitor, out the back, and through the wall, doing a lot of damage in the process if it's of any size).

We still have to get that three-dimensional coordinate projected onto our two-dimensional screen. Actually, the projection formula is pretty simple, using proportions. The only additional number you need is some hypothetical distance that your eye is from the screen (or the Z coordinate at which your eye is located). Since we have no idea what units we're measuring, any number will do (and it will also affect the results in ways that you can play with later). We'll call that number ID (for eye dis-


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tance? Oh, well). Take a look at figure 3 for a sketch of how we get the proportions, in this case for Y. Y is the 3-D point's Y coordinate. Z is the 3-D point's Z coordinate, and PY is the projected Y coordinate. The projected Z value is 0, since it's on the screen. The same sketch could be used for the projected X coordinate. The formula is the same when X is plugged in instead of Y.

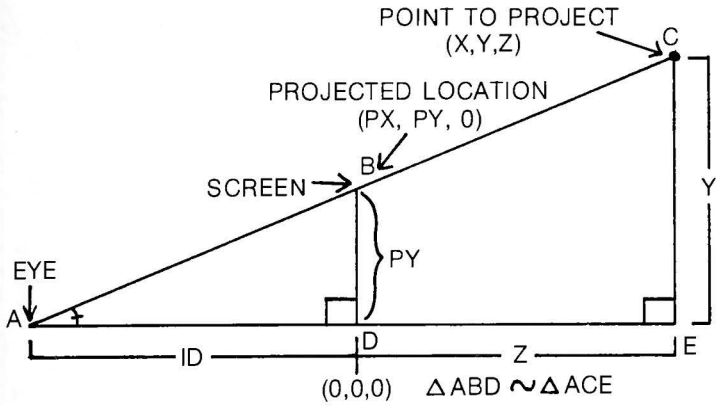


Figure 3. Computing proportions for a projected point.

Anyway, looking at the sketch, we can see that there are two similar triangles whose sides must be proportional. (Okay, geometry students, why are the triangles similar? Did you say because each of the corresponding angles are congruent? Right!) The proportions you get are:

$$\frac{Y}{ID+Z} = \frac{PY}{ID}$$

With a little manipulation, that's equivalent to:

$$PY = \frac{Y * ID}{ID + Z}$$

With the same approach, you also get:

$$PX = \frac{X * ID}{ID + Z}$$

And that's how you get your projected coordinates (PX,PY) out of any old 3-D coordinate set.

So this is what happens: You take the coordinates of all the endpoints in a figure, you store them in some kind of array in the computer, you remember (better yet, tell the computer) which coordinates get connected by lines (sort of like connect-the-dots), project all the coordinates onto the screen, then connect all the projected coordinates with lines.

The neat part now is that once you have all these coordinates in an array, you can turn them upside down, sideways, inside out, whatever you please.

A Few Things You Can Do with Your Coordinates. First, let's put the coordinates somewhere where it's convenient to talk about them. Use three arrays, X(*n*), Y(*n*), and Z(*n*). If you have ten endpoints, X will go from X(1) to X(10), and so on. The first point will have coordinate X(1),Y(1),Z(1). Got the general idea?

Move It. You can move your object in any direction just by adding some number to any set of coordinates. Add 5 to all the X values, for example, and the object will move 5 units to the right. Add 100 to all the Z values and the object should move back 100 units (through the monitor, the wall, the garage. . .), and should appear much smaller when next displayed.

Give It a Center. Before anything else, pick a point in the center of the object and remember it. When you scale or rotate an object, you'll need a center as a reference point.

Why It's a Good Idea To Give It a Center. What happens if the center isn't very close to the object? Let's use a rotation for an example. Say the center we choose is somewhere near the sun. Rotate the object forty-five degrees around the center. Where's its display point? Is it anywhere near your monitor screen? Noooooooo. Riding around on the earth, your monitor would catch up to it in about forty-six days, more than 1.5 billion miles away in space. Better to rotate your object in place—that is, around a center in its center.

Make It Bigger or Smaller. You can easily scale your object so that its actual size (not perceived size, as controlled by distance away) changes. Say you want to double the size. Your multiplier is 2. First, subtract the coordinate of the center from each of your points. Then multiply each coordinate by your multiplier, in this case, 2. Last, add the center coordinate back onto each of the now-scaled coordinates. The deal with the center is similar to what happens with rotating. If you don't do it, your figure can be zapped out into space. This way, it's "scaled in place." Hmmm. For some real fun, try scaling only one dimension, your X coordinates, for example. It's great fun mushing your objects, then stretching them back out again. The multiplier can be any number (except 0; 0 is bad). Numbers like 0.5 will scale an object so that it's smaller.

Rotate It. Here's where you need some old formulas from trigonometry. Suppose you want to rotate D degrees. First find the SIN and COS of D. S = SIN(D), C = COS(D).

If you want to rotate clockwise or counterclockwise, note that the Z coordinate won't change. Each depth value remains the same. If (NX,NY,NZ) are the new coordinates, here's the rotation formula:

```
NX = C * X - S * Y
NY = C * Y + S * X
NZ = Z
```

To rotate left or right (around the Y axis, sort of like a merry-go-round):

```
NX = C * X - S * Z
NY = Y
NZ = C * Z + S * X
```

And to rotate around the X axis (up or down, like looking at the back of a paddle wheel on a steamboat):

```
NX = X
NY = C * Y - S * Z
NZ = C * Z + S * Y
```

So much for that. Next time, we'll list a Basic program that does all of the above. In the meantime, try taking the concepts and equations we've talked about and trying them out yourself. ■

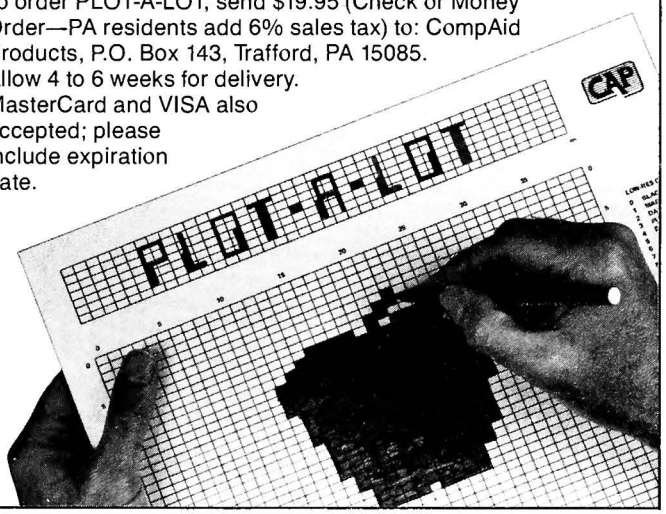
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by Mark Simonsen

A hundred times a day, you type **L-I-S-T** and your Applesoft Listings dutifully appear on your monitor... then promptly scroll off of the screen into Hyper-Space. If the program line you are looking for goes by, you must LIST AGAIN to read it. There's a better way...

2-WAY SCROLLING: Now you can list your programs (all or part) with ths added ability to CHANGE LIST-DIRECTION using the Apple Arrow Keys. The monitor becomss a "Search Window" to be moved UP AND DOWN through a listing at will.

IMPROVED LIST-FORMAT:* (optional) Each program statement is listed on a new lins for sasy tracing of program flow, and FAST de-bugging. Commands are properly-spaced (one space between words, not two) and much easisr to follow.

*Similar to XLISTER on Utility City, BUT operates in both directions at Machine-Language speed, directly from the LIST command. For-Next Loops and "If-Then's" are not called out, as they are in XLISTER.

High-speed PRINTER LISTINGS in Improved Format are a snap too, in any column-width.

MONITOR-LISTINGS feature 2-Way-Scroll too. Normal Disassembliss AND Hex Dumps are scanned quickly in BOTH DIRECTIONS. Not to mention informative 2-Way Hsx/Ascii dumps—

MACHINE-CODE Scrolls Both Ways.

```
6000- 53 41 4D 50 4C 45 20 54   SAMPLE T
6008- 45 5B 54 20 46 49 4C 45   EXT FILE
6010- 20 4C 49 53 54 45 44 20    LISTED
6018- 57 49 54 48 20 44 4F 55   WITH DOU
6020- 42 4C 45 2D 54 41 4B 45   BLE-TAKE
6028- 27 53 20 48 45 58 2F 41   'S HEX/A
6030- 53 43 49 49 20 44 55 4D   SCII DUM
6040- 50 20 46 45 41 54 55 52   P FEATUR
6050- 45 2E 2E 2E 2E 2E 2E 2E   E.......
```



Bonus Utilities: Any or all of the following enhancements may be hidden in memory, "unseen" until accessed—

CROSS REFERENCE: Displays sxisting variablss, strings & line nos. on which each occurs—

```
A$: 100 200 250 300
X:  10 20 3000 3010 3020
Y:  50 3000 4000 5200
```

VARIABLE DISPLAY: Displays all program variablss & strings with each one's current value—

```
A$ = "NOW IS THE TIME"
X  = 255
Y  = 3.14159
```

Better RENUMBER and APPEND: Append program lines ANYWHERE into other programs (not just at the end) without renumbering.

PLUS: Free-Space-On-Disk, Enter Machine Language from Basic, Fast Program-Stats, Built-in Hex-Dec Converter, Ctrl-Char.Display, Cursor-Omit or Replace, Applesoft Auto-Line-Numbering . . .

Double-Take $34.95

UNPROTECTED (copyable) and compatible with **Apple II** and **IIe**, DOS 3.3*, Beagle Bros' PRONTO-DOS* and Synergistic's G.P.L.E.*

Normal Applesoft Listing:

2-WAY VIDEO SCROLLING

(HI-Res Picture Mover)

```
 90  HOME : HGR2 : POKE 76B,160: POKE
     769,0: POKE 770,76: POKE 771
     ,44: POKE 772,254
100  FOR PG = 2 TO 3: POKE 230,PG
     * 32: CALL 62454: HCOLOR= 3
     + (PG = 3): FOR X = 0 TO 15
     9 STEP 5: HPLOT 0,X TO X * 1
     .B,159: NEXT X,PG: HGR
110 ST = 163B4: GOSUB 2010:ST = 2
     4576: GOSUB 2010: GOTO 110
2000  POKE L,N - INT (N / 256) *
     256: POKE L + 1, INT (N / 25
     6): RETURN
2010 N = ST:L = 60: GOSUB 2000:N =
     ST + B191:L = 62: GOSUB 2000
     :N = B192:L = 66: GOSUB 2000
     : CALL 76B
2030  POKE 50,63 + 192 * (ST = 16
     3B4): VTAB 21: PRINT  SPC( 1
     20): VTAB 22: PRINT " P=PICT
     URE #";: PRINT 1 + (ST = 163
     B4)":";: GET A$: PRINT A$: IF
     A$ = "P" THEN  RETURN
```

Optional Improved Format:

2-WAY VIDEO SCROLLING

Each statement lists on a new line. Compare to the normal listing above.

Listings scroll Up AND Down at high speed, for easy location of program code.

```
 90  HOME
     : HGR2
     : POKE 76B,160
     : POKE 769,0
     : POKE 770,76
     : POKE 771,44
     : POKE 772,254
100  FOR PG = 2 TO 3
     : POKE 230,PG * 32
     : CALL 62454
     : HCOLOR= 3 + (PG = 3)
     : FOR X = 0 TO 159 STEP 5
     : HPLOT 0,X TO X * 1.B,159
     : NEXT X,PG
     : HGR
110  ST = 163B4
     : GOSUB 2010
     : ST = 24576
     : GOSUB 2010
     : GOTO 110
2000  POKE L,N - INT (N / 256) * 256
     : POKE L + 1, INT (N / 256)
     : RETURN
2010 N = ST
     : L = 60
     : GOSUB 2000
     : N = ST + B191
     : L = 62
     : GOSUB 2000
     : N = B192
     : L = 66
     : GOSUB 2000
     : CALL 76B
2030  POKE 50,63 + 192 * (ST = 163B4)
     : VTAB 21
     : PRINT SPC( 120)
     : VTAB 22
     : PRINT " P=PICTURE #";
     : PRINT 1 + (ST = 163B4)":";
     : GET A$
     : PRINT A$
     : IF A$ = "P" THEN RETURN
```

LONG CATALOGS feature fast 2-Way-Scroll too, speeding up location of file names. Hit the Left-Arrow Key to SCROLL BACKWARD, any-key to continue forward, or ctrl-C for a clean break.

2-WAY VIDEO SCROLLING

```
JCATALOG

DISK VOLUME 123

*A 009 HELLO
 A 010 MULTI-CAT
 A 052 SORTFILE
*A 010 KEY-CAT
*A 052 BYTE ZAP
 A 024 HI-WRITER
 B 034 BBROS LOGO
 A 050 WOWZO
 T 002 XLISTER
 A 062 DOS BOSS
 T 010 LETTER
 T 020 STATEMENT
 T 003 NAIL FILE
*A 052 ALPHA PLOT
*A 008 TEXTTRAIN
*A 009 BEAGLE MENU
*A 021 HANG PERSON
 B 034 GOOD PIC
 B 034 UGLY PIC
 A 020 BUZZWORD
*B 020 FID
 A 020 TEXT DUMP
 I 010 CITY DUMP
 A 009 NIFFUM
 B 000 HAIR GROW
```

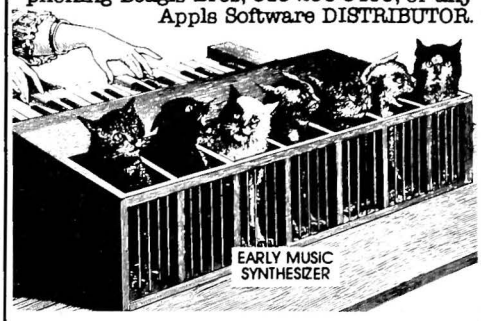


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THE BASIC Solution

By Wm. V. R. Smith

This month's Basic Solution will take a look at a fixture of the office of the future: electronic mail. Already widely used in mainframe and minicomputers, electronic-mail communication systems will become more common in the microcomputer domain as hard disks and local-area networks come into wider use. Messages will be sent business to business, house to house, and, within a business, desk to desk.

The basic premise of electronic mail is that you create and edit a message on your computer, specify to whom you want to send it, and the computer takes care of the details of time and date-stamping it and sending it to the recipient you've designated. Major networks like The Source and local bulletin boards already offer this kind of service to microcomputer owners who have modems.

This month we won't get involved with the transmission of data from one computer to another. We will, however, look into a way you can use electronic mail in an office or home with one computer and one floppy disk (though a hard disk would be nice, too). The program is called *Message Center.*

Type the program in and set it up as the boot program on a disk by typing *init Message Center.* Make sure you use either a blank disk or one with no files on it that you want to keep.

When you boot the disk, the program will ask you which user you are, offering you a list of names to choose from. As the program is listed here, there are three users: user name #1, user name #2, and user name #3 in lines 120 through 140. These are followed with a data line that says "everybody." To customize the program for your use, replace the user names with any number of names of people who will be using the system. Be sure not to get rid of the everybody data. Then change the 4 in line 110 to the number of people in the system plus one (for everybody).

When you tell the program which user you are, it offers you a second menu. From this menu, you can read your messages, send a message, change the date setting, or quit. When you read your messages, you will have the option of printing a message, deleting it, or moving on to the next message. When you've reviewed your messages, you'll be taken back to the menu.

The message-sending option is the heart of *Message Center.* When you select this option, you'll be asked to whom your message should be sent. You can pick someone from the list of users or select the last item in the list in order to send to everybody. Then the program will print the current date and confirm that this is the date to send the message. If you want, you can post-date a message so that the recipient won't get it until some later time.

Now you're ready to enter the message. A piece of "electronic" note paper is displayed on the screen. You type the message in at the bottom. You can either hit return to go to the next line or keep on typing until you reach the length limit of a line. At this point, the program will start a new line from the point where you last typed a space. When you're finished, the program will ask you if it should send the letter. If you answer yes, it will.

The date-changing system allows you to alter the current date on the disk. If you have a clock card with a calendar, you may want to modify the program to read the card.

When you exit *Message Center*, it sets a flag in memory that makes the Apple reboot when reset is pressed. To boot a new disk and get to work after you're finished with the day's messages, all you have to do is put the new disk in the drive and reset. Be careful of this when you're testing the program, as it is possible to reboot accidentally and lose the program if you haven't saved it first.

```
 10 REM ********************
 20 REM * MESSAGE CENTER
 30 REM ********************
 40 DIM M$(20)
 45 DIM AM$(20,15)
 50 D$ = CHR$ (13) + CHR$ (4)
 60 PF = 0:PP = 0
 100 REM ************
 101 REM * THIS IS THE USER AREA
 110 DATA 4
 120 DATA USER NAME #1
 130 DATA USER NAME #2
 140 DATA USER NAME #3
 150 DATA EVERYBODY
 200 REM *********
 210 READ NN
 220 FOR X = 1 TO NN: READ N$(X): NEXT
 230 DATA " THANKS VERY MUCH"
 231 DATA " HAVE A GOOD DAY"
 232 DATA " THANKS"
 233 DATA " KEEP UP THE GOOD WORK"
 234 DATA " TALK TO YOU LATER"
 240 FOR X = 16 TO 20: READ M$(X): NEXT
 242 VN = PEEK (592): IF VN < 1 OR VN > 7
     THEN 245
 243 MU = VN
 244 GOTO 500
 245 M$ = "WHICH USER ARE YOU?"
 246 NN = NN - 1: GOSUB 5000:NN = NN
     + 1
 248 IF VN < 1 OR VN > NN - 1 THEN 245
 260 M$(2) = N$(VN)
 270 MU = VN
 280 GOTO 244
 400 REM *************
 401 REM *INPUT STATEMENT
 403 IF LO = 0 THEN 405
 404 L = LO:I = L:I$ = LO$:LO = 0: GOTO
     440
 405 L = 0:I = 1:I$ = "": GOTO 410
 407 L = LEN (I$)
 410 GET A$
 415 IF A$ = CHR$ (8) AND L <> 0 THEN L
     = LEN (I$):I$ = MID$ (" " + I$,2,L - 1):
     HTAB 1: PRINT I$;: CALL - 868:
     GOTO 407
 420 IF A$ = CHR$ (21) THEN 450
 425 IF A$ = CHR$ (13) THEN 455
 427 IF A$ = CHR$ (27) THEN A$ = "":
     RETURN
 428 IF A$ = " " THEN SP = L
 430 IF ASC (A$) < 31 THEN 410
 431 IF ASC (A$) = 34 THEN 410
 435 I$ = I$ + A$
 436 IF L > 33 THEN 470
 440 HTAB 1: PRINT I$;
 445 I = I + 1: GOTO 407
 450 A$ = MID$ (A$,I,1): GOTO 435
 455 IF I = 1 THEN A$ = " ": RETURN
 460 A$ = I$: RETURN
 470 LO$ = I$:I$ = LEFT$ (I$,SP)
 475 LO = L - SP: IF LO = 0 THEN LO = 1
 480 LO$ = RIGHT$ (LO$,LO)
 485 I = LO
 490 GOTO 460
 500 REM ********
 501 REM * CURRENT DATE
 510 POKE 216,0: ONERR GOTO 540
 520 PRINT : PRINT CHR$ (4);"OPEN
     CURRENT DATE"
 525 PRINT CHR$ (4);"READ CURRENT
     DATE"
 530 INPUT TD$
 540 POKE 216,0: PRINT : PRINT CHR$
     (4);"CLOSE"
 545 GOTO 1000
 550 PRINT : PRINT CHR$ (4);"OPEN
     CURRENT DATE"
 560 PRINT CHR$ (4);"WRITE CURRENT
     DATE"
 570 PRINT TD$
 580 PRINT CHR$ (4);"CLOSE"
 590 RETURN
 1000 REM
 1001 IF PP > 0 THEN 8100
 1002 POKE 216,0: ONERR GOTO 9000
 1005 M$(2) = N$(MU)
 1006 VN = MU
 1007 M$(3) = TD$
 1010 TEXT : HOME
 1020 PRINT "      MESSAGE
      CENTER ";TD$
 1030 PRINT : PRINT "USER NAME :
      ";N$(VN)
 1100 VTAB 10: HTAB 10: PRINT "1 - VIEW
      MESSAGES": PRINT
 1110 HTAB 10: PRINT "2 - SEND A
      MESSAGE": PRINT
 1115 HTAB 10: PRINT "3 - EDIT TODAY'S
      DATE": PRINT
 1120 HTAB 10: PRINT "4 - EXIT MESSAGE
      CENTER"
 1150 VTAB 20: PRINT "PLEASE MAKE A
      SELECTION ";: GET A$
 1160 X = VAL (A$)
 1170 ON X GOTO 2000,3000,2500,4000
 1180 GOTO 1000
 2000 REM ***************
 2001 REM * VIEW A MESSAGE
 2010 TEXT : HOME
 2015 ONERR GOTO 2030
 2020 PRINT D$;"UNLOCK
      MESSAGE ";N$(VN)
 2021 M$(1) = N$(VN)
 2022 F$ = N$(VN)
 2025 GOTO 2040
```

```
2030 POKE 216,0: TEXT : HOME : VTAB 10
2032 PRINT "NO MESSAGES ": GET A$
2034 GOTO 1000
2040 GOSUB 7000
2050 FOR Z = 1 TO NM
2060 FOR Z1 = 1 TO 14
2070 M$(Z1) = AM$(Z,Z1)
2080 NEXT Z1
2090 GOSUB 6000
2100 VTAB 20: HTAB 1
2110 PRINT "1 - NEXT  2 - DELETE  3
     - PRINT"
2115 VTAB 22
2120 PRINT "MESSAGE ";Z;" OF ";NM
     "  YOUR CHOICE ";: GET A$:X =
     VAL (A$)
2130 ON X GOTO 2200,2300,2400
2140 GOTO 2100
2200 NEXT Z
2203 IF FL = 0 THEN 1000
2204 FL = 0
2205 IF Z2 < > 0 THEN 2210
2206 PRINT D$;"DELETE
     MESSAGE ";N$(VN)
2207 GOTO 1000
2210 GOSUB 7505: GOTO 1000
2300 Z2 = Z2 - 1:AM$(Z,1) = "-":FL = 1:
     GOTO 2200
2400 PF = 1: GOSUB 6000:PF = 0
2410 GOTO 2090
2500 REM **********
2501 REM * EDIT DATE
2510 HOME
2520 VTAB 10: PRINT "CURRENT DATE
     IS ";TD$
2530 GOSUB 8800
2535 TD$ = A$
2600 TEXT : HOME : VTAB 10: PRINT
     "PLEASE WAIT"
2610 GOSUB 550
2620 GOSUB 8100
2999 END
3000 REM ****************
3001 REM * SEND A MESSAGE
3010 TEXT : HOME
3020 FOR X = 4 TO 14:M$(X) = "": NEXT
3030 M$ = "SEND MESSAGE TO ": GOSUB
     5000
3035 IF VN < 1 OR VN > NN THEN 3030
3040 M$(1) = N$(VN)
3050 GOSUB 6000
3100 VTAB 20: HTAB 1: CALL - 958
3105 X = INT ( RND (1) * 5):M$(14) = M$(16
     + X)
3110 VTAB 21: HTAB 1: PRINT "DATE TO
     SEND MESSAGE ";TD$: GOSUB 8800
3120 M$(3) = A$: GOSUB 6000
3200 FOR L1 = 4 TO 14
3210 VTAB L1 + 3: HTAB 4: INVERSE :
     PRINT "  ";: NORMAL : PRINT
3220 VTAB 20: HTAB 1: CALL - 958
3230 PRINT "MESSAGE LINE ";L1 - 3
3240 GOSUB 400
3245 IF A$ = "" THEN L1 = 14: GOTO 3260
3250 M$(L1) = LEFT$ (A$,35)
3255 HTAB 4: VTAB L1 + 3: CALL - 868:
     PRINT M$(L1)
3260 NEXT
3300 VTAB 20: HTAB 1: CALL - 958
3310 PRINT "SHALL I SEND THIS
     MESSAGE ";: INPUT A$
3320 IF LEFT$ (A$,1) = "Y" THEN 3350
3330 IF LEFT$ (A$,1) = "N" THEN 1000
3340 GOTO 1000
3350 IF TD$ = M$(3) THEN 3400
3360 GOSUB 8700
3365 IF DF = 1 THEN 3400
3370 F$ = "MONTH # " + MS$:EF = 0:ER =
     0
3380 GOTO 3402
3400 EF = 0:ER = 0: IF VN = NN THEN VN
     = 1:EF = 1
3401 F$ = N$(VN)
3402 M$(1) = N$(VN)
3408 ONERR GOTO 3430
3410 PRINT D$;"UNLOCK MESSAGE ";F$
3420 GOTO 3450
3430 POKE 216,0
3440 NM = 0: GOTO 3500
3450 GOSUB 7000
3460 IF ER = 1 THEN 7710
3500 NM = NM + 1
3510 FOR Z = 1 TO 14
3520 AM$(NM,Z) = M$(Z)
3530 NEXT
3540 GOSUB 7500
3550 IF EF = 0 THEN 1000
3560 VN = VN + 1: IF VN > NN - 1 THEN
     1000
3570 GOTO 3401
3999 END
4000 REM ****************
4001 REM * EXIT CENTER
4010 TEXT : HOME
4012 POKE 592,0
4015 POKE 1012,0
4020 PRINT "HIT RESET TO BOOT DOS
     DISK"
4030 END
5000 REM ****************
5010 TEXT : HOME
5020 VTAB 7
5030 FOR X = 1 TO NN
5040 VTAB X + 7: HTAB 10
5050 PRINT X;" - ";N$(X)
5060 NEXT
5070 VTAB 20: HTAB 1
5080 PRINT M$;: INPUT A$
5090 X = VAL (A$): IF X < 1 OR X > NN
     THEN 5000
5100 VN = X
5110 RETURN
6000 REM *****
6010 TEXT : HOME
6015 IF PF = 1 THEN PRINT D$;"PR#1"
6020 PRINT "TO      : ";M$(1)
6030 PRINT "FROM      : ";M$(2)
6040 PRINT "DATE SENT: ";M$(3)
6050 PRINT : HTAB 3: INVERSE : PRINT "
     ": HTAB 3: PRINT " ": NORMAL :
     REM 35 SPACES
6100 FOR X = 4 TO 14
6110 A$ = STR$ (X - 3) + " ": PRINT
     LEFT$ (A$,2);
6120 INVERSE : PRINT " ";: NORMAL :
     PRINT " ";M$(X)
6130 NEXT
6140 REM
6150 IF PF = 1 THEN PRINT D$;"PR#0"
6160 RETURN
7000 REM ******
7005 ONERR GOTO 7095
7010 PRINT D$;"OPEN MESSAGE ";F$
7020 PRINT D$;"READ MESSAGE ";F$
7025 NM = 0
7030 INPUT NM
7040 FOR Z = 1 TO NM
7050 FOR Z1 = 1 TO 14
7060 INPUT AM$(Z,Z1)
7070 NEXT : NEXT
7080 PRINT D$;"CLOSE"
7085 POKE 216,0
7086 Z2 = NM
7090 RETURN
7095 POKE 216,0: PRINT D$;"CLOSE"
7096 ER = 1
7099 RETURN
7500 REM ****************
7503 Z2 = NM
7505 ONERR GOTO 7700
7510 PRINT D$;"OPEN MESSAGE ";F$
7520 PRINT D$;"WRITE MESSAGE ";F$
7530 PRINT Z2
7540 FOR Z = 1 TO NM
7545 IF AM$(Z,1) = "-" THEN 7575
7550 FOR Z1 = 1 TO 14
7560 PRINT CHR$ (34);AM$(Z,Z1); CHR$
     (34)
7570 NEXT
7575 NEXT
7580 PRINT D$;"CLOSE"
7590 POKE 216,0: RETURN
7700 POKE 216,0: PRINT D$;"CLOSE"
7710 PRINT CHR$ (7): HOME : PRINT
     "SAVING ERROR"
7720 INPUT A$: GOTO 1000
8000 REM **** DATED MESSAGES
8100 F$ = "MONTH # " + MS$:PP = 0
8110 ONERR GOTO 8190
8120 PRINT D$;"UNLOCK MESSAGE ";F$
8130 GOSUB 7000
8135 Z2 = NM
8140 FOR X = 1 TO NM
8150 M$(3) = AM$(X,3)
8160 GOSUB 8700
8170 IF DF = 1 THEN PP = PP + 1:HP = X
8180 NEXT
8190 POKE 216,0
8200 IF PP > 0 THEN X = HP: GOTO 8230
8210 GOTO 1000
8230 H$ = AM$(X,1):AM$(X,1) = "-"
8235 P = X:PP = PP - 1
8240 Z2 = Z2 - 1: IF Z2 = 0 THEN PRINT
     D$;"DELETE MESSAGE ";F$: GOTO
     8270
8260 GOSUB 7505
8270 FOR X = 1 TO 15:M$(X) = AM$(P,X):
     NEXT
8275 M$(1) = H$
8280 EF = 0:ER = 0
8290 IF M$(1) = "EVERYBODY" THEN VN
     = 1:EF = 1: GOTO 3401
8295 F$ = M$(1): GOTO 3408
8700 REM ******
8705 DF = 0
8710 DA$ = TD$: GOSUB 8835
8715 T1 = M * 31 + D + Y * 356
8720 DA$ = M$(3): GOSUB 8835
8730 T2 = M * 31 + D + Y * 356
8740 IF T2 < = T1 THEN DF = 1
8745 RETURN
8800 REM ******************
8810 REM  DATE PARSER
8825 HTAB 1: VTAB 22
8828 GOSUB 400: IF A$ = " " THEN A$ =
     TD$
8830 DA$ = A$: IF LEN (DA$) < 6 THEN
     8825
8835 FOR I = 1 TO LEN (DA$)
8840 IF MID$ (DA$,I,1) < > "/" THEN NEXT
     I: GOTO 8825
8842 P = I:I = 100: NEXT I:I = P
8845 FOR N = P + 1 TO LEN (DA$)
8850 IF MID$ (DA$,N,1) < > "/" THEN
     NEXT N: GOTO 8825
8852 P = N:N = 100: NEXT N:N = P
8855 MS$ = LEFT$ (DA$,I - 1):M = VAL
     (MS$)
8860 DS$ = MID$ (DA$,I + 1,N - I - 1):D =
     VAL (DS$)
8865 YS$ = RIGHT$ (DA$, LEN (DA$) -
     N):Y = VAL (YS$)
8870 IF M > = 1 AND M < = 12 THEN 8880
8875 GOTO 8800
8880 IF D > = 1 AND D < = 31 THEN 8888
8885 GOTO 8800
8888 IF Y > = 0 AND Y < = 99 THEN 8890
8889 GOTO 8800
8890 A$ = MS$ + "/" + DS$ + "/" + YS$
8895 POKE 216,0
8900 RETURN
9000 POKE 216,0: POKE 592,0
9001 END
```

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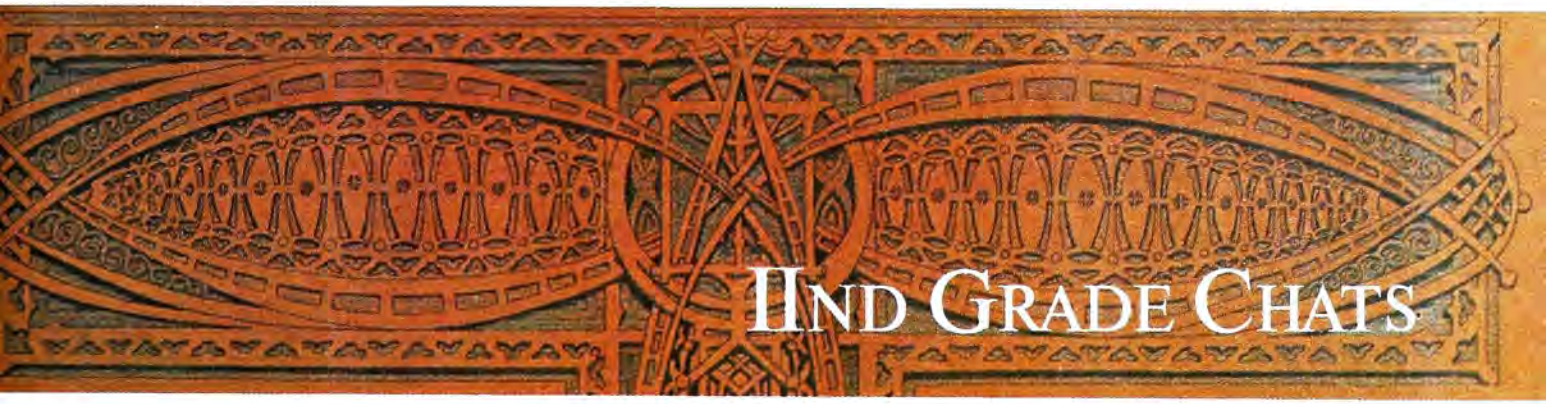
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The Apple IIe represents an improvement over the original Apple II or the II Plus with the addition of lower-case input and display, an inexpensive eighty-column option, and internal enhancements to the computer. The user was not forgotten in the process. Most software for the II Plus is operable on the IIe without modification. However, one problem can arise with the new machine. Much of the existing software understands only upper-case input. Lower-case input where upper-case is expected will be ignored at best; at worst it will cause unpredictable and possibly confusing results. If you want to restrict input just to upper case, your only option is to warn the user early in the program to set the caps-lock key. Such warnings aren't always heeded; it's best for the programmer to take control of the situation.

On mainframe systems, this problem is circumvented by a command



A Case of Cases

by Martin A. Herker and Lee Ludden

UPS$ (*string*). It converts a string to its upper-case equivalent. Since Applesoft Basic does not have that function, the subroutine presented here was designed to simulate it. In the ASCII character set, decimals 65 through 90 ($41–$5A) are set aside for upper case. The lower-case alphabet is represented by decimals 97 through 122 ($61–$7A). The subroutine looks at the individual characters of the string from the beginning to the end. If a lower-case letter is found, it is converted to upper case.

How the Program Works. The source code for the subroutine, written for assembly on *Merlin*, is in listing 1. It should work on other assemblers without major modification. If you don't have an assembler, you can use the Basic routine in listing 2 to poke it in. The subroutine is designed to reside from 768 to 817 ($300–$331). If page three is already occupied by some other machine code, the subroutine may be bloading into any open place in memory. The subroutine is called with the statement *call 768, variable*. The variable is any legal string variable, whether simple, such as A$, or array, A$(10,10). By the same token, a variable may be used as a part of the string definition, example A$(I,J). Thus, although the routine can't act on a whole array at once, it can be used in a loop to convert each element of an array.

Internally, the subroutine operates as follows. After a call 768 the subroutine starts by checking that the next character is a comma. If it isn't, the subroutine returns with a syntax error message, breaking out of the program. Assuming the comma is present, the routine then searches in memory for the variable and finds its location. Before starting to convert, the subroutine checks to see if the variable is a string. If given a real or integer variable, the subroutine exits with a type mismatch error. These operations are done with Applesoft's internal routines CHKCOM, PTRGET, and CHKSTR.

Now that the subroutine is assured that it has a string variable to work on, it begins. It finds the length of the string by searching for the $00 end token. If the string is a null, the subroutine returns to the Basic program. If not, the string location and length are stored in page zero.

The length of the string is loaded into the Y register. Each character of the string is then loaded into the accumulator and checked to see if it is lower case. If it is, 32 ($20) is subtracted from the value and the new value is stored in place of the original. If the character is not in the range of lower-case letters ($61–$7A), the subroutine ignores it and goes on to the next one. This process continues until the entire string has been examined. The subroutine then returns to Basic at the next command in the program.

Adding and Using the Subroutine. There are two ways to add the subroutine to an existing Basic program. The first and simplest, if you have many programs on a disk that will need the subroutine, is to enter it into the memory and save it to disk with the command bsave UPS$, A$300, L$32. Then in any program that uses the utility, the command *print CHR$(4)"bload UPS$,A$300"* should be inserted early in the program. This will load the subroutine into memory. The drawback to this is that the file UPS$ must be copied whenever the program is moved to



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```
                        1  ********************************
                        2  *                              *
                        3  *       UPS$ SUBROUTINE        *
                        4  *                              *
                        5  * CONVERTS A STRING VARIABLE   *
                        6  * TO UPPER CASE ONLY.          *
                        7  *                              *
                        8  ********************************
                        9  *
                       10          ORG $300
                       11                          ;APPLESOFT ROUTINES
                       12 CHKCOM   EQU $DEBE
                       13 PTRGET   EQU $DFE3
                       14 CHKSTR   EQU $DD6C
                       15                          ;ZERO PAGE STORAGE
                       16 VARPNT   EQU $83
                       17                          ;START OF PROGRAM
0300: 20 BE DE         18          JSR CHKCOM      ;CHECK FOR COMMA
0303: 20 E3 DF         19          JSR PTRGET      ;GET VARIABLE ADDRESS
0306: 20 6C DD         20          JSR CHKSTR      ;SEE IF IT'S A STRING
                       21                          ;FIND LENGTH
0309: A0 00            22          LDY #$00
030B: B1 83            23          LDA (VARPNT),Y
030D: F0 22            24          BEQ END         ;IF ZERO, END
030F: 48               25          PHA
0310: C8               26          INY
                       27                          ;FIND STRING IN MEMORY
0311: B1 83            28          LDA (VARPNT),Y
0313: 48               29          PHA
0314: C8               30          INY
0315: B1 83            31          LDA (VARPNT),Y
0317: 85 84            32          STA VARPNT+1
0319: 68               33          PLA
031A: 85 83            34          STA VARPNT
031C: 68               35          PLA
031D: A8               36          TAY
031E: 88               37          DEY
031F: B1 83            38 LOOP     LDA (VARPNT),Y ;GET CHARACTER
                       39                          ;CHECK FOR LOWER CASE
0321: C9 61            40          CMP #$61
0323: 90 09            41          BCC NEXT        ;LESS THAN #$61
0325: C9 7B            42          CMP #$7B
0327: B0 05            43          BCS NEXT        ;GREATER OR EQUAL TO #$7B
                       44                          ;LETTER IS LOWER CASE
                       45                          ;CONVERT TO CAPITAL
0329: 38               46          SEC
032A: E9 20            47          SBC #$20
032C: 91 83            48          STA (VARPNT),Y
032E: 88               49 NEXT     DEY             ;IF NOT DONE, CONTINUE
032F: 10 EE            50          BPL LOOP
0331: 60               51 END      RTS
```

Listing 1. Upper-case converter.

```
10000 FOR I = 768 TO 817
10005 READ J
10010 POKE I,J
10015 NEXT I
10020 RETURN
11000 DATA 32,190,222,32,227,223,32,108
11001 DATA 221,160,0,177,131,240,34,72
11002 DATA 200,177,131,72,200,177,131,133
11003 DATA 132,104,133,131,104,168,136,177
11004 DATA 131,201,97,144,9,201,123,176
11005 DATA 5,56,233,32,145,131,136,16
11006 DATA 238,96
```

Listing 2. Basic routine for poking converter subroutine into memory.

another disk.

The other method is to include the subroutine as a series of data statements and poke them into the proper place in memory at the start of the program. This has the advantage of not requiring a separate disk file. However, if the program already uses data statements, you will have to plan the program so that all data segments and read routines are in the correct sequence. Listing 2 is a routine to poke the code in from Basic.

Wherever a string is input, the next line should be *call 768, variable.* This will ensure that the string is converted to upper case before it is used in the program. The subroutine works on all flavors of Apple II, including emulation mode on the Apple III. An eighty-column card won't interfere with it. The only limitation of the subroutine is that it will convert only for Applesoft. The machine language routines used are not in the Integer Basic ROM.

The subroutine should prove a useful addition to any software that expects upper case that might run on an Apple with lower-case input. It is designed to be flexible enough to handle any type of string variable that may be in an Applesoft program. ■



The Schoolhouse Apple

by Jock Root

When small home computers (Apples and others) first hit the market a few years ago, there were some wonderful predictions about how these machines would revolutionize the process of educating our children. Computers would relieve teachers of drudgery in school and even teach the children at home.

Very little of this has actually happened, partly because of a dearth of good software.

First, there was a flood of drill and textbook programs: The computer would give you a quiz, or it might display a few pages of text and a diagram and then give you a quiz. Boring.

Then there were animated diagrams, interactive text (calling for students to respond to questions placed at various points throughout the text), and better teaching strategies; but the programs were still slow, and it was often harder to learn how to control the programs than to learn what the programs meant to teach. And a lot of the programs were still boring.

Now, that has begun to change. Some really excellent teaching programs are now available—at least enough to show that it can be done.

Teaching and Entertainment. What makes a teaching program excellent? It boils down to two things: The program must be entertaining and it must teach.

Are you surprised to see entertainment on a par with teaching? Don't be. The fact is, if students don't find a program entertaining, they aren't going to spend much time with it or give it their full attention when they do; and that won't help the learning process. A learning psychologist will tell you that students who are really interested will learn things almost as fast as they can understand them, but if they're bored they will learn only that you're a bad teacher.

And what makes a teaching program entertaining? There's no point in trying to make hard-and-fast rules. As soon as you do, someone will come along and break them with a perfectly valid exception. But here's a working approximation of a definition: An entertaining teaching program must be challenging, involving, reasonable, varied, and fast. These characteristics are much the same, you'll notice, as those required of a good game program.

Some Examples. Some of the really good ones go back several years. The first version of *MasterType* (by Bruce Zweig of Lightning Software) came out in 1981—and it's hard to beat as a touch-typing trainer, even today.

MasterType is in a game format. Your space station, in the middle of the screen, is being attacked from the four corners by enemy words. You must type the attacking words in order to destroy them and save the station; and if you hesitate, if you're not quick enough, you may have to type in a word several times before it is destroyed.

MasterType is a fascinating game—easy to get hooked on—and it teaches you to type faster than you can think; which, of course, is exactly the idea. It includes a very good "change menu," which among other things lets you adjust the speed goal so that the game is challenging but not frustrating. There is even a provision for adding your own word lists.

The program is a little short on variety—the same behavior is required again and again; you probably wouldn't feel like doing more than a couple of lessons at a sitting. But even that is probably enough to reveal a definite improvement in your typing skill. The program really does teach.

If we must have mindless drill programs—and we probably must—then let them be as entertaining as *MasterType*!

Some of the "oldies but goodies" are far from simple. About a year ago a program called *The New Step by Step*, from PDI (Program Design), was reviewed in Marketalk Reviews. The program is an interactive course in Basic programming (*not* simple behavior) using a combination of text material on audio cassette tape and synchronized interactive displays and quizzes on the Apple (*not* a simple technique).

The New Step by Step may not be the most sophisticated teaching program ever released, but it could well be the most effective sophisticated one. It doesn't just teach you the rules and symbols of Basic; it actually guides you through writing short programs. It almost teaches you to think in Basic.

"But what's so 'entertaining' about that?" you may ask.

In a program like this, the entertainment aspect is more subtle than in a game-type program: It comes from the fascination of learning a new skill and the triumph of using it successfully. Winning a game is fun, but not as much fun as gaining a new power!

By the way, there is now a sequel to *The New Step by Step*. It's called *Step by Step Two*, and it covers such advanced topics as binary and hexadecimal numbers, the Apple memory map, complex string manipulation, hi-res graphics, and more.

For the Children. Even if your students are not yet ready for touch-typing or for programming in Basic, they can take advantage of some excellent teaching-on-disk.

For example, there's *Math Invaders*, from Winners Circle—a math review program for third-graders on up. This one is almost archetypically simple, the barest elements of an arcade game. You are protecting the bottom edge of the screen, and three math problems are moving slowly down to attack you. You must move your "laser cannon" under one of the problems, load it with the correct answer, and fire to destroy the attacker.

There are no fancy graphics or dramatic sound effects—only the challenge of solving the problems before they hit you. The only touch of imagination in the game is the scoring, which promotes you up through the ranks of the Galactic Navy (unless you get hit by a problem, which busts you back to Cadet).

And yet—after you've played *Math Invaders* awhile, you'll find yourself thinking of it as a game. It isn't. It's a teaching program, remember? That's what's so good about it.

The usual utilities (usual, that is, for a state-of-the-art drill program)—speed and difficulty adjustment and provision for adding your own problem sets—are included.

Math Invaders is an excellent program for classroom use—but it probably would not be so effective in the home. It's too simple—it needs an element of competition to provide the motivation that the game itself lacks.

For home use—that is, ideally, solitary use in a quiet environment—a teaching program

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needs a lot of flash and crackle, a lot of excitement. It must have enough action to occupy the student's full attention, because learning will be in direct proportion to interest. In view of that, it's not too surprising that some of the best teaching programs for home use are similar to arcade games.

Two of the nastiest problem areas, for the grammar-school-age group, are English and math: vocabulary building and simple arithmetic. Fortunately, there are now some very good teaching programs in these fields—bunches of them, in fact.

The programs we're going to discuss were actually developed for classroom use—and even include the heavy documentation required by professional educators. But if you want to teach these behaviors (or learn them) at home, here are some lovely professional tools you can use.

Vocabulary Building. There are two very good groups of programs in this area. One is a series of separate programs called the Arcademic Skill Builders, from DLM (Developmental Learning Materials); the other is a package called *Word Attack!*, a group of related programs that make up a vocabulary-building system, from Davidson & Associates.

The Arcademic Skill Builders are heavy on entertainment. They have excellent hi-res graphics, arcade-style in both their comic-book layout and their baroque detail, and lots of action. No typing skill is required—you don't even need a keyboard: The games are designed for paddle or joystick play, and in case you prefer to use the keyboard several different control-key combinations are provided.

Consider *Word Invasion* as an example. This program teaches recognition of the parts of speech. The player (for these programs, "player" is a more fitting designation than "student") is helping a friendly alien octopus—the documentation says you can call her "A.O." for short—to defend her underwater kingdom.

A.O. is being attacked by four columns of words, moving down on her from the top of the screen. She has a magic ring that will always destroy the particular part of speech it is set for, but she cannot control the setting—that comes up randomly.

The player's task is to find, among the approaching words, the part of speech indicated by A.O. and then to position the ring under that column and "fire" it. If the player is too slow and one of the descending columns hits A.O., she collapses in shock for a moment; three such shocks will end the game.

And there's a joker in the deck—or, if you prefer, a zero and double-zero on the wheel. The part of speech that the ring can zap is selected randomly, and it often does not match the word at the bottom of the most threatening column. Sorry about that, pal. . . .

As a result, you must play the game on two levels. First, of course, you must recognize the parts of speech—but that's only a starting point. You must also think about strategy: choosing the best column to go for whenever you have a choice of more than one.

This little touch of randomness is very important. It does three invaluable things. First, it provides variety: You are not repeating one behavior pattern but intermixing several; second, it encourages you to master the target behavior so you don't have to think about it; and finally, the added touch of Murphy's Law makes the game seem more like "reality" and less like a vocabulary drill.

Word Master, another Arcademic game, teaches recognition of synonyms, antonyms, and homonyms. Here, your weapon is in the center of the screen, surrounded by a circle of eight words. Each of the surrounding words is slowly extending a tendril toward the center, and you must zap it before it reaches you.

You are given a target word and a relationship (synonym/antonym/homonym). You must aim the weapon at the word in the surrounding circle that stands in the specified relationship to the target word—and fire. If you get it right, this will destroy the reaching tentacle.

The random factor in this one is that the tentacles grow at different rates—and each target word you are given has only a one-in-eight chance of matching the most threatening tentacle. Again, you have to play a little ahead of the game.

The other programs in the series are *Word Radar*, a vocabulary recognition game; *Word Man* (after *Pac-Man*), another vocabulary game; *Verb Viper*, which teaches recognition of verb tenses; and *Spelling Wiz*, a spelling game.

These six programs provide six different ways to develop vocabulary skills. Each program includes a "change menu" for setting speed, content, and difficulty level. Each also comes with an impressive packet of documentation, including a discussion of the teaching strategy involved, notes on applications and related learning activities, and model scoring forms, progress records, and student worksheets.

The series has one important drawback—no provision is made for adding your own list of problem words to any of the programs; other than that, the Arcademic Skill Builders are excellent programs.

Another Approach. *Word Attack!*, by Janice G. Davidson, Ph.D., and Richard K. Eckert, Jr., approaches the problem differently. There is only one game, not six, but it's an elegant game—and it's only the dessert: There's a whole dinner that comes first, and even, to continue the metaphor, a cookbook.

Specifically, the package includes a program to introduce new words, two different quiz/review programs, and the *Word Attack!* game itself—plus an editor program, with excellent instructions, to enable you to add your own word lists to the system.

Another plus is that all the displays are in a special typeface—half again as large as standard Apple and twice as easy to read. This will make a big difference to the child with a vision problem.

Word Display, the word-introducing program, is almost classic in format. First the screen is cleared and the new word is displayed

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all by itself; then a synonym or short definition is printed under it; and finally a sentence is given in which the word is used. After a short delay (preset by the user), the next new word is shown.

The format is not quite classic—the new word is not spelled phonetically for pronunciation. But that's hardly a loss. Most users wouldn't understand the phonetic symbols anyway, so having them would be more of a distraction than a help.

One of the review/quizzes is in multiple-choice format—students match the word with its synonym or definition. This one can be run in either normal or reverse—you can choose either the word or the definition from among several possibilities. The other quiz is in a sentence-with-missing-word form and requires the user to type in the word. This is important behavior in itself—the student should be able to type the word, as well as to recognize it.

The feature attraction of the package, of course, is the *Word Attack!* game. The layout is familiar—a "shooter" that can point at one of four targets, as well as a definition that matches a word in one of the targets. But there are some nice differences.

For one thing, the "shooter" is a little man's hat; none of yer nasty, destructive old laser beams here. For another, the graphics are different—the artist on this one likes Greek temples better than comic books. And speaking of art, the sound effects with this program are perfect—perfect for the occasion and perfect for the instrument. Wait till you hear them!

In this game the random factor that adds variety is a little critter that occasionally goes buzzing across the screen. If you can hit it with the little man's hat, you score extra points.

The system comes with a whole disk full of word lists, covering vocabulary for fourth through twelfth grades. The documentation recommends the three most advanced lists as preparation for the Scholastic Aptitude Test (SAT). And the editor allows you to add new lists and makes them available to all the programs in the system: That capability could make *Word Attack!* useful to an adult for learning new technical terms or a foreign language, for example.

The documentation for this program is not as extensive nor as academically elaborate as that accompanying the Arcademic series. Everything you need is here, however, and what's more, everything here is useful (which is not quite true of the Arcademics).

More Math. The same two companies—DLM and Davidson & Associates—have applied their talents to mathematics, with substantially similar results. We have the Arcademic Skill Builders Math series and the *Math Blaster!* package.

The Arcademics, once again, encompass six. They include *Meteor Multiplication*, *Demolition Division*, *Alien Addition*, and *Minus Mission*. When you can handle those, you can try *Alligator Mix*, which intermixes addition and subtraction, or *Dragon Mix* (multiplication and division).

Like their English cousins, the Arcademic math programs provide extensive documentation—and they add a deck of fifty-two flash cards. But also like their cousins, they do not allow you to add your own problems to the game.

The *Math Blaster!* package is also similar to its English cousin. It includes a program to introduce you to various kinds of math problems, a couple of review/quizzes, the game, and an editor.

In this case, the unit of information is a math problem instead of a word, which leads to certain differences in handling; otherwise, the pregame programs in both Davidson packages are similar.

Math Blaster! uses the same special, easy-to-read typeface as *Word Attack!* for most purposes, but all the problems and examples are shown in a typeface four times that size. People who are learning to recognize the shapes of numbers will find this helpful.

The math game is even more fun than the word game—which is saying something! For one thing, the scenario is more exciting. You're at the circus. Your "shooter" is a brisk little man who gets shot out of cannons for a living—he has four different cannons to choose from. You guessed it—each cannon points to a different number.

Whenever a problem is displayed below the boardwalk, you send the man scurrying over to the cannon that points to the correct answer and "fire" him. The floor opens under the man, and with a "thwoop!" of compressed air he is sucked into the cannon and fired out again.

In the meantime, a balloon is drifting slowly down the right side of the screen toward a pin: If it gets popped, the game is over. When the balloon is near the ground, your man can bat it up to the ceiling again; if it's still fairly high, he can't reach it and jumps up and down in frustration. This is the random factor, the distraction: You have to decide, from moment to moment, whether the man should go over and shoot an answer or whether he should wait by the balloon (losing points) until it drifts within reach.

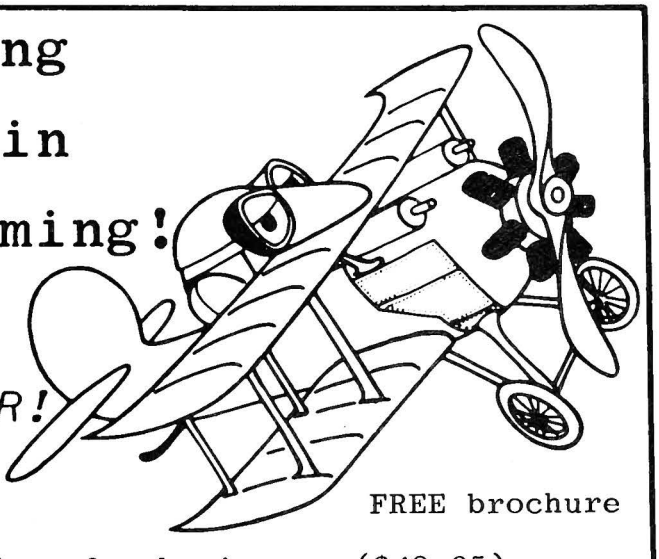
One further point about *Math Blaster!* is worth mentioning. It comes with extensive files of problems (for grades 1 through 6) and an editor with which you can create your own problem files for special purposes. The files supplied cover addition, subtraction, multiplication, and division—nothing unusual about that. But this is one of the few math programs that also have sets of problems in fractions, percents, and decimals.

And that's a lot of what's new in education by microcomputer—at least, as it applies to education in orthodox areas using relatively familiar techniques. Next month we'll look into some less orthodox places. ❑■

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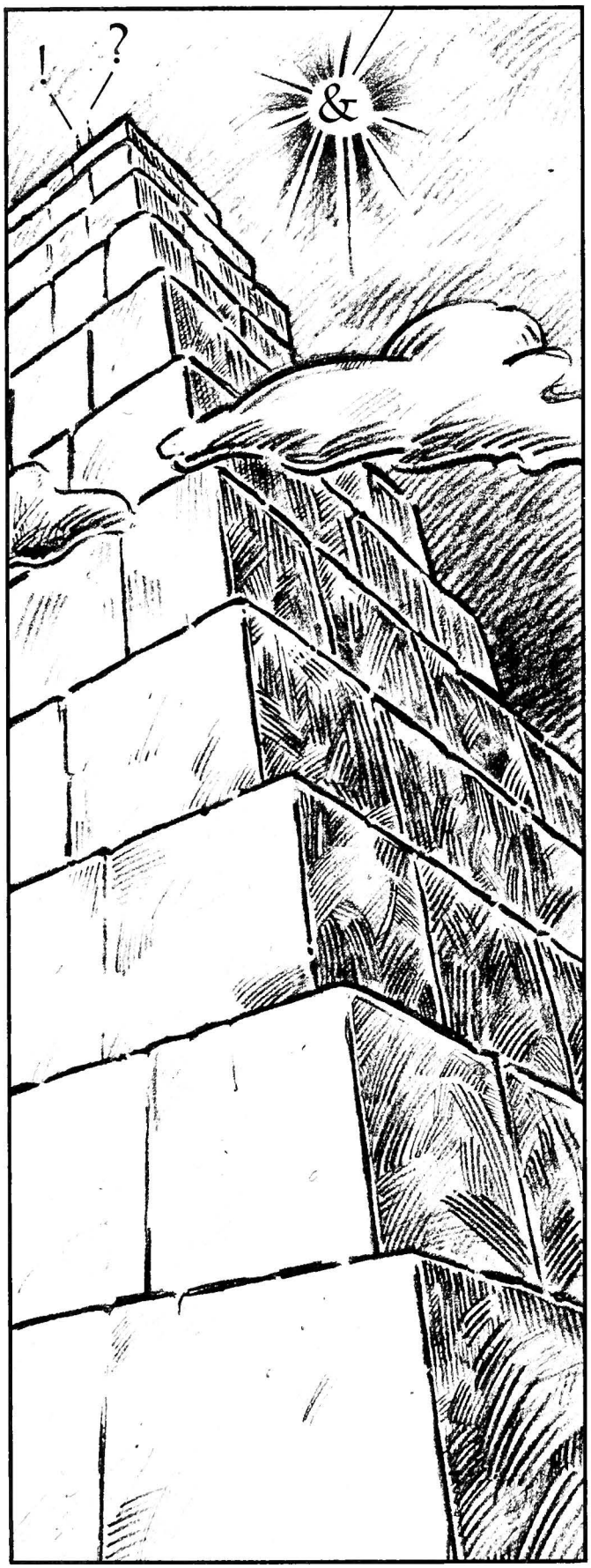
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EVERYONE'S GUIDE TO ASSEMBLY LANGUAGE

BY JOCK ROOT

The Language the Apple Thinks In, Part 1

What is assembly language?

Well, it's many things, of course; but for our purposes, two are important. It's a set of commands that the Apple can understand and execute—and it's a way of thinking.

Consider two drivers: a racing-car driver and a person who drives forty minutes to work each day. They use their cars differently; they think about them differently. The commuter wants power steering, automatic shift, and a smooth ride—no distractions, no surprises. He wants a car he doesn't have to pay any attention to.

The race driver wants just the opposite, a car that he *does* have to pay attention to: a car that will respond, with better performance, to every scrap of attention he gives it.

To put that in programming terms, Basic is the language of choice for the commuter, the person who just wants to get a job done; and assembly language is the choice of the racing driver, who wants to improve his time on every trip.

Here's another way to look at it. When a gadget you're working with suddenly stops working, you can either take it apart and try to find out what went wrong, or you can call a repairman.

If your first thought is to try to fix it yourself—even if you're not an expert—then you'll just love assembly language. If you generally prefer to call in a specialist and let him deal with it, you'll probably be more comfortable with Basic.

To put it yet another way, in Basic you usually say, "Do it," while in assembly you have to say, "Do it like this. . . ." Assembly language is harder to learn and less convenient to use. However, the tradeoff for more work is more power: If you can think in assembly language, you can have the job done the way *you* want it.

The Ultimate Language. The reason for the greater power of assembly language is simple enough: Basic is actually an assembly language program.

And so is Fortran, Pascal, Forth, and any other programming languages you may have heard of—they are all assembly language programs. Some of them go through several intermediate "languages" before they get there—such as the Pascal p-machine—but in the end they all have to talk to the hardware of the computer (the microchips), and the hardware understands only assembly language.

Well, not exactly—at that level, we call it machine language; but the logical structure is the same. Only the names have been changed.

The input and output of a computer chip is in the form of electronic pulses. For now, we don't care what the pulses themselves are like (we'll deal with that some other month); the important thing about these pulses is that they make patterns. There is order and logic in those patterns—they obey certain rules.

Assembly language consists of those same rules and patterns—translated into symbols we humans can understand. We use letters and numbers in our patterns instead of electronic pulses; but the logic is exactly the same.

And that is the secret of the power of assembly language: It is a logical replica of the actual electronic processes in the microchips of the computer. If a computer can be said to "think," then assembly is the language it thinks in.

Well, if you want to be strictly accurate, the microprocessor thinks in machine code. That is, if you measured the actual signals in the Apple's "spinal cord," the *data bus*, you would get a series of bytes of machine code, but we'll worry about that next month. The "nerve pulses" are in machine language, but the logic behind them is the logic of assembly language.

A Set of Commands. Assembly language is not really a language at all, in the human sense of the word. Instead, it's a set of simple and specific instructions to the computer and a set of rules for combining those instructions. The rules are also simple and specific, although some of them are a bit strange.

What, then, makes assembly language so difficult if all the parts are that simple?

Well, think of it this way: A brick, a board, and a piece of pipe are all simple in themselves; but using them to build a three-bedroom house or a ten-story office building is not so simple.

And that's how it is with assembly language. You have to understand the capabilities of the computer—at the microchip level—in order to do anything useful with assembly language. You have to understand both what it can do and how it does it before you can command those capabilities.

But don't worry; it's easier than you probably think. It's rather like those puzzles where you have to solve a problem with limited resources—like getting three missionaries and three cannibals across a river in a boat that will only hold three . . . and preventing the cannibals from outnumbering the missionaries.

The first thing you need to do, of course, is to learn the capabilities of the system. Here's a quick tour of the high points. Next month we'll do it over again in detail.

The Microprocessor. The "brain" of your Apple—its control center—is called the central processing unit, cpu for short. It's a single integrated circuit chip, of the type called a microprocessor, and its identifying number is 6502. This is the chip that tells all the other chips what to do.

The cpu has three main jobs: It fetches instructions from memory and decodes them (in other words, it reads the program); it controls transfers of information throughout the system (reading the keyboard, sending characters to the screen, reading or writing to memory, and so on); and it modifies individual bytes of data (usually letters or numbers) in various ways.

A *byte*, in case you're wondering, is simply a unit of information: specifically, the amount of information that can be stored in one memory location. We'll go into more detail next month; for now, think of it as a "word" in computer language (that is, machine code).

And that's about all the cpu does, from a programmer's viewpoint. Three simple things: It can read a byte from somewhere, it can write a byte to somewhere, and it can modify a byte. That sounds easy enough to learn. . . .

One other capability should be mentioned. The cpu can also test a byte in various ways, or compare one byte to another, and make decisions based on the result. But this is nothing new, if you're familiar with Basic: Think of the if-then structure, and you'll have the idea.

The technical name for this capability is *test and branch*. Some programmers like to compare the logical structure of a program to a river with a main channel and several side branches. Other programmers talk about a tree with a main trunk and several side branches, but they mean

the same thing. There are usually places in a program where the logic can go either one way or the other, depending on whether something has or has not happened. These places are called *branch points* in the logic.

The test-and-branch capability of the cpu is simply a way of testing whether the thing has or has not happened and thus deciding to continue down the main channel or take the branch instead.

Thus our 6502 microprocessor has four main capabilities: It can read a byte from somewhere, it can write a byte to somewhere, it can modify a byte, and it can test a byte and branch.

It can do other things, too, but let's leave the tricky ones (postindexed indirect addressing and nonmaskable interrupts, for example) until another month.

The Accumulator. The inside of a 6502, as you might expect, is a complicated, busy place. It contains several counters, a number of *status flags* (indicators that keep track of various processes), and the built-in logic that controls all of this activity. It also has several different *storage registers*, places where it can store one byte of information.

One of these storage registers is particularly important—you can think of it as the workbench or operating table of the cpu: It's called the accumulator. In order to do something with a byte—examine, modify, or whatever—the cpu has to get it into the accumulator first.

The name comes from the early days of computing, when everything was done with wheels and ratchets—back when light came from gas or oil, and all you could do with electricity was make the cat's hair stand up. In those days, a "calculating engine" had only two or three registers (a register was a device that could be set to register, or display, a particular number); the register in which the answer accumulated, during a series of calculations, was called the accumulator.

Nowadays, things are a bit more sophisticated. The byte in the accumulator of a 6502 can be added to or subtracted from, as in the old days, and (which is new) shifted or rolled right or left, one bit at a time; logically *and*ed or *or*ed, or compared (in terms of greater than, less than, and equal to) with another byte; and tested or modified in various other ways.

Of course, the byte you want to work on has to be put into the accumulator first and then put back where it came from after you've modified it; but that's easy enough. Two of the commonest commands in assembly language are LDA (short for load accumulator—load a byte into the accumulator) and STA (store accumulator—take the byte in the accumulator and store it somewhere).

And now, for those of you who have been wondering about this mysterious "somewhere" that we've been getting our information from, we will consider. . . .

Memory. There are two kinds, read-only (like a textbook) and read/write (like your own notebook or the manuscript of your novel). The read-only memory (ROM for short) is for built-in procedures, programs that do not change: The Apple Monitor, for instance, is in ROM.

The read/write memory (RAM for short—think of it as read-and-write memory. It actually stands for random access memory, but don't ask what that means) is more interesting. This is the computer's main working area. They used to call it core memory a few decades ago, because it was made up of individually hand-wound magnetic cores—one for each bit!—and was hideously expensive. One K of core (1,024 bytes, 8,192 bits) was a high-class machine in those days.

A 48K Apple Has 48K of RAM. The reason core memory, or RAM, is so important is because that's where the action is. RAM is the blackboard the Apple uses for its calculations and holds most of the files it uses for reference; the program that's running, whether Applesoft or assembly language, is in RAM (and so is DOS, if it's present); the keyboard input buffer and pattern for the screen image are in RAM—and so on.

The main difference between RAM and ROM is this: The information stored in RAM can be changed easily by the cpu (remember, you can read it *and* write to it); the information in ROM cannot be changed at all (you can only read it).

Input and Output. Right, then: The cpu does the thinking, the RAM is the working area, and the ROM is for permanent reference. What else do we need?

We need a way for this sytem to communicate with the outside world: a way we can ask questions of it and a way to receive its answers. We need input and output capabilities—I/O for short.

One of the nice things about the 6502 microprocessor is that it uses exactly the same techniques for I/O as it does for memory read and write; you don't have to learn a new set of procedures. When the cpu executes an LDA instruction (that's load accumulator, remember), it doesn't care whether the byte it's loading came from RAM, or the keyboard, or some other device. It just puts that byte in the accumulator and gets ready to work on it.

The same is true for STA (store accumulator)—the cpu simply stores the byte wherever it's been told to, whether that place is in RAM, part of an I/O device, or wherever. This technique is called *memory-mapped I/O*, because the I/O devices are on the same "map" as the memory—in other words, you get to them by the same route.

That's all very convenient, but it brings up an important question: How do you tell these places apart if they're all on the same map?

The answer is easy and (after it's been explained) obvious: They all have different addresses!

Addressing. You see, most command statements in assembly language have two parts: the command itself and an address. For example, when you want to load a byte into the accumulator (LDA), you have to indicate *which* byte is to be loaded; when you store a byte (STA), you have to indicate *where* to store it.

You have more than sixty-five thousand possibilities to choose from! The *address space* of a 6502 system—the number of different addresses the cpu can reach—is 65,536.

Thus a command like LDA or STA is not complete in itself: You have to say LDA 1000 or STA 2468. You always have to specify an address.

Actually, it's worse than that—the address usually has to be specified in the *hexadecimal* number system (base 16), instead of the more familiar decimal system (base 10).

In fact, the subject of 6502 addressing is really too complicated to fit into this article—after all, we only want to do a "quick tour of the high points" this time. We'll do a whole column on addressing and hexadecimal numbers one of these days.

For now, if you want a more complete discussion of hex numbers and 6502 addressing, take a look at the article, "The Handy & Hook," on page 184 in this issue.

And remember, whenever you use an LDA or STA command (or any other assembly language, with a few important exceptions), you must specify an address.

Looking Back—and Ahead. That should be about enough new stuff for one day. Let's see where we've been.

First, we've learned the Secret of the Power of ASL—assembly language is simply a logical model, in human-type symbols, of the electronic processes that go on in the integrated circuits that make up the brain of the Apple. Once you understand those processes and how to command them, you can make the Apple do anything (well, anything that an Apple is capable of).

We've seen that the control center of the Apple is the 6502 microprocessor—that's the chip that gives orders to all the other chips. In fact, assembly language for the Apple consists of the set of instructions that a 6502 cpu can understand and execute.

We've learned that most of the 6502's work is done in the accumulator; and we've learned how to get a byte into the accumulator (with LDA) and how to store that byte in memory (or output it) with STA.

Speaking of memory, we now know the difference between RAM and ROM—and we know that the input and output devices share the same address space.

We also know that addresses are very important and must be included with most assembly language commands (in hexadecimal, yet!)—but that's about all we know about them so far.

Next month, we'll take a closer look at these devices—particularly the accumulator and RAM—and see how they communicate with each other. We'll also examine the Apple's main internal communication channel, the data bus. And finally, we'll try writing a short program in assembly language.

See you then!

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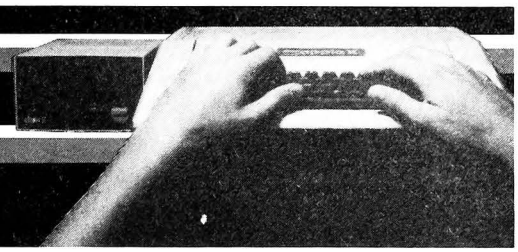
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TRADETALK



☐ **Apple Computer** (Cupertino, CA) has won a legal victory over manufacturers of alleged copycat computers. Through the efforts of Apple, **Formula International** (Hawthorne, CA) has been slapped with a preliminary injunction prohibiting it from copying or selling Apple's copyrighted software. Formula International is the creator of the Pineapple, an Apple look-alike. The preliminary injunction ordered by U.S. District Court Judge Irving Hill was not ordered by U.S. District Court Judge Clarence Newcomber, who refused to grant an injunction against Franklin Computer in a recent hearing in Philadelphia. The Franklin case is being appealed.

☐ The president of **MegaTape** (Duarte, CA), **Gene Moscaret,** has announced **Gary L. Webb** as the firm's new vice president of marketing. In the newly created position, Webb will be responsible for sales and marketing management. Before joining MegaTape, Webb was the national sales manager at Pragma Data Systems. MegaTape is the manufacturer of streaming cartridge tape drives to back up Winchester disk drives.



Gary L. Webb, vice president of marketing at MegaTape.

☐ **Spinnaker Software** (Cambridge, MA) has announced the signing of three authors for its product line of educational and entertainment game software. **Jean Rice,** an independent computer education consultant, has produced *My First Computer*, scheduled for release later this year. Rice is the founding president of the Minnesota Computer Society and a member of the U.S. Department of Education's Computer Literacy Panel. The panel is currently defining the term "computer literacy" for a 1984 national survey of the use of computers in elementary and secondary education. A second author, **Kenneth Madell,** has produced a word game called *Catchword* for Spinnaker. Madell is the author of two versions of the software game *The Visible Solar System*, published by Commodore International. **Frieda Lekerkerker,** also signed by Spinnaker, has produced *Kids on Keys*, which will be released later this year. Lekerkerker teaches computer science at Brandeis University and also serves as a software specialist for Spinnaker. She is a native of the Netherlands.

☐ **Trac Line Software** (Hicksville, NY) has announced a new two-tier dealer program that will ensure system end user service and support, according to **Mort Siegelbaum,** Trac Line's vice president of marketing. Under the program, full-service dealers will install and support end-user installations, maintain inventory, and train personnel. These dealers will earn full discounts. The second category of dealers will sell only hardware and software. Trac Line will provide the postsale support. These dealers will earn smaller discounts but have the option to change categories, Siegelbaum says.

☐ **ComputerLand** (Hayward, CA) has announced the appointment of **J. Walter Thompson Advertising** as its new agency. The announcement ended a review process that began in March. J. Walter Thompson replaces Grey Advertising West, which had handled the account since 1980. "We had a hard decision because of the excellence of all the finalists," said **Roger Lewis,** ComputerLand's vice president of advertising. "But with the rapid expansion of ComputerLand around the world, Thompson's strength internationally was a major attraction for us."

☐ **Programs Unlimited** (Jericho, NY), a national chain of computer centers, has appointed **Dennis Wilcox** as vice president of marketing. Formerly the director of marketing, Wilcox now assumes responsibility for the company's overall sales and marketing. He will help franchisees implement the marketing programs he had previously developed and tested.

☐ **Prentice-Hall Publishers** (Englewood Cliffs, NJ) has announced two additions to the General Publishing Division Computer Group staff. **John Hunger** has been appointed senior editor, coordinating the development and marketing of software programs for microcomputers, and **John Kilcullum** has joined the General Publishing Division's marketing department. John Hunger was formerly the business and technical editor for Spectrum Books.

☐ **William T. Bayer** has been named president of **Shugart** (Sunnyvale, CA), an independent wholly owned subsidiary of Xerox Corporation. Bayer will replace **James Campbell,** who retired June 30. In addition to his new role at Shugart, Bayer will retain his current responsibilities as assistant group executive and senior vice president of Xerox's Information Products Group.

☐ **Startech Marketing** (Woodland Hills, CA) has just emerged as a national software distributor and as exclusive representative of **Muse** and **Sir-tech.** Startech aims to meet the needs of individual retailers by offering a personalized dealer program. Sales efforts will be supported by print advertising and a product catalog.

☐ **Tymshare** (Cupertino, CA) is now offering a service designed to increase the speed and accuracy of communications for correspondent banking. Called FICS (financial institution communications system), the new service uses OnTyme, Tymshare's electronic message network service, for rapid communication of banking information. Data can be sent and accessed by word processors, small business computers, or Tymshare's personal information terminal, Scanset.

☐ **Arthur M. Kohler** has joined Electronic Protection Devices (Waltham, MA) as executive vice president of sales and marketing.

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He was previously vice president of sales and marketing at Fotobeam, a reprographic firm. EPD is known for its line of surge protectors and line monitors, but future plans include a move into software publishing of both business and game packages.

☐ **CBS Software** (New York, NY) has agreed to market and distribute an upcoming line of home education software produced by **Children's Computer Workshop** (New York, NY). The announcement was made by **Thomas Wyman,** chairman and president of CBS, and **Joan Ganz Cooney,** president of the Children's Television Workshop. The new software will have the theme "It's a Whole New World" and will aim to teach children new skills while promoting positive social values.

☐ **David K. Johnston** has been named product director for Safeware, a special line of insurance for personal computer owners offered by **Columbia National General Agency** (Middletown, OH). Johnston, an expert in computer security and control, developed Safeware in response to an unfulfilled need he felt as a personal computer owner. "Standard homeowner's insurance policies normally don't cover computers used for business purposes," Johnston says. "Like me, many people use their home computers for business as well as pleasure. But they usually don't realize this could leave thousands of dollars of hardware and software completely unprotected." Before developing Safeware, Johnston was director of quality assurance for Coopers and Lybrand's Computer Audit Assistance Group. He also coauthored *Galaxy*, a computer game published by Avalon Hill.

☐ **Byte Industries** (Hayward, CA) has announced three vice-presidential promotions. **Sandra Erickson**, formerly marketing manager, is now vice president of marketing; **Rick Telesco**, formerly controller, is now Byte's vice president of administration; and **Jeff Kataoka**, formerly director of franchise operations, has been promoted to vice president of franchise operations. "Making this move will allow me to place much more emphasis on long-term strategic planning," Byte Industries president **David Pava** said. "Byte is anticipating accelerated growth in the number of franchised stores opening next year. We expect over one hundred Byte Shops open by the end of 1984."

☐ **DesignWare** (San Francisco, CA), creator of educational software for Harcourt Brace Jovanovich, Harper and Row, and *Reader's Digest*, has decided to package and distribute programs under its own label. DesignWare recently released *Creature Creator*, a pattern-matching game, and *Crypto Cube*, a word-puzzle program.

☐ **Sirius Software** (Sacramento, CA) has announced several promotions. **Ernest Brock**, author of *Type Attack* and the *Pascal Graphics Editor*, has been promoted to vice president in charge of product development. Previously, he worked with outside authors. **Jim Ackerman** has been promoted to vice president in charge of operations. Ackerman's duties include overseeing everyday operations—shipping, sales,

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APPLE II /IIe Personal Version	$75	$129
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MONEY MAGAZINE — Nov. 1982
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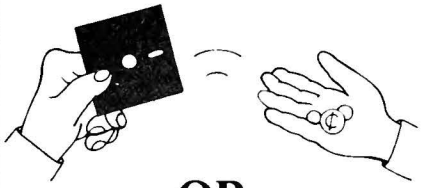
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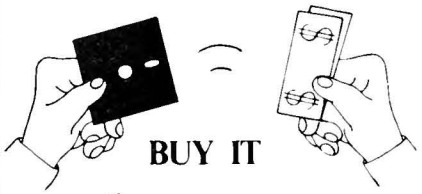
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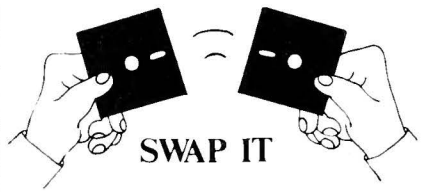
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technical support, and repair. Sirius has also promoted **Greg Cottrill** from operations assistant to operations manager. Cottrill oversees all shipping and production. In other promotions, **Tony Ngo** and **Dan Thompson** have become senior game designers, and **Uriah Barnett** has joined Sirius as a game designer. Ngo is the author of *Bandits* and *Squish 'Em*, and Thompson of *Repton*, among others.

☐ More than twenty-five hundred schools responded to a personal computer fund-raising program sponsored jointly by **Apple Computer** (Cupertino, CA) and **National Community Services** (Lowell, MA), a nationwide fund-raising company. The program, which ended June 30, aided schools in raising funds to buy Apple computers and provided schools that bought Apples with eleven free software disks. Although the program has ended for 1983, Apple Computer and National Community Services will continue to work together in 1984, according to **Nadine Vantine** of NCS.

☐ **James H. Smith** has been appointed manager of operations technology for **Evotek** (Fremont, CA), a manufacturer of high-capacity rigid disk drives. Smith will be responsible for the advanced development of disk media. Previously, he served as director of the physical chemistry department at SRI International.

☐ **MAI/Basic Four Business Products Corporation** (Albuquerque, NM), a subsidiary of Management Assistance, has introduced a sales-incentive program for its microproduct dealers. "Partners in Progress" awards bonus points to dealers and salespeople for sales of the Business Basic/Micro software applications programs. Points are redeemable for prizes.

☐ **David Stalker** has been appointed director of finance for **Datascan** (Santa Monica, CA), a computer hardware and software service company. Stalker previously served as an independent consultant and as controller for the Los Angeles division of R. R. Donnelly and Sons.

☐ **Monica Kantrowitz**, president of **Queue** (Fairfield, CT), a distributor of educational software and publisher of the newsletter *Microcomputers in Education*, has announced several executive appointments and promotions. **Jonathan Kantrowitz** has been appointed chairman of the board and chief executive officer; **Anna Christopolous** has been named vice president and general manager. Kantrowitz previously worked as an attorney, and Christopolous has worked with Queue since its founding in 1980. Other promotions include the naming of **Michael Cuneo** as vice president of communications and **Margaret Kirkman** as vice president of personnel. Cuneo is a graduate of Yale, and Kirkman has thirteen years of experience as a schoolteacher.



New Hampshire students use educational software demo disks earned through NCS fund-raiser.

☐ **Scholastic** (New York, NY) has established a full-time sales organization to support and service its line of Wizware computer software. **Bruce Butterfield**, vice president and publisher of the Scholastic Trade Group, heads the new sales organization, which will be supported by Scholastic's existing retail-book sales force. He will work with dealers and distributors on a regional basis. The Wizware software line, released in May, is designed for children ages six to sixteen. In September, the company will further expand into the software market with *Family Computing*, a national consumer magazine designed for families who have home computers.

☐ **Steven M. Abraham** has been named conference chairman of the **1984 Office Automation Conference**, which will be held February 20–22 at the Los Angeles Convention Center. The OAC '84 program is designed to focus on specific needs of users of all types. OAC will feature an extensive exhibition representing manufacturers, consultants, associations, and suppliers in the office automation industry. The Office Automation Conference is sponsored by the American Federation of Information Processing Societies (AFIPS), whose eleven constituent societies are engaged in the design or application of computers and information systems. ■

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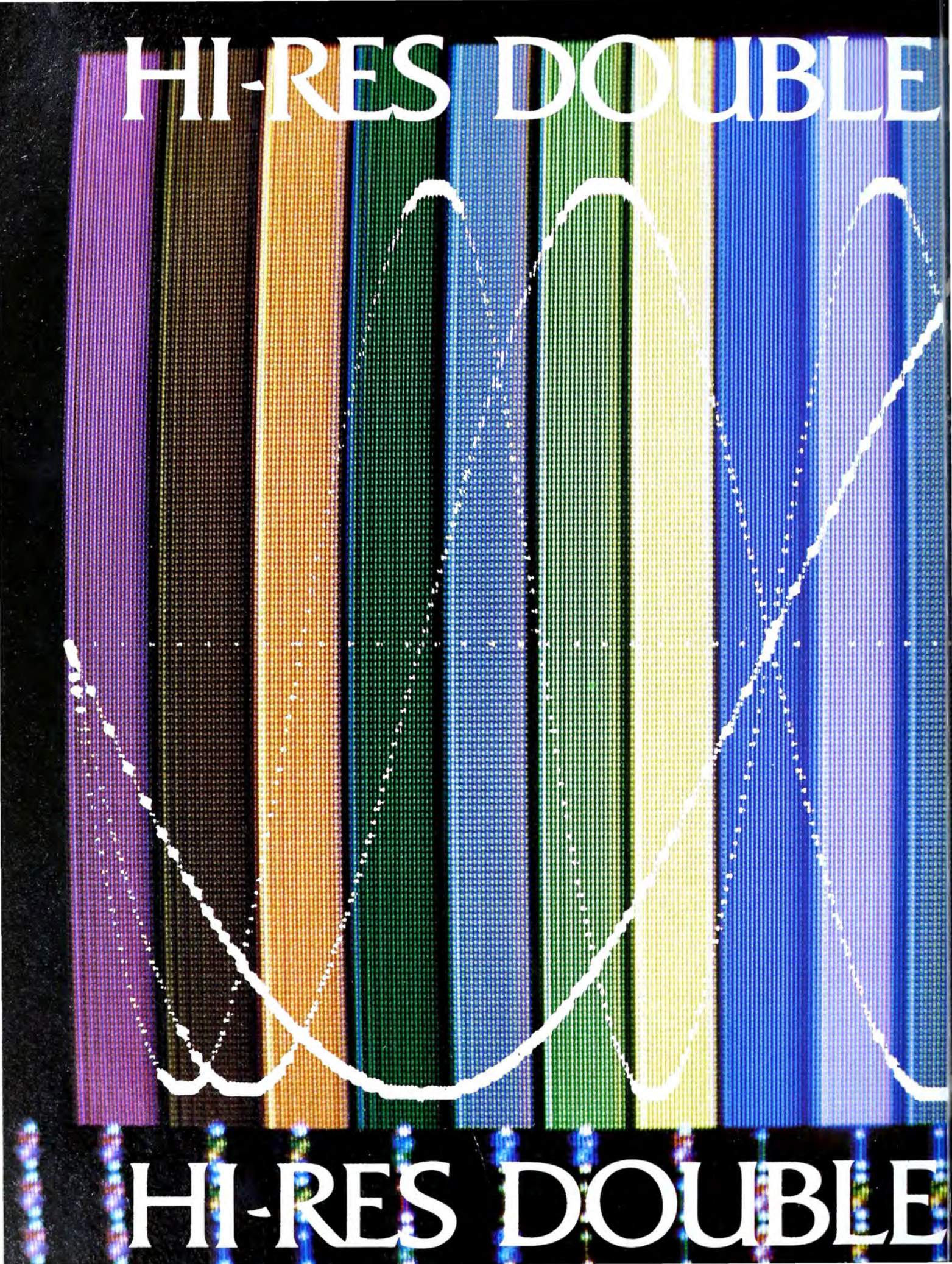
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HI-RES DOUBLE
HI-RES DOUBLE



BY DON WORTH

As the story goes, when Apple was putting together the Apple IIe, the engineer assigned to design the extended eighty-column board for the new machine decided to get a little fancy. He found, in designing a card to produce eighty-column text with an additional 64K of RAM, that he had nearly all the elements necessary to produce higher-precision graphics as well.

The eighty-column cards for the Apple IIe work by *bank switching* the text page in main memory (which is normally only big enough to hold twenty-four lines by forty characters) with an identically sized piece of memory on the card in the auxiliary slot. This additional, "phantom" page contains every other character while the machine is in eighty-column mode. With the new circuitry, when a program stores text in these memory pages, the characters are assembled into twenty-four lines of eighty columns on the display screen. It seemed natural that what could be done for text could also be done for graphics. The only fly in the ointment was that the hi-res-graphics memory requirement is substantially larger than that for text display.

The extended eighty-column text card solves the problem by having more than enough extra memory for a second hi-res-screen page. Thus, double-hi-res graphics were born. At first, the engineer's little enhancement to the previously approved design for the card met with some resistance within Apple, but it finally received the go-ahead. Thanks to that unnamed engineer, you have the opportunity to take advantage of a remarkable new feature that may yet prove to be the most exciting of the many improvements made to the Apple II in several years.

What Do You Need? To use double-hi-res graphics you must have the following:

1. An Apple IIe computer with a revision B or later motherboard. To find out what revision your board is, look at the rear of the main circuit board, just behind the slots, for something of the form:

```
APPLE COMPUTER INC.
820-0064-B (C) 1982
```

If your board has an A instead of a B following the number, you can't do double-hi-res graphics (if you try, your machine will freeze up).

2. An extended eighty-column text card. This is the more expensive of the two eighty-column cards Apple markets for the IIe. The standard eighty-column text card does not have enough memory to perform double hi-res.

3. A jumper between the two gold pins on J1 of the extended eighty-column text card. You should have received a jumper with the card (it's buried under the foam and can be easily overlooked). If you didn't get one, an alligator clip works just as well. Refer to the directions you got with the card. Remember, do not connect these two pins if you have a revision A motherboard; your machine will cease to function!

Now that we have covered the requirements, hopefully there are a few of you out there who can meet them and are still reading. If you peruse the documentation from Apple, you will probably get the impression that in order to take advantage of double-hi-res graphics you must program in assembly language. Not true! Admittedly, the documentation does gloss over some rather important things and is not written to be completely decipherable by anyone with less experience than a systems programmer, but that just makes it all the more exciting. Unfortunately, Apple did not provide any demonstration programs for the new graphics either. That's what this article will set out to rectify.

What Is Double Hi-Res? Before we look at how to activate and use double-hi-res graphics, perhaps we should explain what it means. In the simplest case, double hi-res can be used on a monochrome display (in other words, black and white, black and green, black and amber, or what have you) to produce graphs that are twice as detailed horizontally as they would be with normal Apple hi-res. Thus, instead of 280 dots across, you now can plot 560 (tinier) dots across the screen. The vertical resolution remains the same, however. The difference in resolution between the two modes is very obvious when a comparison is made (more on this later).

As if this weren't enough, if double hi-res is used on a color monitor,

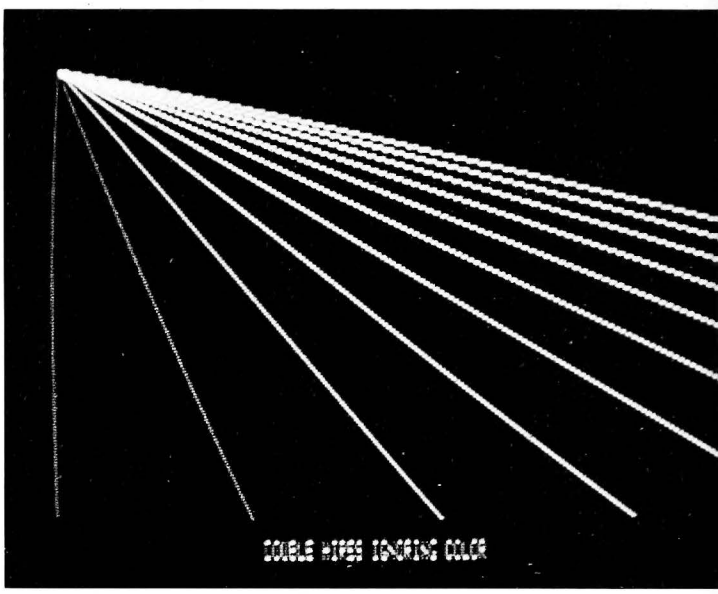
some real magic occurs. By manipulating the dots properly, one can produce up to fifteen (actually sixteen if you count gray twice) colors in a resolution that's the equivalent of standard hi-res. These colors are almost, but not quite, the same as those available to you in lo-res mode. There is another, hidden advantage over standard hi-res in the way these colors can be arranged on-screen, but we will have to lay some groundwork first.

An interesting side note is that, with this new mode, the Apple IIe graphics compare favorably with those of the IBM Personal Computer. The IBM pc has a medium-resolution mode, similar to Apple's standard hi-res, which is 320 dots wide by 200 dots high (Apple's is 280 by 192). The Apple allows up to six colors on-screen in this mode (with some limitations) and the IBM allows only four. The IBM also provides a monochrome high-resolution mode that is 600 dots wide by 200 dots high. Just as in the Apple double hi-res, the IBM uses the same vertical resolution for both medium and high-resolution modes. It turns out that, using an almost identical method, this IBM pc hi-res mode can also be made to produce sixteen colors (at least on a color television or composite monitor). This is probably no coincidence. In essence, there is very little difference between the graphics capabilities of the two machines now that Apple has double hi-res. In fact, from a programming standpoint, it turns out that the Apple's graphics are more flexible.

How Double Hi-Res Works. To understand how to use double hi-res, you need to have some idea of how it works. To understand the inner workings of double hi-res, you should know how standard hi-res works. Refer to figure 1, the diagram of standard hi-res mapping. Each byte in memory, starting at location $2000, is scanned by the video circuitry in the Apple. The bits (1s and 0s) within each byte are interpreted as the presence or absence of dots on the screen. The first dot (at 0,0, or the upper-left corner of the screen) is determined by the least significant bit of the byte at $2000. If that bit is 1, then the dot is lit; if that bit is 0, then the screen is black at that point. The eighth dot is determined by the least significant bit of the byte at $2001. Thus, each byte maps only seven dots (or pixels, as they are called) on the screen.

The most significant bit in each byte is used to select a color "palette" for the dots in that byte and that byte only. If the most significant bit is 0, then only black, green, magenta, and white may be generated for that group of seven dots. If the most significant bit is 1, then black, blue, orange, and white may be generated. Unless they are determined by different bytes, no two horizontally adjacent dots may be green and blue, for example. This bit is called the color bit.

An additional aspect of this system is that, within a group of dots, the color generated is determined by the combinations of pairs of dots. If both dots of a given pair are off, black is the result. If both are on, white is



The program in listing 1 creates this double hi-res picture. Note that the near-vertical lines show a greater increase in resolution than the near-horizontal lines.

displayed. If the first dot is on and the second one is off (and the color bit is 0), a green dot shows up. And, if the first dot is off and the second one on, magenta appears. Herein lies a basic restriction that few Apple owners realize—if you are using hi-res on a color display, you are really getting only half the resolution you would have on a monochrome. Thus, there are only 140 separately definable colored dots across a horizontal row on the screen.

Now to double-hi-res mode. In double hi-res, the picture is generated by taking a byte from auxiliary memory and the corresponding byte from main memory and displaying them together, as shown in figure 2. The same horizontal screen space occupied by two dots in standard hi-res is now occupied by four dots. As with the pairs in standard hi-res, these groups of four dots may be configured to produce multiple colors. Unlike two dots, which have only four possible arrangements, four dots can have sixteen. This is what gives you sixteen colors in double hi-res. To produce a color, each group of four horizontally adjacent pixels on the screen (starting with the bit for the dot at 0,0 at $2000) are grouped into one color unit. If all four are off, you get black; if all four are on, you get white; and if some are on and some off, you get a color. The first seven dots are determined by the value of the byte at $2000 on

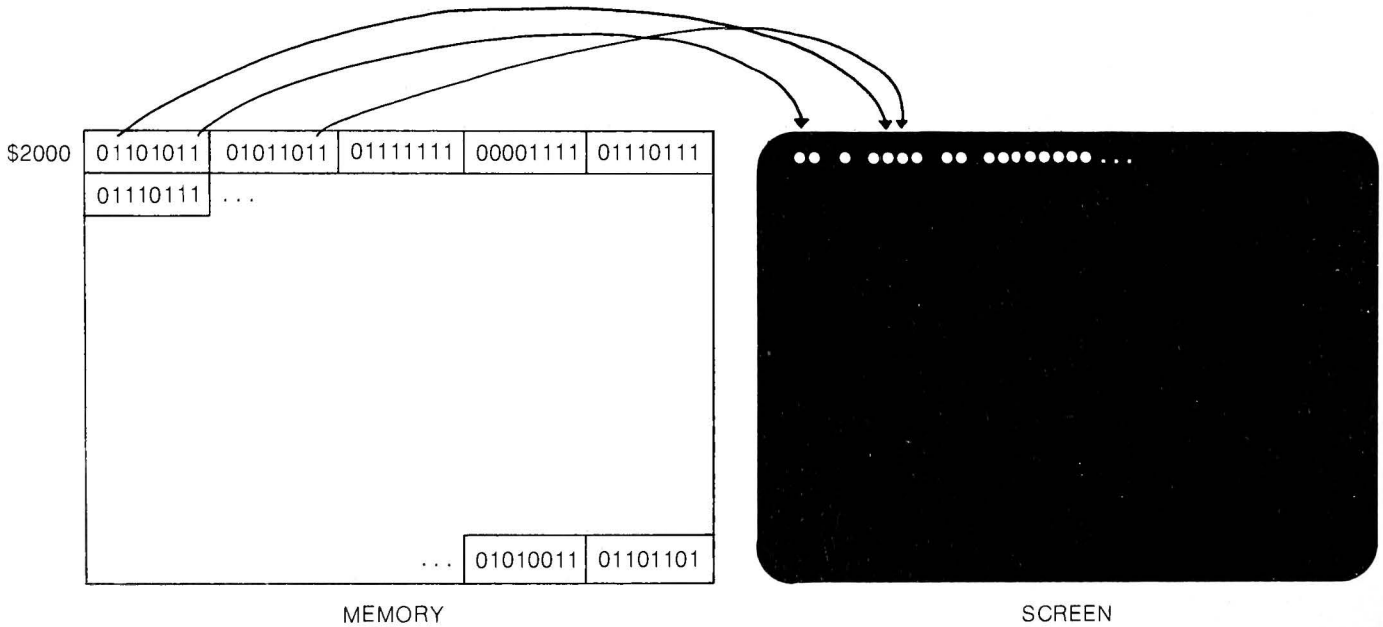


Figure 1. Standard hi-res mapping.

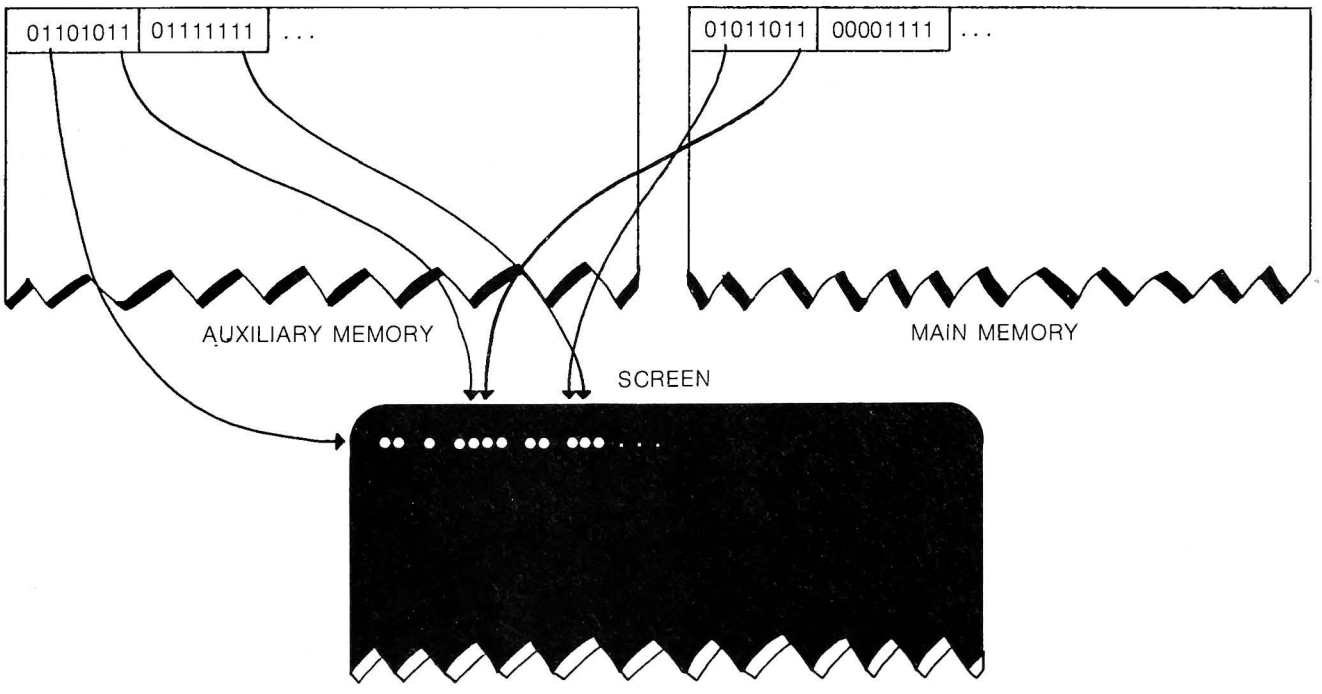
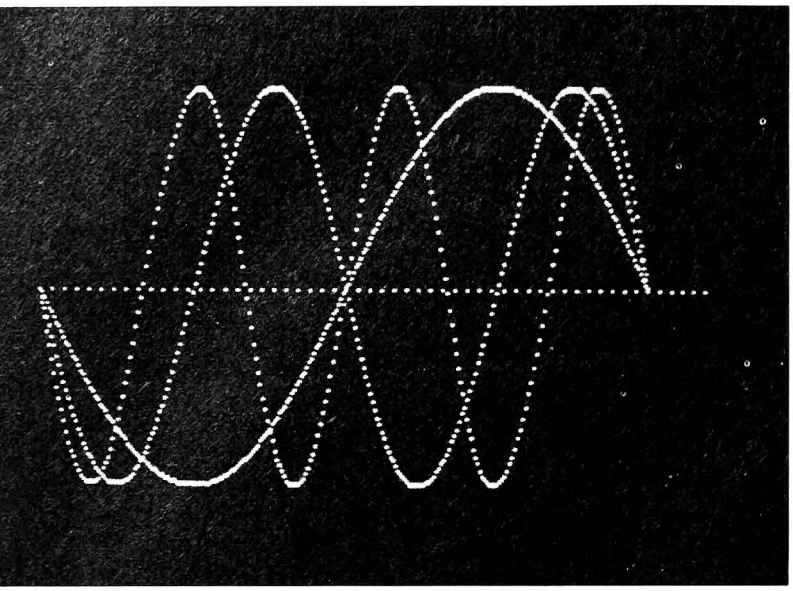


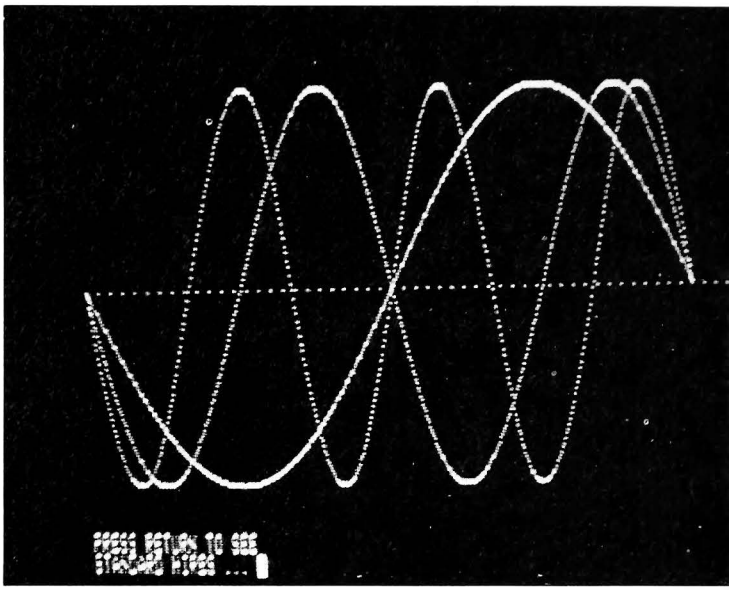
Figure 2. Double-hi-res mapping.

the extended eighty-column text card. The second seven come from the same memory address in main memory. Since both bytes are addressed by the same location value, only one may be written to by a program at a time (the video circuitry can read both at once, since it is independent of the microprocessor).

This requires a bit of page flipping, as we will see later. This means that if you are using color with double hi-res you are really using the same old resolution (140 definable colored dots across) but you have ten more colors to work with. On a monochrome monitor, however, you will see each and every dot, for a total of 560 horizontal positions. You may have noticed that there was no mention made here of the color bit in each byte. Double hi-res ignores it—meaning you can put any color next to any other. This is the third advantage listed earlier in this article.







These sine wave graphs from listing 2 show the difference between hi-res and double hi-res.

How To Do It. You may already be aware of the fact that double hi-res is not supported by Applesoft. It didn't even exist when that language was created for the Apple. It turns out that much of Applesoft's support for standard hi-res can be perverted into supporting double hi-res as well. There are two Basic subroutines that you'll need to use double-hi-res graphics. Both are part of the example program in listing 1.

The first subroutine occupies lines 180 through 250 in listing 1. Its purpose is to set up the environment for double hi-res. In a sense, it is equivalent to the hgr statement (although for double hi-res this might be called dhgr if it existed). Several pokes are performed first. They do the following:

```
10  REM
20  REM EXAMPLE OF A SIMPLE DOUBLE HI-RES PROGRAM
30  REM WHICH DRAWS SEVERAL DIAGONAL LINES
40  REM
50  REM DON D. WORTH 5/25/83
60  REM
70  PRINT CHR$ (4);"PR#3": PRINT CHR$ (12)
80  VTAB 22: HTAB 25: PRINT "DOUBLE HI-RES IGNORING
    COLOR"
90  GOSUB 210
100  HCOLOR= 7
110  FOR DX = 0 TO 10
120  CX = 0:Y = 0
130  FOR X = CX TO CX + DX - 1: GOSUB 290: NEXT X
140  CX = CX + DX:Y = Y + 1
150  IF X < 560 AND Y < 160 THEN 130
160  NEXT DX
170  END
180  REM
190  REM DOUBLE HI-RES INITIALIZATION AND SCREEN CLEAR
200  REM
210  POKE 49154,0: POKE 49156,0: POKE 49153,0: POKE 49239,0
220  POKE 49160,0: POKE 49246,0: POKE 49232,0: POKE 49165,0
230  HGR
240  POKE 49237,0
250  CALL 62450
260  REM
270  REM DOUBLE HI-RES PLOT SUBROUTINE
280  REM
290  XX = INT (X / 7):PG = XX / 2 - INT (XX / 2)
300  XX = INT (XX / 2) + ((X / 7) - XX)
310  XX = INT (XX * 7 + .5)
320  POKE 49237,0: IF PG THEN POKE 49236,0
330  IF XX > 279 THEN RETURN
340  HPLOT XX,Y
350  POKE 49236,0
360  RETURN
```

Listing 1.

```
POKE 49154,0    RAMRD off
POKE 49156,0    RAMWRT off
POKE 49153,0    80STORE on
POKE 49239,0    HIRES on
POKE 49160,0    ALTZP off
POKE 49246,0    AN3 on
POKE 49232,0    TEXT off
POKE 49165,0    80COL on
```

The key pokes here are those to 80STORE, HIRES, AN3, TEXT, and 80COL. Turning on hi-res with annunciator 3 while in eighty-column mode enables double hi-res (assuming you have the jumper installed on your extended eighty-column text card). The TEXT poke switches to graphics from text mode. The 80STORE is used again later to allow your program to shift its access between the two hi-res memory pages.

Line 230 does a standard hgr to blank out the main memory hi-res buffer. The tricky part is telling the Apple to write in the auxiliary memory hi-res area. This is accomplished by poking 49237. This is the trick that makes it all happen. With the 80STORE switch set, poking 49237 will switch from writing hi-res information in the main memory buffer to writing it in the corresponding memory in the eighty-column card; poking 49236 switches back. Thus, if the dot you wish to plot is in the first group of seven dots on a line, or on any odd-numbered group of seven (numbering the first group 1), you merely poke 49237 (enabling auxiliary memory for the hi-res page) and do a garden-variety hplot. If you want to plot a dot in an even-numbered group of seven, poke 49236 first instead. Once the switch is made, call 62450, a standard Applesoft call to clear the hi-res screen, clears the auxiliary hi-res area.

You can draw lines in double hi-res, but with limitations. For instance, hplot 0,0 to 279,0 results in a dashed line rather than a solid one. You may not ordinarily use hplot to draw a horizontal line in double hi-res, as it will perform its function entirely within one buffer or the other. Of course, if you are clever, you can do two hplots with appropriate pokes preceding them to obtain a solid horizontal line. Vertical lines may be done with a single hplot, however.

The second subroutine occupies lines 260 through 360. It takes the place of an imaginary *dhplot* statement. Given X (in the range from 0 to 559) and Y (in the range from 0 to 199), it determines which buffer needs to be enabled (by finding out which group of seven dots is specified by X), pokes the proper soft switch, and performs a standard hplot. This subroutine will plot single points only—a subroutine to plot horizontal or diagonal lines is far more complicated and makes a good exercise for the reader.

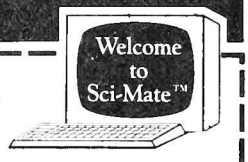
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Listing 1 draws several diagonal lines on-screen, using the two previously described subroutines. Since each dot must be individually computed, things go rather slowly. In this example, use a monochrome display or a color TV with the color turned completely off to get the best effect.

Listing 2 offers a better opportunity to compare the results of standard hi-res and double hi-res. First, a group of sine waves is drawn in double-hi-res mode, then, invisibly, the same curves are drawn on standard hi-res page two. When all this is complete, you can toggle back and forth, comparing the two versions, by pressing return. One thing to notice is that it is not a trivial matter to switch back and forth. Several pokes are required, and eighty-column mode must be turned off by printing escape control-Q (CHR$(27);CHR$(17)) or the eighty-column support software will blithely stomp all over your Applesoft program! This is because the program turns off 80STORE, disabling without warning the eighty-column support software's ability to page-flip between text screens. Again, the results of the program are most striking when a monochrome display is used.

The final example program in listing 3 is where the real fun begins. Everyone has probably run *Color Demo* on the DOS System Master disk. It draws color bars in lo-res-graphics mode, showing all sixteen colors at once. A similar program can be written to do this in hi-res, but it's not nearly as pretty (only six colors). If you run listing 3 you'll see something very much like the lo-res color bars, but they are displayed in double hi-res! The color bars are formed by plotting every possible combination of four dots—on or off. Thus, the first bar is black (all four dots in each group are off), the second is three off and the last one on, the third is off-off-on-off, and so on. White is produced last with on-on-on-on. Exactly like counting to sixteen in binary. It is critical that these patterns appear starting on columns evenly divisible by 4 (if you count the first column as 0). To see what happens if you don't, try setting XB in line 180 to 1, 2, or 3. The result is decorative but not particularly useful.

Now that you've seen all this, it must be obvious that, with every Apple IIe and extended eighty-column text card sold, the odds increase that there will soon be commercial and public-domain software available to take advantage of double hi-res. Hopefully we won't have long to wait. For now, build on these three example programs and make all your friends with older Apples green with envy (and red, and gray, and pink, and aqua, and . . .).

```
10  REM
20  REM COMPARISON OF SINE WAVES IN BOTH
    DOUBLE-HI-RES
30  REM AND STANDARD-HI-RES MODES
40  REM
50  REM DON D. WORTH 5/25/83
60  REM
70  PRINT CHR$ (4);"PR#3": PRINT CHR$ (12)
80  VTAB 22: HTAB 25: PRINT "DOUBLE HI-RES IGNORING
    COLOR"
90  GOSUB 250
100  REM DOUBLE-HI-RES SINE WAVES
110  HGR
120  POKE 49237,0
130  CALL 62450
140  FOR X = 0 TO 550 STEP 10:Y = 80: GOSUB 290: NEXT X
150  FOR P = 6 TO 2 STEP - 2
160  X = 0
170  FOR CX = 0 TO (3.14159 * P) STEP (3.14159 * P / 500)
180  Y = 80 + SIN (CX) * 70
190  GOSUB 290
200  X = X + 1
210  NEXT CX
220  NEXT P
230  GOTO 380
240  REM DOUBLE-HI-RES INITIALIZATION SUBROUTINE
250  POKE 49154,0: POKE 49156,0: POKE 49153,0: POKE 49239,0
260  POKE 49160,0: POKE 49246,0: POKE 49232,0: POKE 49165,0
270  RETURN
280  REM DOUBLE-HI-RES PLOT SUBROUTINE
290  XX = INT (X / 7):PG = XX / 2 - INT (XX / 2)
300  XX = INT (XX / 2) + ((X / 7) - XX)
310  XX = INT (XX * 7 + .5)
320  POKE 49237,0: IF PG THEN POKE 49236,0
330  IF XX > 279 THEN RETURN
340  HPLOT XX,Y
350  POKE 49236,0
360  RETURN
370  REM NOW PLOT SINE WAVES IN SINGLE HI-RES
380  HGR2 : POKE 49236,0: POKE 49235,0
390  PRINT CHR$ (12): VTAB 22: HTAB 25: PRINT "PLEASE
     WAIT . . ."
400  FOR X = 0 TO 275 STEP 5:Y = 80: HPLOT X,Y: NEXT X
410  FOR P = 6 TO 2 STEP - 2
420  X = 0
430  FOR CX = 0 TO (3.14159 * P) STEP (3.14159 * P / 250)
440  Y = 80 + SIN (CX) * 70
450  HPLOT X,Y
460  X = X + 1
470  NEXT CX
480  NEXT P
490  REM ALLOW USER TO TOGGLE BACK AND FORTH
500  POKE 49236,0: POKE 49235,0
510  PRINT CHR$ (12): CALL - 936: VTAB 22: PRINT "PRESS
     RETURN TO SEE"
520  INPUT "STANDARD HI-RES . . . ";A$
530  PRINT CHR$ (27); CHR$ (17)
540  POKE 49164,0: POKE 49152,0: POKE 49237,0
550  POKE 49234,0: POKE 49232,0
560  INPUT A$: GOSUB 250: GOTO 500
```

Listing 2.

```
10  REM
20  REM THIS PROGRAM DRAWS 16 COLOR BARS ON THE
    SCREEN IN
30  REM DOUBLE HI-RES GRAPHICS MODE
40  REM
50  REM DON D. WORTH 5/25/83
60  REM
70  PRINT CHR$ (4);"PR#3": PRINT CHR$ (12): PRINT
80  VTAB 21: POKE 36,1: PRINT " ";
90  REM INITIALIZE DOUBLE-HI-RES MODE
100  POKE 49154,0
110  POKE 49156,0
120  POKE 49153,0
130  POKE 49239,0
140  POKE 49160,0
150  POKE 49246,0
160  POKE 49232,0
170  POKE 49165,0
180  XB = 0
190  REM ERASE THE GRAPHICS SCREEN
200  HGR
210  POKE 49237,0: CALL 62450
220  HCOLOR= 7
230  DL = 73 / 16:TB = - (DL / 2)
240  REM PLOT GROUPS OF 4 DOTS IN EVERY COMBINATION
250  FOR X0 = 0 TO 1
260  FOR X1 = 0 TO 1
270  FOR X2 = 0 TO 1
280  FOR X3 = 0 TO 1
290  TB = TB + DL:T = INT (TB)
300  VTAB 21: POKE 36,T: PRINT X0: POKE 36,T: PRINT X1
310  POKE 36,T: PRINT X2: POKE 36,T: PRINT X3;
320  FOR AD = 0 TO 24 STEP 4
330  IF X0 THEN X = XB + AD: GOSUB 430
340  IF X1 THEN X = XB + 1 + AD: GOSUB 430
350  IF X2 THEN X = XB + 2 + AD: GOSUB 430
360  IF X3 THEN X = XB + 3 + AD: GOSUB 430
370  NEXT AD
380  XB = XB + 32
390  NEXT X3,X2,X1,X0
400  PRINT "  ";: GET A$
410  END
420  REM DOUBLE-HI-RES VERTICAL LINE DRAW ROUTINE
430  XX = INT (X / 7):PG = XX / 2 - INT (XX / 2)
440  XX = INT (XX / 2) + ((X / 7) - XX)
450  XX = INT (XX * 7 + .5)
460  POKE 49237,0: IF PG THEN POKE 49236,0
470  HPLOT XX,0 TO XX,159
480  POKE 49236,0
490  RETURN
```

Listing 3.



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Besides this, Money Street does your checkbook and bank statement chores. It gets you in balance and keeps you there. The program prints seven separate audit reports, creates an easy-to-access cancelled check file, and gives you a detailed report of each reconciliation session.

Money Street may be the only accounting program you need because one master program handles unlimited checking accounts. More than that, the program is tax deductible when used to collect tax data (See IRS Publication 17).

Additional Features.

- Split entries between codes.
- Fast machine language programming. Nine seconds from start-up to data entry.
- Handles unlimited checkbooks.
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- Credit card accounting.
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4. List code dictionary
5. Sort by payee
6. List deposits
7. List un'cld checks
8. List un'cld deposits
9. List all entries
10. Sort by date cleared
11. Print check registry
12. Print selected month
13. Print selected code
14. List code totals
15. List monthly totals



How it works. On your computer screen, you create a facsimile of your checkbook. You see 17 items per screen and can scroll for more. As the computer balances your checking account, you give each check or deposit its own category code. You get 100 you name'em codes. Press Ctrl-O and see a code dictionary. To set up codes, just type them in. You can add, delete, or change codes any time without affecting data.



Money Street's most amazing feature is its "real time" data bank. It accumulates year-to-date totals for each of the 100 categories. You see these totals instantly. Just enter a check, and look at the bottom of the screen. The year-to-date total will flash into view with each new entry.

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- Glenn Rodkin, president of Oklahoma City Apple Users Group wrote: "Tremendous! It's fast, reliable and covers all the contingencies a checkbook program should."
- Michael Salesin of West Bloomfield, Michigan wrote: "When next year's tax season rolls around, my accountant will send you love and kisses."
- Howard Serotta of Lansdale, Pennsyvania said: "I am totally pleased with Money Street. I like the sub-totals, the speed, and the many print options."
- Hisher Logic of San Luis Obispo, California wrote: "It's doing all my bookkeeping (six accounts)—what a time-saver."
- Gary Rominger of Sacramento, California wrote: "It works! I love it! Your claim of 30 minutes to learn it is fully justified."

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Mind Your Business

BY PETER OLIVIERI



Welcome to the July installment of Mind Your Business. Because there are always newcomers to our ranks, it seems appropriate to go back over some old ground occasionally. In this dynamic industry, the passage of even a few months' time can result in new packages and enhancements that make old reviews old indeed.

With that in mind, we'll be taking another look at database management systems in an upcoming column. We'll consider the *PFS* series, *DB Master*, *dBase II*, and *DataFax*, among others. If you've had any experience (good or bad) with database management packages, please jot down your comments and send them along. Send them soon, by the way; the articles are even now in the works. While you're at it, don't forget last month's request to comment on any "useful utilities" you're happy with.

What's Up, Mac? What with various new developments and the rumors that abound, it's difficult to keep up with what's really happening in the computer industry. The latest speculations about a new computer from Apple raise some familiar questions. What will the new machine's impact be on owners of other Apple computers—the II, II Plus, IIe, and III? If there are newer models with fancier features, will these earlier machines become obsolete?

Despite appearances, the answer is no. These machines are not becoming obsolete. There are just different models being produced to take advantage of newer technology. That's what happens with most products—televisions, stereos, you name it. At some point you may want to upgrade to enjoy some of the new features being offered. But in the meantime, it's important to remain aware that it's the software that makes the computer do what it does. This makes the software the most important component of your computer system.

The key, as we've stated before, is to be sure you buy your computer and software to solve some very real problems you're facing. If the software for the computer you currently own successfully helps you solve your problems and manage your business, your present machine will never be obsolete for you. And while it might be nice to have a mouse, like Lisa has, to make interfacing with the computer that much easier, having a mouse won't do you a lot of good if the software to solve your particular business problems is not adaptable to one.

What the Heck Is CP/M? Chances are that in your reading of the articles and advertisements contained in computing magazines you've come across the term CP/M more than once. A variety of products and software are available in CP/M. What is CP/M? Is it something you should have in your Apple?

CP/M stands for "control program for microprocessors." Digital Research Corporation's goal in designing CP/M was to create a "program" that allowed computer programs to be run on a wide variety of computers. But we're getting ahead of ourselves. Let's back up a bit.

First of all, CP/M is an operating system. An operating system (often referred to as an OS, for obvious reasons) is a set of programs that help the computer operate. These programs are essentially transparent to the user—that is, they do their business without the user having to be aware of exactly how they work. The programs that are part of the operating system are crucial to the successful completion of many of the tasks we ask our computers to do. Indeed, if we had to issue to the computer all the commands that are necessary to perform all its functions, using a computer would be annoying and tedious, not to mention time-consuming.

We take for granted a lot of things that go on inside that little machine. Say, for example, that you want to get a printed copy of the catalog listings for one of your disks. All you have to do is turn on your printer, type pr#1, and then type catalog. Think for a minute, though, about all the things that have to happen in your computer in order for this simple task to be accomplished. First, the computer has to recognize what keys you've pressed on the keyboard. These keystrokes then have to be assembled into a meaningful command, which in turn has to be looked up. Somehow, too, the disk drive has to be turned on and the disk catalog has to be found. Then the right information has to be transferred into the temporary memory of your Apple before that information is sent to the printer. And finally, the printer has to be located and the information sent as requested.

Even this lengthy explanation is an abbreviated, imprecise representation of what happens when you request that your disk catalog be printed out on paper. Nothing at all was said, for instance, about such things as the evaluation of commands (any syntax errors?) or the verification of what slot the disk-drive controller card was in. There is, indeed, a lot we take for granted.

All of the tasks we've been talking about are handled by the operating system. An operating system is a set of computer programs that come with your machine when you buy it or that can be purchased separately as an extra feature. As you know, the operating system for the Apple is called DOS (short for "disk operating system"). Each computer has its own operating system; the TRS-80's, for example, is called TRSDOS.

A program that's designed for a microcomputer with a specific operating system will not work on another microcomputer, at least not without some modification to the machine. CP/M, also an operating system, was designed to eliminate this stumbling block. As you may know, there are CP/M machines (the Osborne is one) and there are also CP/M attachments (a card or board) that can be added to your Apple to give it the CP/M look. But why might you be interested in doing this in the first place?

Well, you may not. Even though CP/M provides some very nice features, it is not necessarily the best operating system ever designed. Nonetheless, however, adding CP/M does make your Apple a more powerful and flexible machine. CP/M runs on more kinds of machines than any other operating system. This makes it very attractive to software developers because it significantly broadens the market for their products. And this, in turn, means that there is a lot of software made especially for the CP/M environment that won't run on unaltered Apples.

If at some point you should discover a CP/M applications package that interests you, you may want to consider adding CP/M to your system. This is done by inserting a peripheral board, or card (such as the SoftCard from Microsoft), into one of the free slots on the motherboard of your machine. A CP/M card is not inordinately expensive, and the process of installing it is much like installing a disk-drive controller card. Once you have CP/M on your Apple, you're free to use either Apple

DOS or CP/M (as your needs dictate).

If you'd like to learn more, a book on CP/M—found either at your dealer's or at a store selling computer books—would provide valuable additional information. Also, your dealer might be a good source of information and might be able to demonstrate some of CP/M's features. For more information about CP/M-compatible software, send away for a copy of Digital Research's recently published *CP/M Compatible Software Catalog*.

Like other products, CP/M requires users to learn some new vocabulary. For example, to get a listing of the programs on a data disk, you must type *dir* (for directory) instead of *catalog*. In addition, the commands available to the CP/M user are more extensive and thorough than those in Apple DOS.

Just as computers continue to change and improve over time, CP/M will continue to evolve. There will at some point be new microcomputer versions of CP/M that allow you to run two programs simultaneously (that is, to be printing out a spreadsheet, say, at the same time as you're creating a document with your word processor). This capability has long been a feature of CP/M systems on larger machines. In addition, you can expect CP/M versions that are faster and more widely compatible. More important, the amount of software that will run in a CP/M environment will most certainly continue to grow.

So when you're reading the latest issue of your favorite computer magazine, don't ignore the mentions of CP/M-compatible products. After all, you may just discover that the very package you need in order to get the most out of your computer is actually designed to run in CP/M.

Remember VisiCalc? *VisiCalc* was, after all, responsible for much of the initial interest people had in microcomputers. This package (a spreadsheet) was certainly faster than the traditional paper-and-pencil methods.

This product, too, changed over time. In response to user suggestions, VisiCorp developed a more advanced version of *VisiCalc*. Indeed, some of the limitations of the original program had more to do with the design of the Apple II than they did with the software package itself; in fact, the *Advanced Version* of *VisiCalc* is currently available only for the Apple III. There are, however, other spreadsheet packages that can be run under CP/M. Some of these programs contain the more advanced features that some users desire.

Included in the "most-wanted-features" list are the ability to vary the width of a particular column in your worksheet (rather than having to change the width of all columns together), the ability to "freeze" a cell so that its contents can't be erased accidentally, the ability to make the contents of a cell "invisible" so that only certain users can determine what value resides there, more selective cell-formatting capabilities, and more extensive report formats. (*VisiCalc Advanced Version* also contains a built-in internal rate-of-return function and can consolidate similar models into one larger model.)

One of the more popular CP/M spreadsheet programs is *Multiplan*, distributed by Microsoft. *Multiplan* contains all the "most-wanted" features listed above. In addition, it permits you to identify cells by a name rather than by a row or column designator. Thus, you could enter a formula such as PAY = HOURS * WAGE RATE. Furthermore, it's possible to enter values in a column, sort a column of entries, or divide the screen up into eight different windows. *Multiplan* is available for the Apple II and III, with CP/M, of course.

If you're thinking about buying a spreadsheet, it's worthwhile to consider the advanced versions of various programs that are becoming available, such as *VisiCalc Advanced Version* for the Apple III and *Multiplan* for CP/M-enhanced Apple IIs and IIIs. If you have an Apple II without CP/M, you may want to consider whether the extra flexibility a CP/M system makes available might be of value to you.

Business User Group. Feedback from readers is a very important aspect of this column. The sharing of experiences does much to help each of us become more comfortable with the technological wonders happening around us.

Paul Metzker (Jonesburo, GA) recently wrote in to thank all those B.U.G. members who suggested solutions to a problem he was having in

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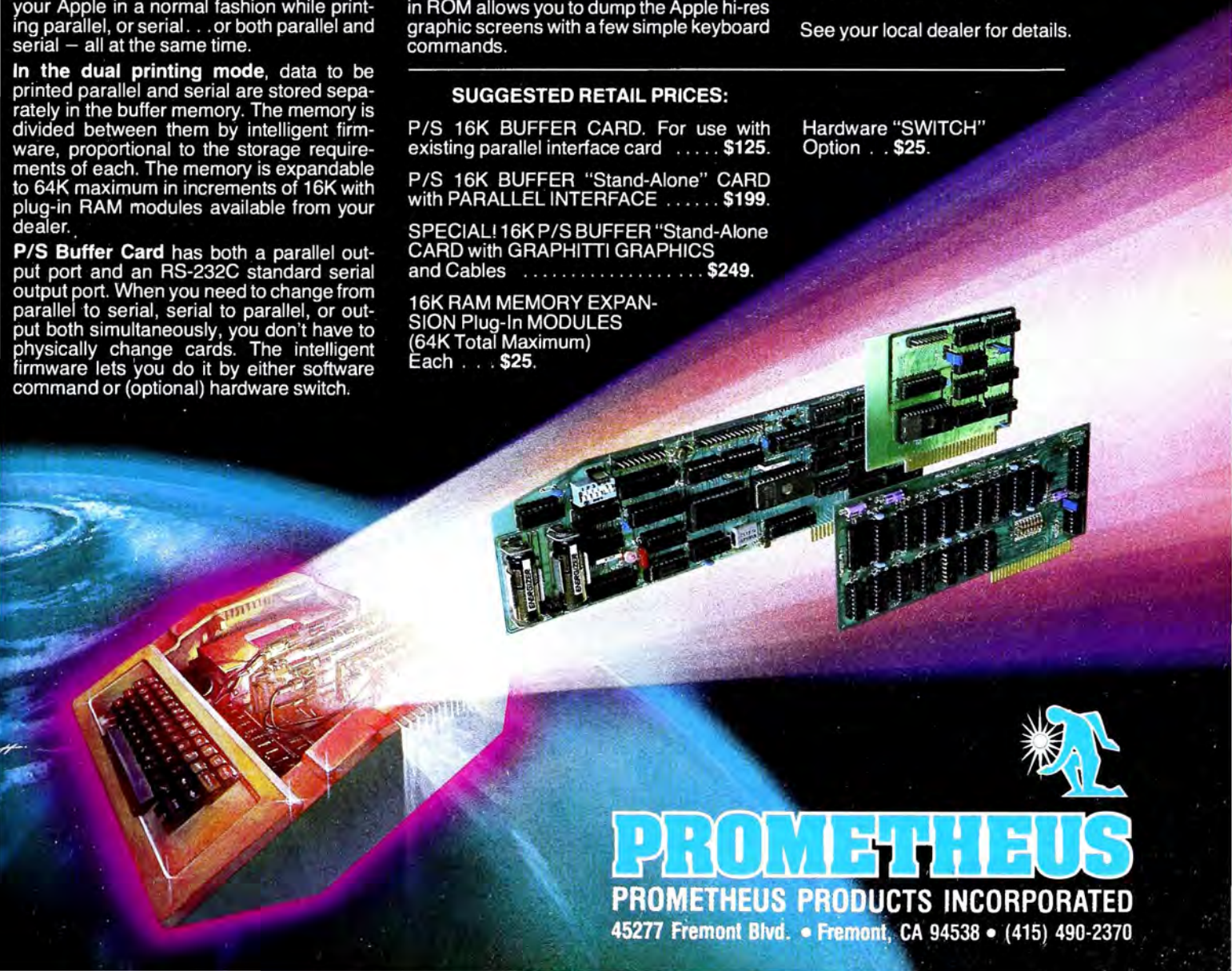
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getting his Epson printer to work properly. The help he received enabled Metzker to establish a glossary of commands he now uses regularly to take advantage of the features of his Epson printer. In fact, Metzker sent along some rather impressive samples of his latest work.

Having gotten such good information on his printer problems from fellow B.U.G. members has prompted Metzker to pose another question. He'd like to know if anyone has found an easy way to address envelopes using an Epson without resorting to labels.

The major factor in making this an easy process is having envelopes that are on continuous sheets of paper that can be "sprocket-fed" through your printer. These envelopes are a bit more expensive than regular envelopes, but they are well worth the additional cost. Of course, a mailing-list software package is better still, but the sheets of envelopes really make the whole business go more smoothly. One distributor of such envelopes is NEBS Computer Forms in Townsend, Massachusetts.

Epson Disk. Speaking of the Epson, another B.U.G. member, Peter A. Pitch (311 Benton Street, Leavenworth, WA 98826), has developed a disk to be used with *Apple Writer II* that already has all of the Epson features built in. The disk, called *ECG*, supports all Epson commands, including some graphics. It can be obtained by sending $10 to the author at the address shown; the cost is $7.50 if you send along a blank disk. A trial of the disk revealed that it's quite helpful in getting the Epson to perform up to expectation.

Apple Writer III. Professor Harley Flanders (Boca Raton, FL) wrote to say that a recent overview of *Apple Writer III* should have mentioned two additional items. First, if a file is printed to disk rather than to the printer, it will come back formatted exactly as it will look when printed. Second, if you wish to print a small portion of a document (such as a single page), simply use the following sequence of commands: .EP0 at the beginning, .EP1 where printing starts, and .EP0 where printing ends. (To find and remove these symbols, use F/.EP/.) Flanders also felt that the review was somewhat unfair to WPL, the special word processing language available with *Apple Writer III*. He has had great success with it and has "yet to see a better word processor" than *Apple Writer III*.

Barry Downes (New York, NY) is not as happy with *Apple Writer III* (where would we be without differences of opinion!). Downes works at GINI International as a writer for television and film and has had a good deal of experience using both *Apple Writer III* and *Word Juggler*. He begins by pointing out that you can, in fact, display your material on-screen to see how it will look when printed out. But he feels that this has little value, because when you try to operate the system by "printing to console," it tends to scroll through and you must press a few keys to stop it. *Apple III* also lacks an end-of-page indicator (as does *Word Juggler*); for a professional writer, this omission can be a serious drawback.

On the other hand, continues Downes, *Word Juggler* is so easy to use that it can be learned with little more than half an hour's instruction, and keyboard templates show you exactly what each function key does. In addition, it can do lots of helpful little things—type envelopes immediately, load in a whole set of parameters to shape any document, and so on. In summary, Downes feels that there is no comparison between the two products: *Word Juggler* wins hands down!

Of course, these differing perspectives on the same product serve to underscore the importance of trying before you buy. Different packages will, of course, please different people. Know what you want.

Inventory of Inventory Programs. Wayne L. St. John (Carbondale, IL) writes in with a semiurgent request. A client of his retails a fairly wide variety of goods and has a sizable daily volume. The business is growing and is in need of a good inventory-control system. It's likely that the client will soon get a microcomputer, so it's essential that good software for handling his inventory problems be identified early. Suggestions, anyone? ■

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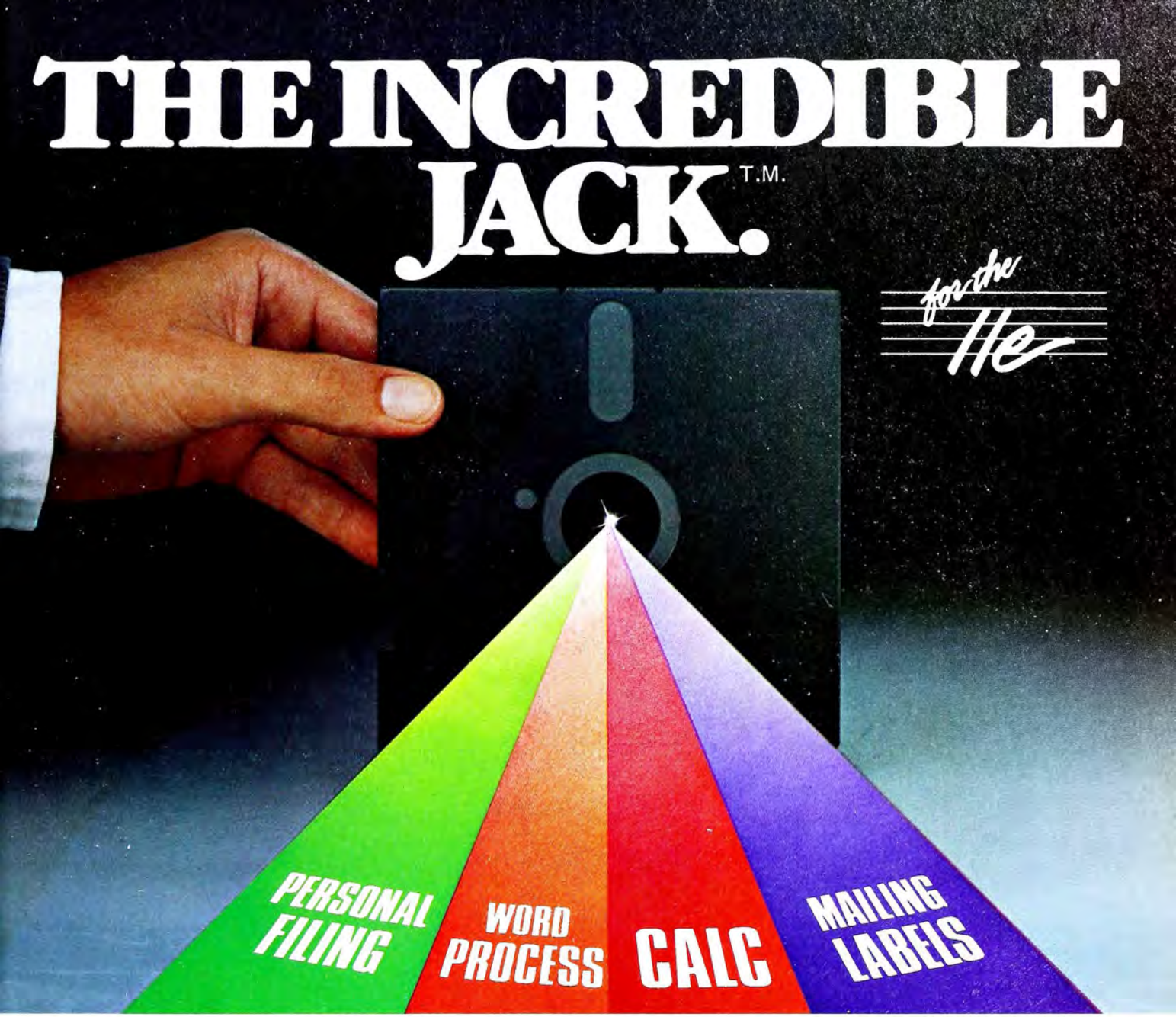
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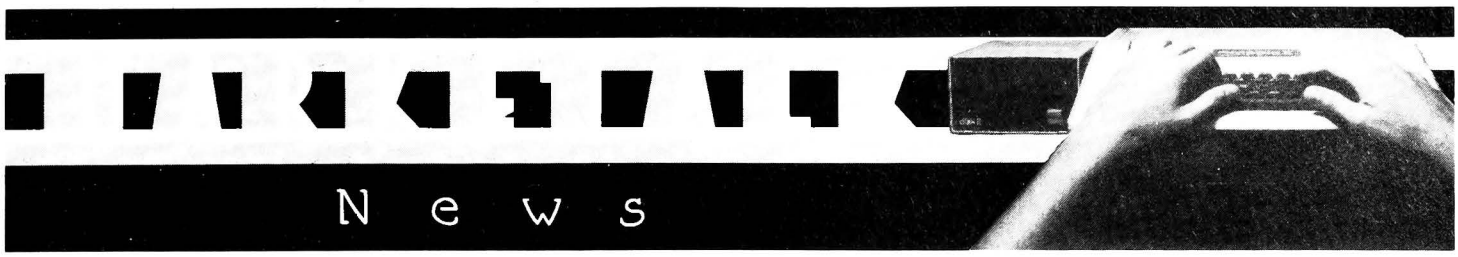
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TME



Unless otherwise noted, all products can be assumed to run on either Apple II, with 48K, ROM Applesoft, and one disk drive. The requirement for ROM Applesoft can be met by RAM Applesoft in a language card. Many Apple II programs will run on the Apple III in the emulator mode.

☐ Logic design and simulation is now possible with the help of *Micro-Logic* from **Spectrum Software** (690 West Fremont Avenue, Suite 11, Sunnyvale, CA 94087; 408-738-4387). It lets engineers draw logic diagrams on the screen, using the program's graphic design module. $450.

☐ *VisiCalc* commands need no longer be confusing. The VisiCalc Wallchart from **Crest Software** (2132 Crestview Drive, Durango, CO 81301; 303-247-9518) graphically depicts the program's commands in large, readable type. Included in addition to the commands are the actual keystroke combinations with specific explanations. The chart is two-color and measures eighteen inches by twenty-five inches. $4.

☐ **Star Micronics** (1120 Empire Central Place, Dallas, TX 75247; 214-631-8560) has reduced the price of its Gemini 10 printer by $100. The new price is $399.

☐ The latest in a line of educational games from **Computer Advanced Ideas** (1442-A Walnut Street, Suite 341, Berkeley, CA 94709; 415-526-9200) are *Master Match* and *Wizard of Words*. *Master Match* is an animated game similar to a popular television game show in which players try to find logical matches in images and words under numbered squares. The game helps children learn to associate pictures, words, and phrases and offers lots of interesting and motivating subjects. An editing system allows you to create lessons on any subject, using words or pictures. $39.95. *Wizard of Words* helps children develop reading, spelling, and vocabulary skills in a fantasy environment complete with a princess, knights, heralds, and even a nasty dragon. The program draws its words from a dictionary of more than twenty thousand words. *Wizard of Words* also has an editing system that lets you create words and lessons for any of *Wizard*'s five different games. $39.95.

☐ The *Screen Printer*, developed by **Smart Systems** (499 Sulky Lane, Frederick, MD 21701; 301-694-8307), is a Pascal procedure that transfers the exact contents of the screen onto any printer. Either the primary or secondary text screen may be printed, or both can be printed side by side for eighty-column display. The Videx Videoterm eighty-column card is also supported. Pascal is a requirement. $25.

☐ *Simultaneous Equation Solver* (SEQS) converts your computer into an algebra machine. You enter equations in ordinary algebraic form and *SEQS* solves them. The program lets you solve one equation at a time or a system of up to twenty equations, which may be simple or complicated, linear or nonlinear. Almost any type of problem that can be reduced to equation form can be handled. *SEQS* is available from **CET Research Group** (Box 2029, Norman, OK 73070; 405-360-5464). $100. Also from CET Research is *NLLSQ*, a nonlinear least-squares program designed to help chemists, biologists, engineers, and medical researchers solve a variety of curve-fitting and parameter-estimation problems. All you have to provide is a data file and a few lines of Basic code. $150. *French Curve* is a program for smoothing and expanding data files that contain as many as six hundred pairs of X,Y values. The program joins separate segments into a continuous curve without abrupt changes in slope or curvature. *French Curve* comes in handy for smoothing, interpolating, and expanding tabular data. $95.

☐ **SKU** (2600 Tenth Street, Berkeley, CA 94710; 415-848-0802) has developed a starter kit for the Apple. Key elements in the package include two Maxell disks, an Intro PerfectData disk drive cleaning kit, an Intro PerfectData video display cleaning kit, a Flip Pak disk storage unit, an electrical power surge protector, and $140 in rebate coupons from the following accessory and software vendors: VisiCorp, Datamost, Sirius, Broderbund, and Sierra On-Line. $66.99.

☐ A seminar titled "Computers for Farm and Family" is planned for August 26–28 in Saint Paul, Minnesota. The seminar will be held in conjunction with the Minnesota State Fair and will feature exhibits, vendor presentations, and educational sessions for experienced and inexperienced owners of farm and home computers. For more information, contact Sandra Becker at the **Office of Special Programs, University of Minnesota** (405 Coffey Hall, 1420 Eckles Avenue, Saint Paul, MN 55108; 612-373-0725).

☐ The LA-100 is a hardware/software package from **Total Logic** (Box 416, Fort Collins, CO 80522; 303-226-5980) that lets you use your Apple as a sixteen-bit logic analyzer to probe, capture, and display logic signals that occur in your digital hardware designs. You can use it to analyze designs implemented with microprocessors, memories, flip-flops, gates, and other logic operators. $795.

☐ **Computer Media Directory** (2518 Grant Street, Houston, TX 77006; 713-524-6565) publishes a guide to computer publications and computer writers. The book lists editors and department editors, regional correspondents, and phone numbers of computer publications. It also contains lists of computer editors and reporters on major daily newspapers, national and regional business publications, and general-interest magazines. $79.95.

☐ **Koala Technologies** (4962 El Camino Real, Suite 125, Los Altos, CA 94022; 415-964-2992) produces a touch tablet that lets you draw directly on a video screen, bypassing the keyboard. The Koalapad touch tablet is a hand-held peripheral connected to the computer by cable. You can draw on the tablet with your finger or a stylus, creating an image that appears on the screen. The tablet serves as a sketch pad, a custom keyboard, and a controller to play strategy games. The included software has youth-oriented educational games, a video coloring book, music instruction, animated cartoons, and a graphics tool kit. The tablet also has two "firing" buttons that eliminate the need for a joystick. $125.

☐ For owners of Strobe plotters, the *Third Party Graphics Software Availability Guide* presents an overview of various software packages for use on Strobe graphics plotters. The guide lists more than thirty applications packages that interface with Strobe plotters and most microcomputers. It will be updated quarterly to include additional packages as they're released. Strobe users and dealers can obtain a free copy of the guide by writing or calling **Strobe** (897-5A Independence Avenue, Mountain View, CA 94043; 415-969-5130).

☐ **M & R Enterprises** (910 George Street, Santa Clara, CA 95050; 408-980-0160) has come out with *Sup'r Ledger*, a general ledger program. It handles up to two hundred separate accounts, fourteen hundred transactions per time period, and ten independent cost centers. The program generates seven reports: a working trial balance, balance sheet, income statement, general ledger, journals, chart of accounts, and budget income statement. *Sup'r Ledger* supports most eighty-column boards. $295.

☐ *Crypto-Cube* from **DesignWare** (185 Barry Street, San Francisco, CA 94107; 415-546-1866) is an educational game for word-puzzle fans. Each side of the cube has a crossword grid, and players take turns uncovering letters to fill in the missing words. Players can pick one of fifty possible puzzles on the Crypto Disk, or they can create their own word list for placement on the cube by using a puzzle generator. $39.95. In *Spellicopter*, the pilot must go on a dangerous rescue mission requiring good memory, verbal, spelling, and navigation skills. The goal is to rescue letters that are stranded on a distant field, organize them into a correctly spelled word, and bring the whole thing back to the landing pad. $39.95.

☐ **Legend Industries** (2220 Scott Lake Road, Pontiac, MI 48054; 313-674-0953) has come out with its 18K Static RAM Card. The card contains a battery backup system, letting you store programs or monitor routines after powering down. The card fits in any slot, and its write-enable/protect switch lets you protect information in the card. You can also relocate DOS onto the card and install a boot routine that automatically installs DOS into the machine upon boot-up. $159.95. Legend's *Pascal Super Emulator* is a software package to be used with the Apple Pascal 1.1 operating system. It lets you use multiple Legend RAM cards up to a maximum of four, with the capability of combining the total RAM into one drive. $29.95. Legend has come out with the 128KDE RAM Card that works with the II, the IIe, and the III. A SOS driver is available separately. $599. The S' Card lets you upgrade from 64K to a full one megabyte of memory. The card is compatible with all Apples and can be installed into any slot, and several of the cards can be installed into one machine; a total of seven megabytes can be added. All software written for Legend's 64KC and 128KDE cards will work with the S' Card. $399.

☐ **Applied Software Technology** (170 Knowles Drive, Los Gatos, CA 95030; 408-370-2662) has a new filing program out called *Qbase*, a personal database and report-writing package. It includes a mailing label print program and contains several features for data-entry checking and on-screen calculating. $189. *Purchase Order*, a template for *Qbase*, is $49.95. *Legal Office Manager*, an applications package with a template and supporting program, is $249.

☐ **Zoom Telephonics** (207 South Street, Boston, MA 02111; 617-423-1072) has introduced a low-cost modem. The Summa 300 is a single-slot, 300-baud direct-connect modem that combines modem and Apple communications circuitry on a single-slot card. It also comes with software that lets you capture the screen image in the Apple's memory. $119.

☐ A versatile RS-232 adapter has been developed by **B & B Electronics** (Box 475, Mendota, IL 61342; 815-539-5827). The Multi-Adapter has one male and two female connectors with pins two through twenty-five of each connector connected to socket strips. There are two diodes connected to the socket strips that can be used to make an "or" gate or used for signal isolation. $79.95.

☐ Owners of personal computers may borrow computer programs from **The Electric Bookshelf** (Box 1409, Norcross, GA 30071), a member-owned collection of computer programs. There are no membership fees required to join. The library has programs for the Apple, including CP/M. For a listing of programs and a membership application, write the Electric Bookshelf.

☐ *Inventory Manager* (Marketalk Reviews, December 1982), formerly published by **Synergistic Software**, is now available exclusively from **Satori Software** (5507 Woodlawn Avenue North, Seattle, WA 98103; 206-633-1469). $125; hard disk version, $350.

☐ For members of the bar only: **Independence Software** (433 West Fifty-fourth Street, Suite 20, New York, NY 10019; 212-582-7899) presents *Legal Reader Tech Probe*. It bridges the gap between attorneys' databases or libraries and the facts as presented by ongoing developments. *Tech Probes* for given statutes, contracts, and other documents or areas of law may be ordered individually. Demonstration disks are available free.

☐ A comprehensive time and billing software system for professionals has been introduced by **State of the Art** (3183-A Airway Avenue, Costa Mesa, CA 92626; 714-850-0111). *Professional Time and Billing* can be used by itself or combined with other State of the Art modules. The software includes the following: a billing system that turns time and expense records into detailed bills for clients, an accounts-receivable system that tracks client billings and processes cash receipts, and an entry system that records billable and nonbillable time as well as expenses on accounts and special projects. $795.

☐ **Mountain Computer** (300 El Pueblo Road, Scotts Valley, CA 95066; 408-438-6650) has introduced a small-sized 5¼-inch Winchester hard-disk system. The Mountain 5 Megabyte Space Saver System is $995 without the controller. The cartridge system is $1,325. Mountain has also come out with the Image tape drive, a ten-megabyte cassette-type tape drive designed as a backup for 5¼-inch Winchester disk drives. The single-head, four-track cassette drive can record or transfer at either 30 or 90 inches per second. Backup time is four minutes at 90 ips, and transfer rate is 72K per second at the same speed. $1,095; controller interface, $295.

☐ A program designed to provide state disclosure reporting and campaign analysis for small and medium sized political campaigns has been introduced by **Aspenware** (129 Promethean Way, Mountain View, CA 94043; 408-252-4960). The program, *Campaign Control*, keeps a campaign financial record, produces accurate disclosure reports, and analyzes a diverse contributor base. It's written with the computer novice in mind and is currently available for the California market. Requires two disk drives. $475.

☐ **VR Data** (777 Henderson Boulevard, Folcroft, PA 19032; 215-431-5300) has added the Hard Disk III to its line of Winchester disk drives. The system comes in a five-megabyte fixed version or in a removable-cartridge version. $995; adapters start at $150.

☐ *SpeedRead+* is a software package that helps you improve reading speed and comprehension. It comes with several short stories and a text edit feature that lets the student, teacher, or trainer add customized text and examinations. Four reading/training modes cover reading speeds of five to five thousand words per minute. From **INET** (536 Weddell Drive, Suite 1, Sunnyvale, CA 94086; 408-734-0311). $64.95.

☐ **Smith Micro Software** (Box 604, Sunset Beach, CA 90742; 213-592-1032) has released *Stock Portfolio System, Second Edition* for the Apple III. The system tracks an unlimited number of stocks options or bonds, and it maintains cash accounts within a single investment portfolio. Access to the Dow Jones News/Retrieval Service is available, allowing you to get quotes or use your Apple as a terminal into other Dow Jones services. The system requires 128K and will support a second drive, Apple's ProFile hard disk, and Hayes's Smartmodem. $185.

☐ *Programmer's Power Tools II* and *III* extend Basic, giving you the capability to write sophisticated programs without having to sacrifice the simplicity and flexibility of Basic. They're both from **CE Software** (801 Seventy-third Street, Des Moines, IA 50312; 515-224-1995). *PPT II* lets programmers perform sorts and searches, format numbers on the screen or printer, and build easy-to-use inputs. It also includes features for the IIe. $59.95. *PPT III* brings to Business Basic the same sort of power *PPT II* brings to Applesoft. Sorts, searches, input, conversions, and disk formatting are all available from your Basic program. $79.95. CE also offers the Personal Work Station. It features a built-in file cabinet, locking storage area, a fold-away work surface, and smooth-rolling casters. $99.95. A matching printer stand is available at $44.95.

☐ **Inmac** (2465 Augustine Drive, Santa Clara, CA 95051; 408-727-1970) has available several multioutlet surge protectors. The protectors protect your equipment against surges, spikes, and transients in power lines. They also filter harmful AC line noise that can distort stored data and are available in one, two, four, six, and eight outlet versions. $89 to $149.

☐ *KeyTran* is designed for use in business and professional applications in which a ten-key numeric pad is useful. *KeyTran* electronically alters the standard Apple keyboard for numeric data entry with special function keys for *VisiCalc* users, text and numeric data entry, and easy shift-key use in word processing. It's compatible with all software, eighty-column cards, and lower-case adapters. Available from **Price Performance Products** (1928 North Kenmore Avenue, Chicago, IL 60614; 312-929-0568). $89.95.

☐ **Instant Software** (Route 101 and Elm Street, Peterborough, NH 03458; 603-924-9471) is publishing two programs on one disk. *Mountain Pilot* is a flight simulation through a mountain pass. Your mission is to deliver supplies to some secluded miners. *Precision Approach Radar* requires you to land aircraft in a dense fog. As the controller, you must guide five different types of crafts, including a UFO. $19.95. In the business department, Instant Software publishes *Business Cycle Analysis*. The program helps you in decision making on inventory control, investments, personnel increases, and credit extensions. It also studies business cycles, calculates moving averages and pressure curves, and prints graphs of business cycles for records. $59.95.

☐ **Advanced Logic Systems** (2674 North First Street, Suite 210, San Jose, CA 95134; 408-946-1400) is providing a preboot program that allows *Apple Writer II* and *IIe* to operate with Advanced Logic's Smarterm II. The program lets you take advantage of Smarterm II's eighty-column board. Smarterm costs $179, and you can get Advanced Logic's preboot disk by sending in a form enclosed in the Smarterm package. $5.

☐ **Staff Computer Technology** (10457 Roselle Street, Suite J, San Diego, CA 92121; 619-453-0303) has developed The Key to protect software from being pirated. Software with The Key can be copied, but it will not run unless The Key is installed in the Apple. The Key is programmed with a security code; software suppliers can have codes known only to them. Quantities of twenty-five: standard version, $29 each; high-security version, $99 each.

☐ *Quick Score* grades tests using an optical mark card reader. The program checks students' cards and compares them to an answer key, all while remembering each student's response and keeping tabs on the whole class. When the last card is fed in, *Quick Score* begins evaluating and analyzing test data and reporting results. It can keep a running total of the points each student has scored to date, and it has routines for editing student records. From **The PICA Foundation** (Box 35487, Charlotte, NC 28235; 704-334-6444). Requires either a Chatsworth 500 OMR card reader, Chatsworth 2000, or Mountain 1100A automatic-feed card readers. $300.

☐ The *Troeger Math Placement Guide* from **Merit Audio-Visual** (7 West Eighty-first Street, New York, NY 10024; 212-787-4766) determines each student's math achievement level through a selection of questions within specific ranges of difficulty. The program complements standardized achievement tests and presents the results immediately. $59.

☐ Taxan has introduced its 410-64 interface card for the IIe. The card has 64K memory, eighty-column capability, and an RGB monitor interface. It also has five video modes including extra-high-density 560-by-192 display. Available from **TSK Electronics** (18005 Cortney Court, City of Industry, CA 91748; 213-810-1291). $349.95.

☐ **ESP Computer Resources** (9 Ash Street, Hollis, NH 03049; 603-465-7264) has released an enhanced version of its *Datakeyper* database-management system. The new version features calculated fields, global search and replace, transaction file processing, multiple-file processing and updating, multiple indexes per file, and purge capabilities. $99.95 to $149.95; hard-disk version, $395.95.

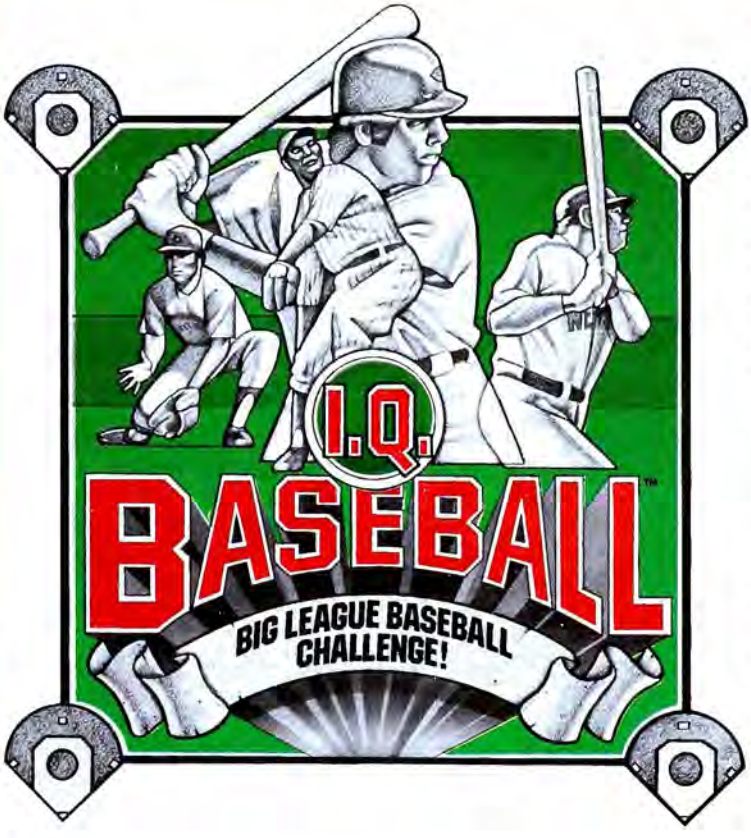
☐ **Learning Systems** (Box 9046, Fort Collins, CO 80525; 303-482-6193) has several programs available for educators. The *Assistant Principal* keeps and updates student records. Important information on any student can be displayed, giving school personnel instant and up-to-date information. $189.95. *Basic Math Skills* is a series of four programs that drill students on math facts in the four primary mathematical functions. Each skill sequence consists of at least thirty problem levels that progressively increase in difficulty. Addition, subtraction, multiplication, and division sequences are $44.95 each. The *Basic Math Skills Package* is $155.95. *Handwriting Skills* lets the teacher demonstrate the correct formation of manuscript letters, cursive letters, and even cursive letter connections and combinations. Using an Apple Graphics Tablet, teachers can enter any or all of these letters to be used in instruction. Apple Graphics Tablet required. $39.95.

☐ **Software Publishing** (1901 Landings Drive, Mountain View, CA 94043; 415-962-8910) now has *PFS:Write* available for the IIe. This word processing program integrates with all other PFS programs, allowing data to be shared. It can also read text-file output generated by other software. Your document appears on the screen as it will look when printed. The screen defines a page, and a ruler at the bottom tells what column the cursor is in and where the tab and margin settings are located. Because *PFS:Write* works with other PFS programs, you can include graphs, database information, and reports in your text. $125.

☐ *Powersharing: The Microcomputer* is a fifty-minute program that provides a starting point for anyone who needs to understand what the microcomputer is and what it does. Tapes come in all video formats. From **Martha Stuart Communications** (Box 246, Hillsdale, NY 12529; 518-325-3900). $195; rental, $45.

☐ When you purchase *Micro Link II* from **Digital Marketing** (2363 Boulevard Circle, Suite 8, Walnut Creek, CA 94595; 415-938-2880), you also receive two hours' free use of NewsNet, a national electronic newsletter-publishing service. Normally, an hour of NewsNet costs $18. *Micro Link II* requires CP/M and sells for $89.

☐ Contest time! The **Association for the Advancement of Health Education** (1900 Association Drive, Reston, VA 22091; 703-476-3440) is sponsoring a health-education software competition. Software entries should be original pieces designed for educational use in schools, homes,



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hospitals, voluntary and public health organizations, clinics, and industry. First prize is $1,500; two second-place awards of $500 each and five $100 third-place prizes will be given out. Winning entries become property of the sponsor, with royalties being paid to the authors. Entries must be received by November 1, 1983.

☐ Hold it! **Aztec Electronics** (12345 Westminster Avenue, Santa Ana, CA 92703; 714-554-1730) is doing its part to reduce theft. Hold-It is a product that combines aircraft cable technology with an adhesive to secure your computer system without your having to modify furniture or your equipment. $19.95.

☐ A self-paced instructional program for children ages four to seven, *Math Facts Level 1* is available from **T.H.E.S.I.S.** (Box 147, Garden City, MI 48135; 313-595-4722). The program uses colorful drawings and large colored numbers and letters to teach youngsters the fundamental concepts of math. It's made up of sixteen different units covering the numbers 1 to 20, number placement, spelled-out numbers, addition and subtraction with and without symbols, and more. $25.

☐ **Blue Chip Software** (19824 Ventura Boulevard, Suite 204, Woodland Hills, CA 91364; 213-881-8288, 800-835-2246) has released *Tycoon*, a game in which the player trades precious metals, foreign currencies, treasury bills, and agricultural commodities. The program simulates news stories and commodity graphs. Performance of commodities is based on the news stories, not on random numbers. *Tycoon* has a built-in program generator that allows you to create a new trading environment at any time, ensuring that the game is always challenging. $59.95. Blue Chip has also lowered the price of *Millionaire* to $59.95.

☐ The **Forth Interest Group** (Box 1105, San Carlos, CA 94070; 415-962-8653) invites you to its Fifth Annual Forth Convention on October 14 and 15 at the Hyatt in Palo Alto, California. The convention will focus on Forth-based systems and will include hands-on tutorials, exhibits and vendor booths, lectures, and discussions. Registration, $5.

☐ *Hi-res Versatile Calculator* from **Tackaberry Software** (Box 2857, Ormond Beach, FL 32074; 904-677-2054) turns the Apple into a scientific calculator that operates in four bases: decimal, hex, octal, and binary. The program has more than fifty functions, and the display makes the screen look like an oversized calculator. It features trigonometric and logorithmic functions, statistics, logical operations, ASCII tables, and more. Included is a ten-minute demonstration program. $59.95.

☐ *Apple Grade Book* is a grade-recording system for teachers. **J & S Software** (140 Reid Avenue, Port Washington, NY 11050; 516-944-9304) has included several options in this version. With the program, you can add up to thirty-five grades per student, list students' records, list the classes or students' averages, make grade corrections, and print class information. There's also an elementary-school option that lets you use the same student names for different subjects without retyping them. $34.50.

☐ **Amdek** (2201 Lively Boulevard, Elk Grove Village, IL 60007; 312-364-1180) believes in its products. All its monitors now carry an unconditional two-year warranty. All existing warranties will be extended.

☐ **Davong Systems** (217 Humboldt Court, Sunnyvale, CA 94086; 408-734-4900) now offers hard-disk-drive systems with twenty-one or thirty-two megabytes (formatted capacity). The new drives also feature a faster average access time of forty milliseconds. Booting the Apple directly from the hard disk gives you immediate access to programs and files. Davong Multi-OS supports DOS, Pascal, and CP/M, which can reside simultaneously on the hard disk. Twenty-one-megabyte version, $3,295; thirty-two-megabyte, $3,995.

☐ Designed to reduce the storage space for disks, the C-Line Mini Disk Holder holds four 5¼-inch disks in individual pockets and fits in any standard 5½-inch ring metal binder. Pockets are made of nonglare vinyl. Mini Disk Holders are packaged twenty-four to a box. Available from **C-Line Products** (Box 1278, 1530 East Birchwood, Des Plaines, IL 60018; 312-827-6661). $20.

☐ *Compu Ped* is a pedigree program designed to help the animal breeder produce three and five generation pedigrees. It's designed for easy operation to allow even the novice computer owner to take advantage of its features. From **B & L Mac** (132 Patton, Richland, WA 99352; 509-375-3490). $35.

☐ **Howard W. Sams** (4300 West Sixty-second Street, Box 7092, Indianapolis, IN 46206; 317-298-5400) is publishing *Money Tool*, an easy-to-use money-management program for the home or small business. The program is broken down into three interactive operations. The transaction element is for entering expenses and deposits. A summary report creates reports based on recorded transactions; reports can calculate charges on a daily, weekly, monthly, quarterly, or yearly average. The budget section develops budgets for comparison against the summary reports as a measure of financial performance. Transactions may be posted in sixty categories. $59.95. *Financial Facts* performs the majority of financial calculations commonly needed in personal and small-business management; it calculates depreciation, interest, loan principal, future value, and more. The program offers four methods of calculation, and amortization tables are available for mortgage payments and other long-term loans. It also figures the value of an investment following deposit or withdrawal. $59.95.

☐ *Min-Route* is a program that can be used to assist urban and resource-management planners in evaluating transportation networks. The purpose of the program is to find the shortest path between two points through a transportation network. From **TW2 Consulting** (Box 1074, Eagar, AZ 85925). $59.95.

☐ **Chang Labs** (5300 Stevens Creek Boulevard, Suite 200, San Jose, CA 95129; 408-246-8020) has an integrated business-graphics-and-spreadsheet package available called *GraphPlan*. The package offers built-in statistical commands, graphics, sorting and ranking, and spreadsheet capabilities. The spreadsheet has built-in formulas and requires 70 percent fewer keystrokes than most spreadsheets. *GraphPlan* creates pie charts, horizontal or vertical line and bar graphs with stacking capability, and scattergrams. Requires minimum of 64K memory and CP/M. $395.

☐ The latest audio tutorial from **FlipTrack Learning Systems** (Box 711, Glen Ellyn, IL 60137; 312-790-1117) is *How to Use VisiCalc*. The tutorial starts with the basics of how to set up a spreadsheet with labels, values, and formulas, and then moves to more advanced concepts such as replicate, choose, lookup, and net present value. $65.

☐ The price of *The Incredible Jack of All Trades* from **Business Solutions** (60 East Main Street, Kings Park, NY 11754; 516-269-1120) has been increased from $129 to $179.

☐ **Simple Soft** (480 Eagle Drive, Suite 101, Elk Grove, IL 60007; 312-364-0752) has added *Loan Analyzer*, a mortgage and loan analyzer, to its *QuikCalc* line of financial-analysis products. *Loan Analyzer* professionally formats reports to present a concise analysis. Calculations are included to show complete amortization schedules, interest rates, interest paid between dates, impact of loan charges, and the effects of early loan termination. The program calculates unknown variables such as loan amount, loan term, loan payment, and balloon payments. The program runs in conjunction with *VisiCalc* or *SuperCalc*. $99.95.

☐ White Pegasus, an Apple Bulletin Board System, is on-line twenty-four hours a day. Browsers can post and read messages for *Dungeons and Dragons* players. Members can exchange private mail, download programs, and play several on-line *D&D* games. To become a member, dial (214) 680-9322 by modem.

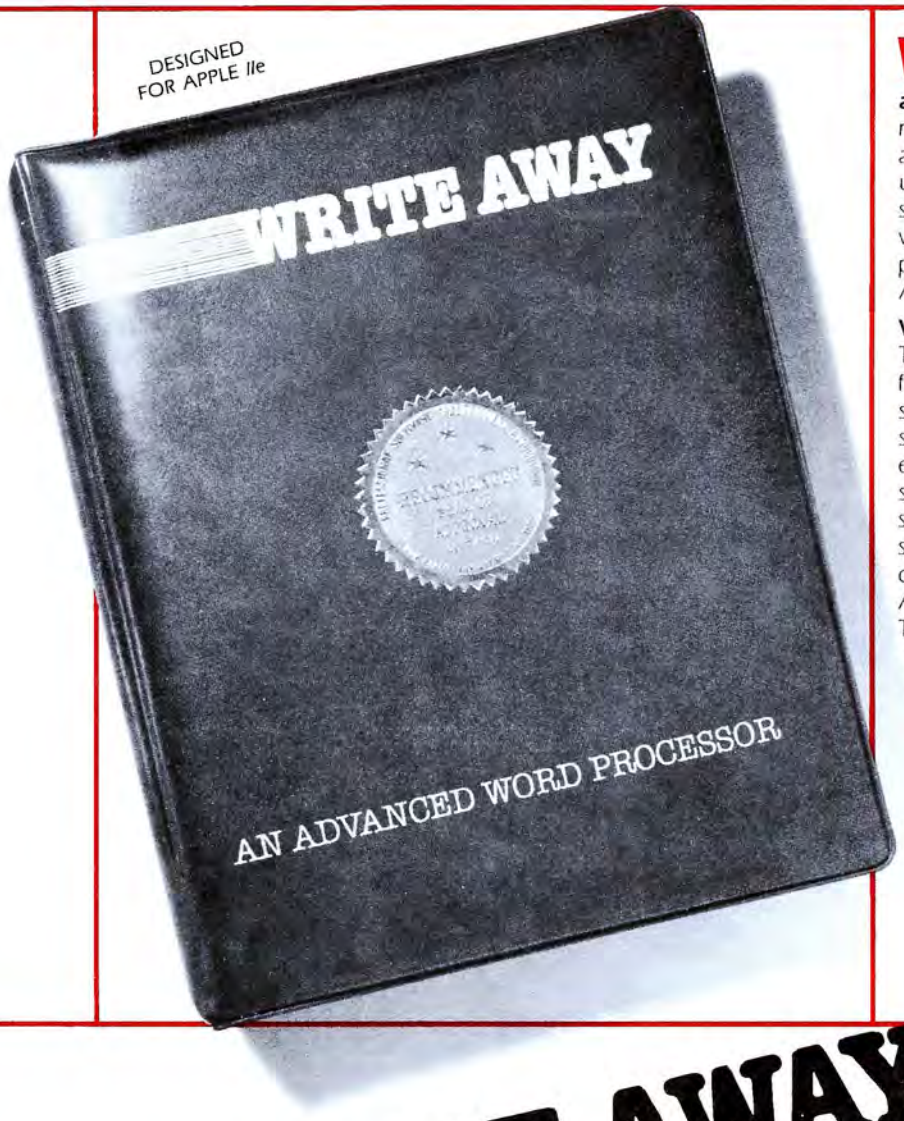
☐ **Alyncia's Adventures** (2519 Little Creek, Richardson, TX 75080), a hobbyist-founded user group, offers a pamphlet and several *Dungeons and Dragons*-oriented playing aids on disk. Several utilities for character generation, game and campaign maintenance, and dungeon mastering are available to assist the fantasy game player. For more information, send a stamped self-addressed envelope to Alyncia's Adventures.

☐ A dual floppy-disk drive introduced by **Comrex International** (3701 Skypark Drive, Torrance, CA 90505; 213-373-0280) is plug-in-compatible with the Apple and provides 286K of formatted capacity. The CR-1000 ComDrive replaces two standard disk drives and occupies half the space. The ComDrive is designed in a slim configuration and fits on top of the Apple. $599.

☐ **Actuarial Micro Software** (3915-A Valley Court, Winston-Salem, NC 27106; 919-765-5588) has released *Monte Carlo Simulations (MCS)*, a utility that allows you to prepare for many seemingly unpredictable occurrences such as emergency health care or automobile expenses. *MCS* can be used in applications such as personal financial planning, forecasting, risk management, social sciences, education, self-funding, and corporate financial planning. The program can run by itself and can communicate with *VisiCalc* through DIF files. $60.

☐ **Phoenix Software** (64 Lake Zurich Drive, Lake Zurich, IL 60047;

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312-438-4850) has released *Forms Foundry*, a software package designed for small business. *Forms Foundry* lets the small-business owner generate professional-looking business forms using plain paper rather than expensive custom forms. The program is menu-driven, so there's no need to set up report formats. *Forms Foundry* handles invoicing, purchase orders, statements, debit-and-credit memos, and more. Calculations are performed within the software. Documentation on how to modify the software is included. $149.95.

☐ In a summer promotion, **MicroPro** (33 San Pablo Avenue, San Rafael, CA 94903; 415-499-1200) will give away CP/M free to Apple users who purchase either *WordStar*, MicroPro's word processing package, or *InfoStar*, its database-management system. This represents a savings of $375. In addition, MicroPro has reduced the price of *WordStar* and *InfoStar* by $100 so that those who already have CP/M may purchase either product or combinations of them at a significant savings. The CP/M package that MicroPro is giving away features the new StarCard—a Z-80B circuit board that offers CP/M, 64K RAM, a seventy-column display, and many other features. StarCard's accompanying software contains CP/M version 2.2 and system utilities on one side and StarCard utilities on the other. The feature that distinguishes this card from other Z-80 cards is that it doesn't require the sharing of the Apple's memory. MicroPro also has released several software products. The first is *StarBurst*, which links different programs for office tasks. Managers can create a customized series of menus and help messages; users press a single key from the menu to perform a series of tasks. With a customized *StarBurst* system, the computer novice simply asks for the starting menu and is guided through a routine task. To build the system, the manager uses a text editor to create menus exactly as they will appear on-screen. Requires CP/M. $195. MicroPro has also announced the 3.3 versions of its word processing products. *WordStar 3.3* has a terminal and printer program that can be used to set default options on such functions as justification, help level, and others. The Apple's number keys are also used as programmable function keys. CP/M is still required; price is still $495. *SpellStar 3.3* now includes the 20,000 most frequently used words in *Houghton-Mifflin's American Heritage Dictionary*. The updated version also allows you to store foreign characters and accent marks. Requires CP/M. Still $250. *MailMerge 3.3* has a conditional print feature that lets you select which records you want to merge, such as those in particular zip codes. CP/M remains required; the price, $250, remains the same. A new one from MicroPro is *StarIndex*, which lets you create an alphabetized index with subentries, a table of contents with up to four levels of emphasis, a list of tables, a list of figures, and a reformatted original document in outline style. It runs with any version of *WordStar*. *StarIndex* can number paragraphs, sections, and tables; it can track page numbers through additions and deletions, insert blank pages, insert summaries of chapters in the table of contents, produce a list of paragraph numbers and the pages they're on, and more. You need CP/M for this one, too. $195. The WordStar Professional bundles *StarIndex* with the 3.3 version of *WordStar*, *MailMerge*, and *SpellStar*. You can get the whole set for $695 until August 31. After that, it's $895.

☐ **VOAD Systems** (8570 Wilshire Boulevard, Suite 227, Beverly Hills, CA 90211; 213-550-0629) has announced Voice Oriented Auto Dialer Keyboard Phone, a terminal enhancement that replaces standard rotary or touch dialing telephones and allows high-speed automatic dialing from nearly any terminal, computer, or workstation. It connects to any RS-232 port and is equipped with an RJ-11 jack for hookup to a handset, headset, or speaker phones. The Keyboard Phone draws all its power from the telephone line. $199.50.

☐ **Softwest** (465 South Matilda Avenue, Suite 104, Sunnyvale, CA 94086; 408-737-0624) has announced that *PIE Writer* has been released in a new version, 2.2. This version supports eight eighty-column cards, standard forty-column, and the Apple IIe. The word processor can be configured for 64K; *PIE* and its format parameters can be loaded into memory together. Transferring between the two is instantaneous. $149.95.

☐ **C & C Software** (5713 Kentford Circle, Wichita, KS 67220; 316-683-6056) has released the second in its *Kids' Corner* series: *Learning about Numbers*. Three programs in *Learning about Numbers* use graphics to hold the attention of children and teach them arithmetic, telling time, and counting. The disk contains a management program so parents or teachers can monitor and control a child's activities with the disk. $40; a backup disk is available for $10.

☐ **Borland International** (4320 Stevens Creek Boulevard, Suite 129, San Jose, CA 95129; 408-244-6292) publishes *Menu Master* for the CP/M user. The program displays simple instructions on the screen and lets you accomplish what you want without having to learn computer terms. You can open or close files, pass parameters to programs, and process data in single keystrokes. *Menu Master* consists of one general-purpose set of menus that let you perform any typical operating-system functions. The package includes a file menu, a word processing menu, and a development menu that lets you create customized menus. $195.

☐ **Gunther Computer Consortium** (Lake Drive, Southampton, NY 11968; 516-283-4769) has introduced three services for *VisiCalc* users. A nationwide telephone hot line that gives immediate answers to *VisiCalc* operation and application questions is available between 10 a.m. and 6 p.m. Eastern time. A monthly newsletter answers frequently asked questions and describes creative applications for *VisiCalc*. Two-day seminars in Southampton will be conducted by *VisiCalc* experts. The power of the spreadsheet program will be demonstrated through individualized hands-on exercises on the attendee's computer. Hot line service and newsletter are included in the $10 per month subscription fee.

☐ **Hayden Book Company** (50 Essex Street, Rochelle Park, NJ 07662; 201-843-0550) has released several new programs. *Microcomputers Can Be Kidstuff* lets youngsters learn about microcomputers and how to use them productively. The book prepares kids to begin learning Basic and Pilot with clear descriptions and explanations of hardware and software. Information on writing and saving programs and using commercial software is also provided. $8.95. *Secrets of Better Basic* reveals programming tricks and techniques used for writing faster and more effective Basic programs. The book also offers faster and more effective programs for testing and debugging, using memory more efficiently, handling strings, using loops and subroutines, and creating disk files. It has five appendixes that include ASCII codes and equivalents, numerical systems and conversions, some Basic functions, sample disk and memory tests, and some useful software. $14.95. *Using Microcomputers in Business* describes the advantages and disadvantages of computerization, enabling the potential user to make intelligent purchasing decisions. The book covers business applications from the fundamentals of microcomputer systems to the fine points of word processors, accounting programs, databases, and disk drives. $12.95.

☐ *Disk Protection Program* from **The Ziw Company** (Box 1616, Niagara Falls, NY 14302) requires no software modification and is as easy to use as *CopyA*. *DPP* stops *Locksmith*, *Nibbles Away*, *Copy II+*, and other bit copiers. If you have a modified DOS, it will also stop the Wildcard and Crackshot cards. $45.

☐ **PMS** (650 Foothill Boulevard, La Canada, CA 91011; 213-790-9054) has released *Medical/Dental Billing System*, a program that takes care of the billing needs of up to ten doctors. It handles up to twenty thousand active patients and six thousand transactions per billing cycle. The Apple III system will keep track of detailed transactions for up to a year. Standard insurance forms are generated. Requires Corvus hard disk. Apple II, $1,995; III, $2,495.

☐ **Great Divide Software** (7475 West Fifth Avenue, Suite 303, Lakewood, CO 80226; 303-238-5258) has introduced a tool for technical analysis of the commodity-futures market. *Commodipak* was designed to provide technical charts for the new or experienced trader. With these charts, the trader will be better equipped to forecast what the market is doing and will be able to make sounder investments. Its features include simple operation, formatted reports with user-defined indexes, a variety of reports, and the ability to do spreadsheet analysis. $395.

☐ *Triad* allows one or two players to select and battle nine deadly foes one at a time. Victories and defeats are tallied in ticktacktoe fashion; three Xs or Os in a row means that the player wins and advances to the next skill level. From **Adventure International** (Box 3435, Longwood, FL 32750; 305-862-6917). $34.95.

☐ **Micro Simulation** (202 East Fourth Street, Rochester, MI 48063; 313-651-2770) has released *PSIM*, a Pascal-based simulation language. *PSIM* enables the development and evaluation of models for evaluating scheduling policies, facility modifications, inventory systems, and more. Requires Pascal. Apple II, IIe, $600; III, $700. ◨

The ART and CRAFT of the GAME

by MARGOT COMSTOCK TOMMERVIK

Louis Sullivan was an architect. He worked primarily in the nineteenth century, yet some of his buildings endure today.

Louis Sullivan was not an ordinary architect. During his prime, his buildings precipitated controversy. They weren't what was expected; they weren't what had been done before. Some people hated them; others were inspired by them.

One who was greatly inspired by them was a struggling young architect a couple of generations later. Even if you've never heard of Sullivan, you've probably heard of his spiritual protege. His name was Frank Lloyd Wright.

Wright's buildings created even more controversy than Sullivan's. Buildings such as Fallingwater in Pennsylvania and Taliesin West in Arizona seem ahead of our time, although they were erected in the twenties and thirties.

The Wright Stuff. Frank Lloyd Wright was greatly influenced by the work of Louis Sullivan. But his buildings bear no resemblance to Sullivan's. To suggest that this is a matter of the eras in which each man worked would be meaningless; neither was particularly influenced by his era.

If his work was so different from Sullivan's, what was it that Wright so emphatically credited Sullivan for?

Louis Sullivan was a philosopher. To be more precise, he was an aesthetician. Louis Sullivan looked beneath the prettiness of a building or the accepted traditional meanings of particular styles. He ignored them.

Instead, he looked at the function to which the proposed structure was to be put. He looked at its projected purpose—what it was to be used for, what it would represent. On the basis of this, he created a form. He said, "Form follows function," and that decoration must be organic and must spring from the function through the form. Because things are for use by people, their decoration must reflect the people for whom they're designed. Not the expressed desires of those people, but their essences.

So it is with everything of quality. So it is with the best literature, the most memorable paintings, the greatest sculpture. So it is with the loveliest clothing, the finest furniture, the most efficient office.

And so it is with games.

Every one of the best games begins with a premise, a reason for being, a function. Each game is designed to serve its function.

The function of a game may not be as complex as that of a department store building or a painting. And, as in every art form, there are those gifted creators who have no idea why they choose the elements they use in a game. Perhaps "gifted" merely means "apt to be right on a subconscious level."

The result of form following function is integrity. All the pieces fit together so well that one more or one less is unthinkable.

A person of integrity is one who has a clear set of basic values, whose actions always reflect those values and whose emotions spring from the same values. A perfectly integrated person never has to choose between his best judgment and his desires; because both are founded on the same values, they don't conflict.

Integrity Is Contagious. Any design can have integrity. If you've visited Disneyland, you may have noticed the trash cans. The designers of Disneyland didn't restrict themselves to the buildings and attractions; they thought about every object that would be in the park and designed it to fit its surrounding theme. So the trash cans in Adventureland are rustic, old-wood type; in New Orleans Square they look French and smack of wrought-iron filigree; and in Tomorrowland they're clean-lined and futuristic.

In games, integrity refers to the fine-tuned fitting together of the forms and decoration used in the service of the object and of the overall functions. Which simply means that the idea, the object, the difficulty, the theme, the plot, the graphics, the text, the scoring must all fit together and enhance one another.

Game Players Sleep Better. In the broadest sense, all games share a common function. By definition, a game's job is to be a competitive activity, governed by rules, that amuses and diverts; a game is a form of play. Play, by definition, is recreation entailing pleasurable amusement and fun. Play is also defined as brisk or free motion, freedom, scope; and that's relevant too.

Note that diversion does not mean escape and that being amused entails being conscious—not mindless. Humans are thinking creatures; at root, our minds are our sole means of survival. Our species could not have survived at all if using our minds were not pleasurable—indeed, fun.

Good games, then, have another function: to divert our minds, to challenge our minds, to exercise our minds in such a way that we can experience the pleasure of their successful functioning. Do not assume that arcade-type games are excluded from this analysis. What do you suppose does the coordinating in "hand-eye coordination"?

Recreation really is the same word as re-creation. Our minds have many facets, and it's a function of games to showcase those facets for our enjoyment. Games re-create slices of life—either realistically or abstractly—that challenge some aspect of our abilities or personalities (both centered in the gray matter) to perform and succeed in a brief period of time.





The result is that good games produce fuel—spiritual fuel.

Consider that many goals we humans set for ourselves take a long time to achieve—becoming a doctor or lawyer, rising in business, honing an art to the fine point at which it will provide a living; even getting that high school diploma takes twelve years. And, while we're working on our goals, we often have to forego things we'd like a whole lot to do or have. The process of putting off immediate pleasures for greater happiness in the future is called deferring reward or delaying gratification. It's also a form of deferring success.

A good movie or book can remind you in a very short time that goals can be achieved and that the rewards are worthwhile. Playing a game can have a similar effect. Movies and books can inspire you by showing you the success of others. Inspiration is spiritual fuel.

Games show you your own success in microcosm. Games give you immediate rewards for your efforts; they're something you can succeed in mastering in a short time. They give you reason to feel immediate pride in your ability. The more challenging the game you master, the greater the reward and the stronger your pleasure in yourself. Pride, pleasure in your ability to succeed, is fuel.

That fuel keeps you going in your long-range real-life quest.

Getting Down to Jeweled Joysticks. These are some of the overall functions of games. They apply to all kinds of games—athletics and board games and crossword puzzles and arcade games and war games and computer fantasies and adventures. Beyond these, every individual game has its own specific function, which determines the detail of the form it takes.

Consider chess. Not computer chess, but any chess. Remember, we're already assuming the overall functions of amusement, diversion, enjoyment—all that good stuff.

The function of chess is to create an atmosphere that abstracts and simulates the pure strategy of battle. Before jumping into creating a prototype based on such a premise, game authors have to extract specific guidelines from the function definitions of the games they're designing. Some considerations for chess would be: Battle has participants of various abilities; battle is waged on a finite battlefield, which has parameters. The outcome of any tactical maneuver is determined by fixed rules; no single tactic wins the entire battle. The goal is to win territory, figuratively if not actually.

The form, then. The game of chess is played on a field that is simple, so as not to interfere with strategy, but with fixed parameters that allow enough freedom for the player to control his fate. Pieces represent fighting elements of various abilities, represented by ways of moving, and limits, represented by restrictions on movement and alternation of turns. The form must be simple enough to be held in mind easily, complex enough to leave strategic possibilities wide open.

Because the function is to simulate only strategy, elements of chance are not present in chess. The player is totally in control of her fate; only the opponent can cause surprise—as would be the case in real strategic planning, but not in the carrying out of that planning in actual battle.

The Sets Get Fancy. War games introduce the elements of real battle—random elements such as weather, difficult-to-predict factors such as troop morale and loyalty, and the reality that the aggressor's tactic can fail. These are the form; the function is the simulation of contingent strategies of real battle, of the waging of that battle, and of its probable outcomes.

Even though this definition introduces elements of chance into the accepted form of the game, the fact that simulation of reality is involved limits these elements. Weather, for example, may only be random within the realm of possibility. A war game in which a single battlefield was snowbound one day and besieged by tropical heat and a plague of malarial mosquitoes the next would not go far. Further, the abilities of pieces are not represented, as in chess, but are simulated. Your tank moves so many hexes each turn because the distance that many hexes represents is the distance the real version of that tank could move in the amount of time being simulated.

Fantasy games share some of the forms of war games, but their functions—and their origins—are very different.

The root of fantasy games is not simulation, but imagination; not strategy, but atmosphere. The progenitor of fantasy role-playing games is make-believe. Every child who plays dress-up with the clothes from the old trunk in the attic, who plays cops and robbers or cowboys and Indians, is engaging in a fantasy role-playing game.

The function of fantasy role-playing games is to create a believable imaginary atmosphere in which players can assume participatory characters that they can improve and develop through the actions and choices of play.

Fantasy games must simulate reality so well that they can suspend reality and carry players along. The fantasy must function within the laws of reality except when it purposely alters them; the alterations must be logical and consistent within themselves, must be graspable and understandable. The characters players are to identify with must also be logical and consistent, even if improbable.

The Extra Step. As fascinated as kids are with magic, they seldom play spontaneous games in which they use magic spells; there's no way they can easily simulate magic. Learning real "magic" is no help; do you remember a pang of disappointment when you first realized that magic wasn't really magical? Formalized fantasy role-playing games can take this extra step. They can set up a consistent set of rules of magic—a new physics, sort of—that players can accept and incorporate into their reality suspension. Within the world of *Wizardry*, loktofeit and mahalito are perfectly real and natural. Two real people discussing a session of *Wizardry* speak of using these unlikely spells just as naturally as if they were describing the play of cards in a hand of bridge.

The characters with whom players identify are as important as the real-feeling imaginary world. Players must be able to control the destiny and usually the status of their characters. Control can mean earn, acquire, discover; it can't mean arbitrarily "luck into." Imagine if characters rose a level in *Wizardry* merely by reaching another floor in the dungeon, whether they'd made a hundred successful expeditions or none. A lot of the point of playing would be lost.

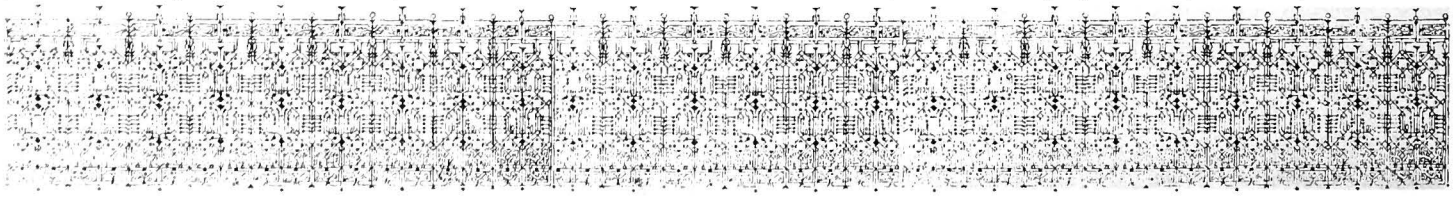
Such a change in the play of *Wizardry* would be completely out of place. It wouldn't fit with the rest of the game; it wouldn't integrate. The common element in all good games is integrity; the missing element in most bad games is integrity. Integrity is fidelity of the forms used in a game to each other and of all the forms to the game's function.

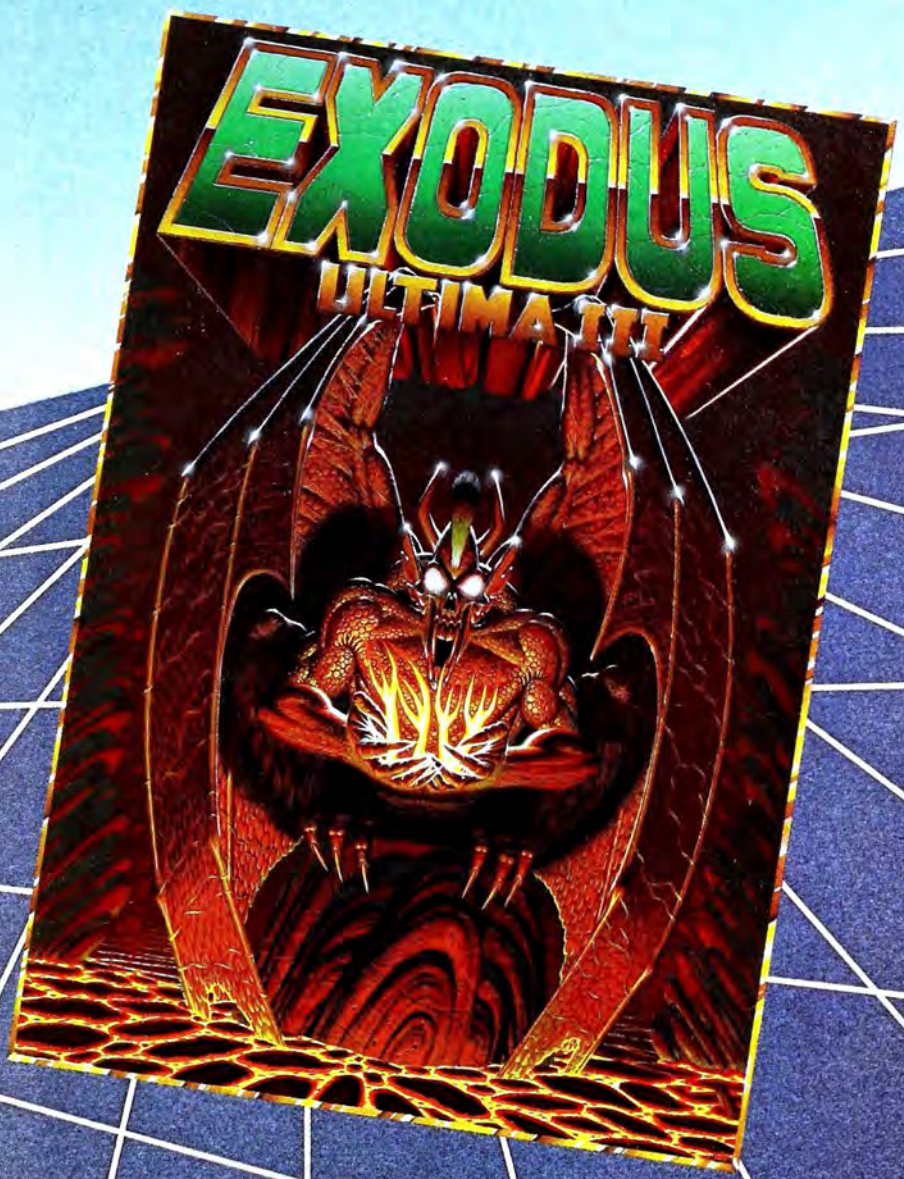
So, another way to think of integrity in a game is as consistency of purpose. The war simulation with truly random weather conditions lacks this; so would a fantasy game in which players couldn't affect their characters' growth; and so would a chess game in which, each time a player "took" a piece, a dice roll was required to determine which piece was to be removed from the board.

Misadventures in Adventuring. Adventures are games in the style of the very first game to derive from and require the capabilities of the computer. That game, devised on mainframes by two think-tank programmers named Crowley and Woods, came to be known simply as *Adventure*; when it was translated to the microcomputer, it was called *Microsoft Adventure* and *Apple Adventure* and *The Original Adventure.*

Soon, microcomputer programmers began devising variations on the original adventure—whole new adventures using the same game form. The first person to do this, Scott Adams, called his offerings to the genre *Adventure #1*, *Adventure #2*, and so on. Ken and Roberta Williams added pictures to the game style and called their games *Hi-Res Adventure #1*, *Hi-Res Adventure #2*, and so on.

It came to pass that when people in computerdom spoke of adven-





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tures, they meant games that simulate adventuresome situations in which you must logically deduce what you want the computer to do and tell it in your words, rather than choosing from a selection of commands offered by the programmer. The object of the game is to explore the setting, usually composed of many rooms that must be mapped, discover the object of the game, and then achieve it by solving riddles and puzzles presented by circumstances you encounter.

Therefore, while in the general gaming world, *Dungeons and Dragons, Traveller*, and *Kingmaker* are fantasy role-playing adventures or war-game adventures, in computerdom, they are merely fantasy role-playing games or war games. Adventures are a unique and specific genre.

Early adventures were strong on puzzles but light on plot. Most involved searches for treasures in various settings. The natural direction for the genre was toward interactive prose—to good stories, well-plotted tales. Today's adventures range from treasure hunts to murder mysteries to outer space sagas to courses in running a dungeon. Plot has become a crucial, integral part of good adventuring.

It's the logical demands adventures place on programmers and players that make adventures so popular. Solving good adventures requires impeccable logic; you can leave few stones unturned. And, if they're good adventures, they'll recognize correct logic in almost any terms. Some bad adventures degenerate into word-guessing games; you've solved the puzzle, now you must spend half an hour figuring out the one word or combination of words the program will accept to acknowledge that fact. Good adventures strive to anticipate any logical statement of the answer.

The Adventuring Mind. Of all forms of computer entertainment games, adventures require by far the most conscious thinking. The kind of problem solving the best adventures call for also best simulates real-life problem solving. An adventure puzzle can stump you, then wake you up in the middle of the night because your resting mind has been mulling the problem and has discovered a new approach, a possible solution. The feeling when your solution works is no less exhilarating than the fruits of any problem solving or flash of inspiration in real-life situations. Your mind working well is the source.

Yet it's in adventures that you'll see integrity bite the dust most often. Chances are, only handfuls of readers are aware of any specific adventure that has this problem (such adventures seldom do well); so we'll consider what might have happened in an adventure you're more likely to be familiar with.

Zork III has a theme. One of its very specific functions is to illustrate that benevolence is an effective attribute. You must meet each challenge with a benevolent attitude to win the game—which, the game also shows, does not mean being a wimp.

If, halfway through the game, the authors had introduced a puzzle to which the solution was to attack and destroy an unarmed group of pilgrims, then make off with their goods and money, the game would fall apart. Players, having been taught by earlier puzzles to act strongly but benevolently, would feel cheated—and would be completely at sea about how to behave in later situations. The same disillusionment would occur if unwitting players were to act kindly toward the pilgrims, only to have the group draw forth hidden weapons and do the players in.

Fortunately, neither of these things happens in *Zork III*; rather, like Infocom's other games, it is an excellent example of total integrity in gaming.

Arcade Abstracts. It's been suggested that the professions of acting and the armed services share a quality that few other professions offer: Both call equally on the mental and the physical capabilities of their participants; both require superb condition of the whole person for success.

Arcade-type games don't require the whole person; they do speak to the desire in human beings to be so involved. Good arcade-type games exercise the whole brain—they make you feel as though you're using your whole self because they challenge both your motor centers and your awareness and planning orbs. This aspect of mental fun is the main function of arcade games.

Arcade-type games don't require strong plots or heavy value structures. Many of the best arcade-type games are at heart pure abstractions, despite the cute—or horrendous—scenarios with which publishers may choose to describe them in the packaging.

Crossfire is an excellent case in point. *Crossfire*'s package describes an elaborate science-fiction situation in which the crosspaths of the game's screen are imagined to be city streets; the player represents the last remaining human from the city who must defend it from a multitude of metamorphosing multilived aliens. Now that you've heard the description, forget it.

Crossfire is far more abstract than chess. The player controls a diamond beset from all directions by stones that turn into spiderlike shapes that turn into big-eyed circles that turn into lacy diamonds. The player's bullets or stunners or whatevers are much faster than the competition's; and although the player's diamond shares the speed limit for moving, it's presumably much, much more clever—after all, it's got a human mind on the spot thinking for it; the critters have to rely on procedures set by the programmer in hopes of anticipating some of the moves of the immediate mode human. This element, of course, is why so many arcade-type games appear to be stacked against the player. They aren't, at least not in that respect, and not at all if they're good.

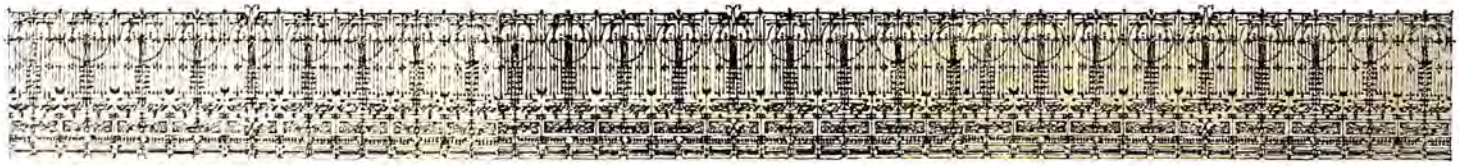
Crossfire, like all good arcade-type games—and more so than most—requires a good deal of practice on the player's part to be mastered. Mastering the game involves pitting your mind (yup) against the programmer's. You must learn to avoid the obvious responses and deal with the built-in pitfalls; this comes from thinking and concentration. Practice is what you need to get your physical abilities to carry out what your head says needs to be done. When at last your responses are going directly from recognition to fingers—when it feels like you don't need to think about what to do—then what you're really experiencing is your mind working at peak capacity: without verbal direction. Playing *Crossfire* well takes every ounce of your concentration, and it's exhilarating. But it isn't your fingers or your eyeballs that feel so good. It's your mind.

That's what a good arcade-type game is all about. It's an exercise, a morning workout, six laps around the track, and a quick dip in the summer surf. For your brain's muscles.

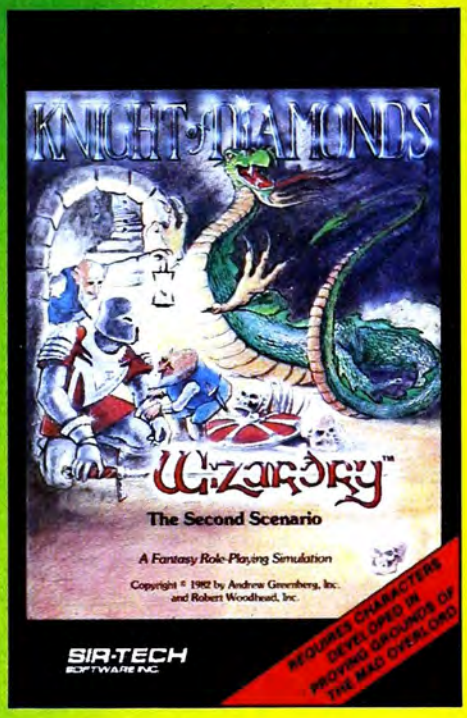
The Plot Must Thicken. The more complicated the game becomes and the more important the scenario, the less the arcade value and the more the strategic value. *Lemmings*, in which you have to pair off two kinds of circles—or either with a third kind—while watching out for metamorphosing circles that you can't touch and closing appropriate numbers of doors all within a time limit, is no longer a quick dip; it's more like doing twenty laps while the kettle's whistling.

Bolo is a true arcade-style game, abstract like *Crossfire* despite its name (it's supposed to be a tank war, but you needn't care). It's so challenging on its fast levels that it starts out slow enough for you to learn your strategies consciously. Taking advantage of this, *Bolo* takes place on a mazelike field many times the size of the viewing screen, the exploring of which averts any hint of the tedium you might expect at the early slow pace. The game calls for planning and executing plans while learning to be ready to change tactics at an instant's notice. Later on, you'll need all you've learned on the early levels to work in that finely honed, no-time-to-mull-it-over-now state.

The market is periodically glutted with new arcade games that reach for a new angle. Most of the twists are merely tedious; some are irritating; plenty are window-dressing. Colorful screens are a plus; beyond that, most of the gimmicks detract from the fun the arcade game is intended to provide. The brisk gallop around the lake on a spirited horse becomes the driving down a rutted road of a wagon pulled by six mules, each of



Wizardry



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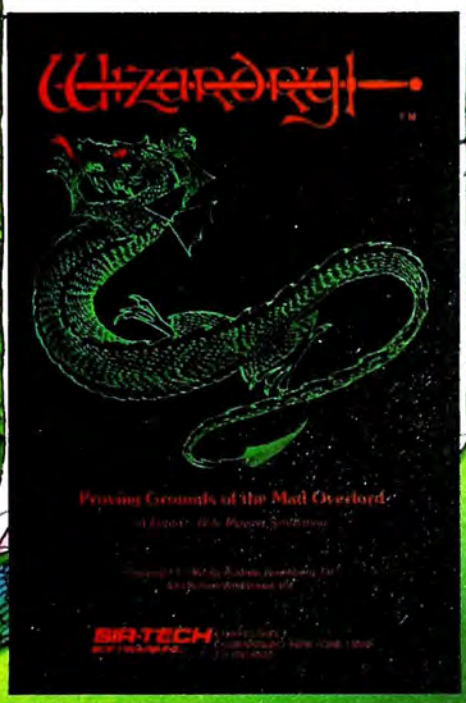
If successful, you will return the enchanted staff of Gnilda to Llylgamyn and *become* the Knight of Diamonds, but formidable adversaries block you at every turn. To begin your quest, simply **place yourself under the spell of Wizardry®.**

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which wishes to go in a different direction.

In a good arcade game, variations stem from the theme and functions of the game. If the idea of the game is to exercise players' ability to figure out how to get a jumping, climbing, and running playing piece through a screen full of platforms and ladders while avoiding obstacles, variations won't include randomly collapsing platforms or fast-shooting robots. Harder configurations of platforms and the addition of elevators, moving platforms, or dependable falling obstacles might be. *Donkey Kong* and *Miner 2049er* are good examples.

Decoration—which often misrepresents itself as the game's theme—arises from the real, playing theme. A spider making his way from planet to star to planet in outer space in a *Miner*-type game would be distractingly unbelievable; but a spider venturing through a cider factory works okay. A *Pac-Man* variation in which a little human ate chicken drumstick after chicken drumstick while pursued by a bevy of aged southern colonels would pall quickly even if it played smoothly.

A good arcade game is perfectly playable without decoration, and no amount of decoration can save a bad game. But poor, overelaborate, unrelated, or senseless decoration can damage a good game. Good, organic decoration adds to the fun of playing a good game simply by pleasing the eye or tickling the imagination or funny bone.

Only extremely well-devised games don't need variation within. Most games benefit by additions and changes from level to level; some may need only increases in speed or quantity of obstacles, others need new playing fields such as new mazes, still others grow by having adversaries get smarter. In most, once you master the highest difficulty level you're pretty much done. Just a few are so demanding of the players' abilities that they remain challenging without changing anything but the level of difficulty—and long after the greatest difficulty factor has been reached. *Alien Rain* and *Crossfire* achieve this. So, nearly, did *Gobbler*, Sierra On-Line's best version of *Pac-Man*.

Some Values Are More So. Some functions are more important than others; so long as all functions are served to some extent, a game can maintain its integrity and do well.

Choplifter is a good game. Yet its gaming values fall short in some regards. To the joystick novice, it may be very frustrating; to the expert, it's too easy and the ultimate goal can be reached too fast.

But *Choplifter*'s strengths overcome its weaknesses; those strengths involve values that reach beyond the computer, qualities much rarer than those *Choplifter* lacks. Consequently, novices overcome their frustration and experts ignore the simplicity. They both play again because the plot is a gripping, valuable one, and it's easy to accept because it's integrated into the whole so well; the plot is central to *Choplifter*. The hostages are not truly realistic; they are representative. But their representation captures the essence of the values the hostages represent: innocence, hope, benevolence, and helplessness. Having seen them, you must save them; only the least imaginative and most hardhearted don't feel this.

Once the game is won, the beauty of the graphics brings players back again. It's thrilling and satisfying to see achievement surpassing any before. When the technical achievement is matched by aesthetic detail, the result is like a great painting or a beautiful symphony; there is pleasure simply in experiencing it.

Let's consider the functions that Dan Gorlin and Broderbund might have chosen for *Choplifter*. It's conceivable that the game achieved every one of them.

Dan Gorlin had a goal. He chose to simulate on the computer as accurately as possible the physical motion and response of a helicopter. His discovery of the ways to create *Choplifter*'s remarkable graphics was the result of Gorlin's desire to give form to the function of the chopper. This he achieved.

Broderbund wished to create a game that would challenge players to master control of a simulated helicopter and enable them to use their expertise for a purpose that would give them incentive, pleasure, and the satisfaction of worthwhile accomplishment. This Broderbund achieved.

Had Broderbund then chosen to base *Choplifter*'s score on how many enemy craft were destroyed, *Choplifter* might never have seen the bestseller charts, much less topped them. That form of scoring would have negated the basic functions the company set for the game. You're supposed to rescue the hostages, but you'd make the high-scores list by keeping the hostages running around as long as possible so as to lure and fight more tanks and planes. Because the game is extremely successful in engendering sympathy for the hostages, players would have to blank out their feelings in order to ignore the little people waving to them. The pleasure meter would drop enormously.

David through the Looking Glass. The ultimate example of form following function to produce integrity is a game that's truly unique. No other game has set out with similar specific functions and, appropriately, no other game has even attempted such a form. The game is *The Prisoner*, by David Mullich from Edu-Ware.

An ambitious program, *The Prisoner* served several related functions: to place players in an extremely alien world of mystery and inexplicable logic or purpose—re-creating the atmosphere such a place would have—and to challenge players to discover the purpose and logic of the place, to act upon what they discover, and to escape from the place.

The form Mullich chose began by having neither the documentation nor the game instruct players beyond their overall goal: to escape. Not even a hint of what keys to use is given—and, indeed, the keys to use vary from situation to situation. Even in the mazelike parts, some require compass directions, others up-down-left-right—which, you have to discover. Relatively abstract graphics and strange alien sounds have an effect paradoxically both lighthearted and ominous. Single-key directional exploration intermingles with situations in which players converse with strange others using full English sentences in the best attempt at artificial intelligence the personal computer has seen in or out of games. Players soon realize, often accidentally via frustration, that doing the unexpected or the opposite of what you're told often produces clues.

Many more are the forms that serve *The Prisoner*, and they all work. The newer version adds hi-res graphics because the author's skill increased to allow them; they serve just as well—still not helping the player at all.

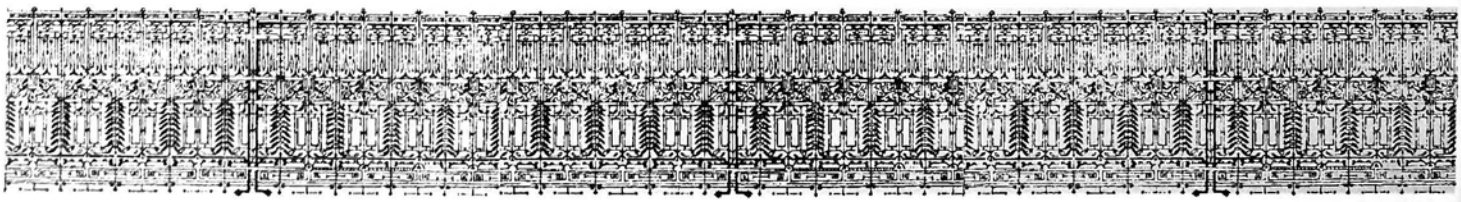
Facing the Firing Squad. Execution is a crucial part of the form of all games. How well a game is programmed, how fine and smooth its graphics, how responsive its joystick or its parser—all can make or break a good game, although the better the gaming values, the more likely a game is to overcome some flaws in execution.

Fact is, good graphics do not a great game make. And the most playable bore in the world won't make it to your game collection. Yet a good game needs these things—graphics only if they serve its function (which they do not in prose adventures), but playability always.

One of the functions necessary in commercial games is that they attract consumers. Great graphics do that. Even packaging comes into play; it isn't essential, but without attractive packaging a game has to have terrific word of mouth for most of us to know about it.

A game still starts with its functions. Most of them can be served to some degree despite less-than-perfect execution (although most players can smell sloppy execution almost without opening the package, and they don't). An example would be the terrific game idea your little sister came up with that would have been a super game if only the pictures weren't so crude—and if only the monsters didn't get you when you could still see an eighth of an inch of air between you and them.

Usually, great games look great. If they have graphics, the graphics are sharp and clean; if they don't have graphics, the text is smooth and moves evenly. If, when you first boot up a new game, the first thing you



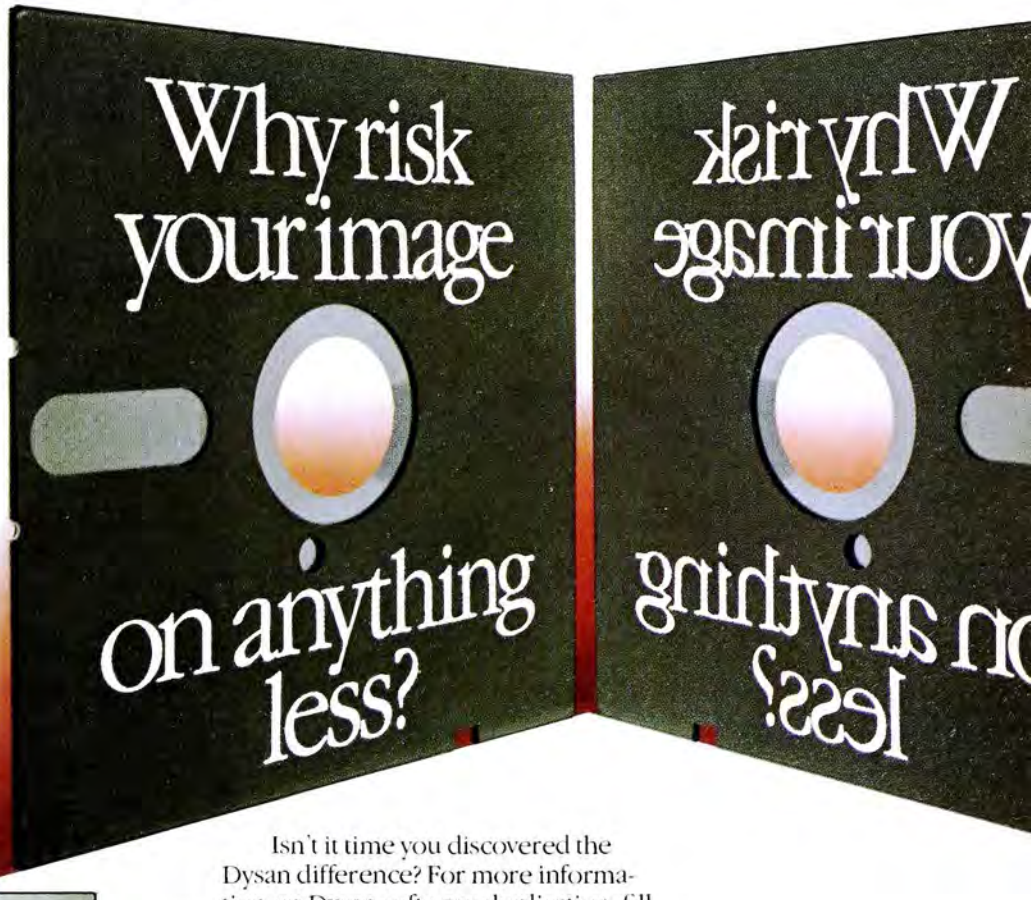
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find yourself doing is making excuses for the programmer or discounting details as not really important anyhow, look again before you buy. The publishers and programmers that produce great games care way too much to let stuff like that get by. Not every great game advances the state of the art, but every one at least reflects it.

The point is that excellence of execution is subsumed by the overall functions of all games, just as is the idea that a game's specific functions must be interesting and fun. Unless the execution is good and the premise is valid, these ends aren't served.

The genres of games vary in their emphasis. Adventures and fantasy role-playing games emphasize plot. Fantasy role-playing games also emphasize character. Adventures depend heavily on logic. War games and simulations emphasize minute detail and fidelity to facts. Arcade games stress graphics and physical playability.

Meeting of Genres. Today, some new kinds of games are combining the elements of several genres. In some cases the elements are integrated throughout the game, as in *Aztec* and *Castle Wolfenstein.* Arcade action combines with travel through fantasy mazes; there's time for strategy, but just barely. In others, the parts are combined in a coarser weave; examples are *Escape from Rungistan* and *Desecration.* In *Rungistan*, the player must take quick action in key parts of the adventure where time would be of the essence; once or twice, you need to use some arcade skill, although the level is such that nonarcaders can master the game. In *Desecration*, the variation is even less closely woven. In three places in this adventure, you must stop and survive difficult arcade games in order to go on with the adventure. The arcade episodes are so hard that they must be mastered ahead of time (which is provided for) in order to have a chance.

Also in the experimental stages are interactive stories that combine reading screens full of text interspersed with anything from puzzle-filled pages of graphics to questions that affect the story's outcome to complete strategy and arcade sequences.

The strategic fantasy-arcades, as we might call *Wolfenstein*, for example, are the only ones of these that show great promise. *Rungistan* was cute, and its author was on the ball, having all the action sequences grow out of the adventure circumstances quite naturally, but others of this type are more gimmicky; and adventure players usually just don't want to have to fight an arcade-type threat in the middle of a session of logical reasoning—even if they love arcade games, when that's what they're in the mood for.

The direction is toward closer and closer simulation of life, toward the creation of a universe. If Ultrasoft finds a way to provide with its *Serpent's Star* the sounds and smells of the Himalayas and even an occasional monsoon, you can bet they will. The complete game of the future will have elements of all the genres, but they will be so carefully integrated that you'll never feel shoved from one to another.

Imagine what fun—and what life-learning tools—future computer-generated games might be, when programmers have at their disposal not just hi-res graphics and sound boards but holograms and automatic voice recognition and voice response from highly developed artificial intelligence.

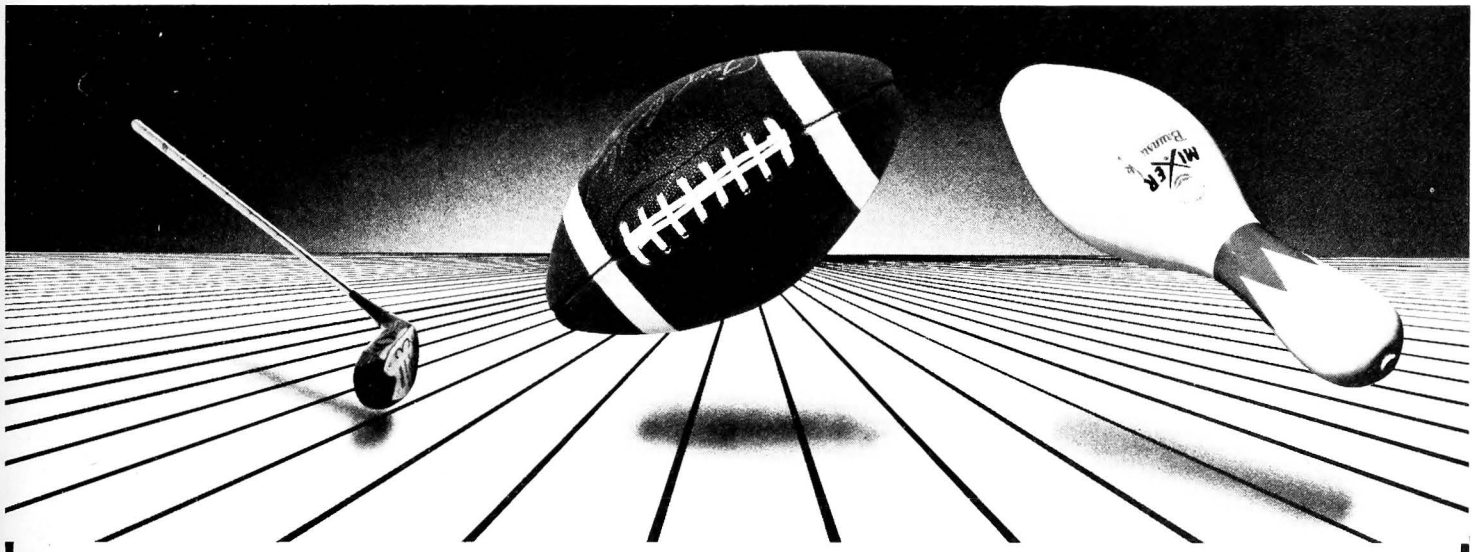
Then, far more than now, Louis Sullivan's simple statement that form follows function will be crucial. With so many parts to be considered, a strong central function and theme will be a requirement for such a game to make sense at all.

The Pride and the Passion. Good games do make sense. They teach, they exercise, they inspire. And if you still feel guilty when a sober acquaintance looks archly down her nose and says, "I don't play games; I bought my computer for important uses," remember that almost all the strides that have stretched the Apple II far beyond what was considered possible were made by game makers making games. And most of them were game players playing games before that.

"It should be noted that children at play are not playing about; their games should be seen as their most serious-minded activity."

—Montaigne in Essais

It isn't just children. Good games are amusing, fun, diverting, healthy, and important activities for all of us. ∎



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We learn, for instance, that we are more entertained by the involvement of our imaginations than by passive viewing and listening. We learn that we are better taught by experience than by memorization. And we learn that the traditional distinctions — the ones that are made between art and entertainment and education — don't always apply.

TOWARD A LANGUAGE OF DREAMS.

In short, we are finding that the computer can be more than just a processor of data.

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Something along the lines of a universal language of ideas and emotions. Something like a smile.

The first publications of Electronic Arts are now available. We suspect you'll be hearing a lot about them. Some of them are games like you've never seen before, that get more out of your computer than other games ever have. Others are harder to categorize — and we like that.

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SOFTWARE ARTISTS? "I'm not so sure there *are* any software artists yet," says Bill Budge. "We've got to earn that title." Pictured here are a few people who have come as close to earning it as anyone we know.

That's Mr. Budge himself, creator of PINBALL CONSTRUCTION SET, at the upper right. To his left are Anne Westfall and Jon Freeman who, along with their colleagues at Free Fall Associates, created ARCHON and MURDER ON THE ZINDERNEUF.

Left of them is Dan Bunten of Ozark Softscape, the firm that wrote M.U.L.E. To Dan's left are Mike Abbot (top) and Matt Alexander (bottom), authors of HARD HAT MACK. In the center is John Field, creator of AXIS ASSASSIN and THE LAST GLADIATOR. David Maynard, lower right, is the man responsible for WORMS?

When you see what they've accomplished, we think you'll agree with us that they can call themselves whatever they want.

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"Odesta has set the standard against which everyone else in this industry will be measured..." Ian Chadwick, InfoAge 6/83

Checkers 2.1 by David Slate

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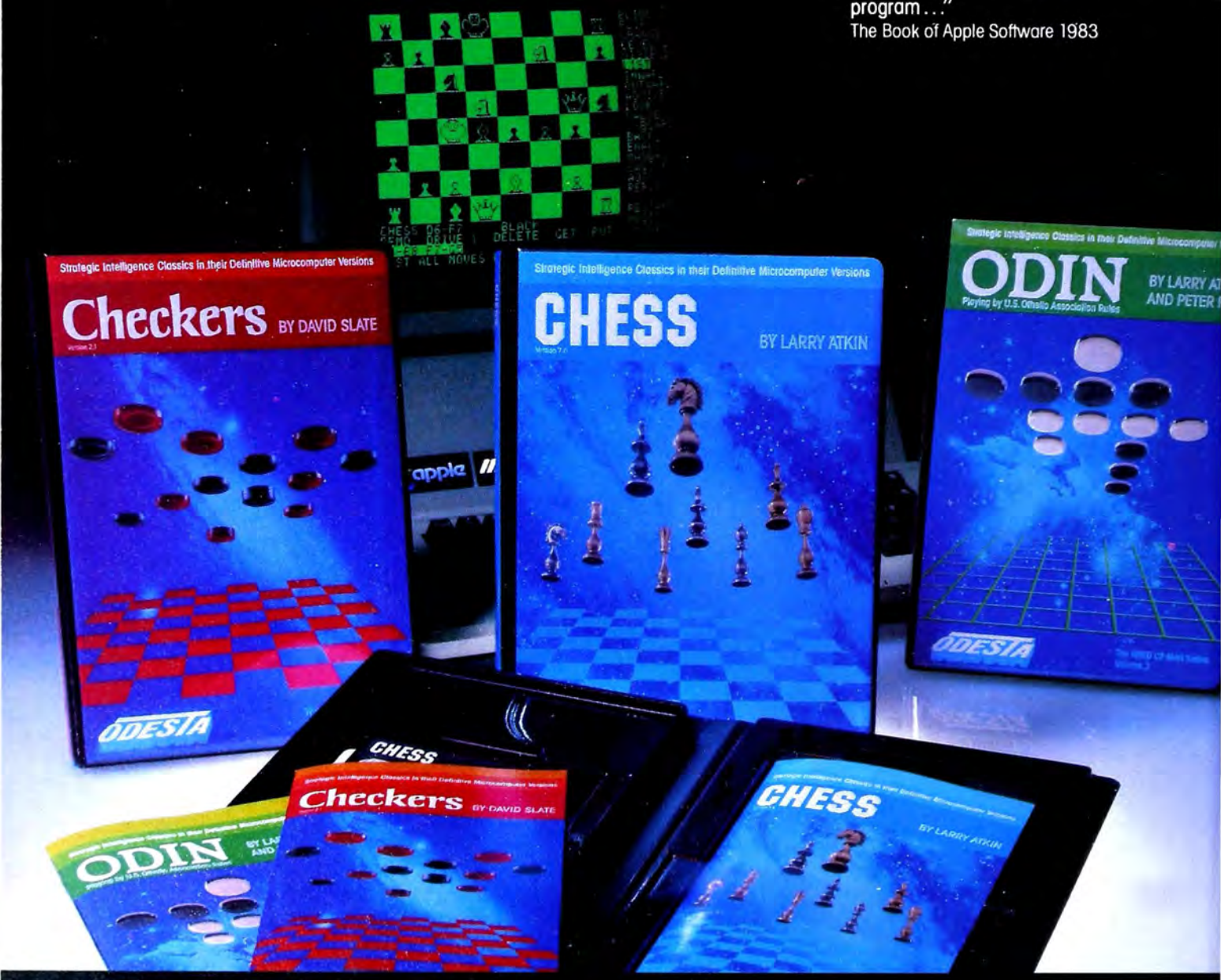
Chess 7.0 by Larry Atkin

"Chess 7.0 is the definitive chess game available on the Apple and Atari computers... It is certainly the best chess program that I have seen for any microcomputer." The Book of Apple Software 1983

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Reviews



Software. The stuff real computers eat. Whether it's games, business applications, hobbyist utilities, communications programs, or for home use, you'll find it reviewed and critiqued here. You might even find a few items on hardware.

A lot of people read this section to figure out whether they should spend their bucks on something or not. Others read it to reinforce their consciences for having already spent the bucks. Still others read these reviews so they'll have something to disagree with and write to Open Discussion about.

A popular section, to say the least.

Many of us will be ducking inside to play with our Apples this summer when it gets too hot outside (at least that's the excuse we'll use), and that means we'll be looking for new things to buy. This month marks the first of two parts of our annual summer extended-reviews section: Marketalk Reviews Big Summer Blowout.

Unless otherwise noted, all products can be assumed to run on either Apple II, with 48K, ROM Applesoft, and one disk drive. The requirement for ROM Applesoft can be met by RAM Applesoft in a language card. Many Apple II programs will run on the Apple III in the emulator mode.

The Witness. By Steve Galley. *The heavy perfumed smoke from the great man's pipe enfolded Watson the moment he cracked open the door, and the sweet strains of violin music doubled in volume and pathos.*

"Holmes," Watson ventured, "I hate to interrupt you, but. . . ."

"Then don't, sir," came the deep response, although no sign of awareness of the good doctor showed in Holmes's lank, languid form. He went right on drawing bow across strings of the instrument he loved to caress.

"But Holmes," Watson protested, "it's such a fascinating case. Not many suspects, you know, but quite difficult. You see, all the evidence points to one fellow, and I'm convinced the poor chap didn't do it. But, gads, Holmes, I can't find the proper evidence to figure out who did, and—"

"My good fellow"—Holmes said, finishing a melody and raising his chin tentatively from the violin—"we've just finished a wearing case; tell me no more and send these people elsewhere. I need time." He drew deeply on his pipe and began to fall back into his playing position.

"No, no, Holmes," said Watson, warming to his task. "This isn't people, at least not real ones. It's the new Interlogic Mystery from Infocom I'm talking about, called The Witness. *As the player, we actually witness a murder and must solve the mystery. It all takes place in the pulp-style world of Los Angeles in the year 1938."*

"Well, why didn't you say so, man?" Holmes whisked his violin into its case and changed to his mystery-solving pipe. "You know how I loved Deadline."

"Yes, but, well . . . I never did understand exactly how you knew the butler. . . ."

"Elementary, Watson," Holmes remarked as he hurried Watson to the computer room. "Los Angeles, eh? In 1938. Leave it to Infocom to be the first to bring us a science-fiction mystery."

Everything about *The Witness* reflects the style of the pulp detective magazines of the late thirties and early forties—history, rather than science fiction, from our perspective. And all the era-relevant details of the game and the package have been carefully researched for accuracy.

The package itself is lots of fun. Cliche after cliche from those popular pulps jumps off the outside folder in thirties-traditional multiple typefaces. Raymond Chandler and Dashiell Hammett, move over; here comes Infocom. The dossier contains a bunch of clues, including a pack of matches from the Brass Lantern restaurant (could our friend Zork resemble Alfred Hitchcock?); a thirties-style telegram actually set up and authenticated by Western Union; a page from the *Santa Ana Register* of February 1, 1938, doctored only to include the story relevant to the game; and a copy of *Nat'l Detective Gazette*, complete with authentic ads

from the *National Sheriff* of 1938 and filled with stories that supply the documentation for the game.

The Witness is fun to play, but the mystery adventure form is still in its infancy. Although the interaction is terrific, it's kind of like terrific caviar; it makes you hunger for the main course. You'll think of a hundred questions you know you can't ask, and it's not totally consoling knowing that if you can't ask them you don't need them. Still, if this first step weren't so good, it wouldn't make you think of how much more you'd like.

The mystery, when all is said and done, is fairly simple; *Deadline* was more complex. But the atmosphere and sense of reality make up for it. *The Witness* is another plum for mystery buffs. And, like the pulps it emulates, the entire package is apt to become a collector's item some day. MCT

The Witness, by Steve Galley, Infocom (55 Wheeler Street, Cambridge, MA 02138; 617-492-1031). $49.95.

Hard Hat Mack. By Michael Abbot and Matthew Alexander. There's a new kid in town—Electronic Arts. Get used to the name because you're going to be hearing of the company and seeing its products in the future. A lot.

Hard Hat Mack represents the company's entrance into the Apple market, and if the game is any indication, Electronic Arts is a company whose time has come.

For the past year, Apple gamers have been crying, pleading, and hungering for better games. *Choplifter* stopped the crying, and *Miner 2049er* stopped the pleading, but the hunger remained.

It's time to get out the bibs and finger bowls because *Hard Hat Mack* is going to satiate that hunger.

You want us to say it? Okay, we'll say it. *Mack* is a good game. There, we've said it. It's colorful, fun, challenging, addicting, and smooth. It's not a game that you play for five hours and throw to the back of your disk collection; it's a game you play for five hours, throw into your disk collection, and then pull out for "just one more game."

The plot is simple. *Hard Hat Mack* is trying desperately to finish constructing a building while avoiding falling rivets, neighborhood vandals, construction hazards, and inspectors from the Occupational Safety and Health Administration.

Once you see the word "building" in the description, you should automatically know that there are ladders to climb in order to reach different levels and gaps you must jump over. Sound familiar? Sound like *Miner 2049er*? In many aspects, it is. Unfortunately, the game limits itself to just three screens. Once you master the third, you start over on the first again, only this time with more obstacles.

Mack uses the conventional transports of the game's genre: elevators, lifts, ladders (chains), and conveyor belts. A new one that *Mack* introduces is the springboard. Already in the coin-op arcades but new to the Apple arena, the springboard lets you bounce to the next highest level, and from the top level you can bounce to the bottom. Comes in handy when the OSHA inspector is ready to cite you for ignoring government regulations.

In case you're thinking, "Just three screens, eh? Should be a breeze to master," forget it. Locations of girders that you must pick up are random, which cancels just about any patterns you plan to memorize. The name of the game is improvise.

Mack is a game for almost everybody. Two animals the game isn't designed for are glory hounds, because high scores aren't saved to disk, and wimps, because even the first screen takes some practice to get through. "Mastering" it is next to impossible.

And now some words about packaging. When you see an Electronic Arts game on the rack at the computer store, you'll be tempted to take it home and play it on your stereo's turntable. Its packaging is not unlike those of record albums. It looks like a record album, it feels and folds like a record album, and it even has liner notes like a record album. And even with the elaborate packaging, the game remains competitively priced.

If you put *Hard Hat Mack* in the ring against all other games on the market one at a time, it would win most bouts in the opening seconds of the first round. It's that good.

Until now, the arcade realm of computer games has been dominated by just a handful of companies. Electronic Arts takes its games seriously and aims to let others know it means business. *Hard Hat Mack* should serve as a warning shot. A loud one. MTV

Hard Hat Mack, by Michael Abbot and Matthew Alexander, Electronic Arts (2755 Campus Drive, San Mateo, CA 94403; 415-571-7171). $35.

Pensate. By John Besnard. John Besnard, pronounced something like behnár, is a unique person—not because he defies us to mispronounce his name by trade-naming his products Bez, not even because he dares to write entire games in an alien tongue, but because he's an excellent programmer and a lover of games who has no desire to make a career of programming games.

Besnard is devoted to his long-time career at Hughes Aircraft; but when Hughes promoted him out of hands-on computer work and into management, he found himself going a bit crazy. So he bought an Apple and began teaching it tricks. Before long, he was turning out games for his kids that he and his neighbors liked to play.

"You should publish that, John," a good friend said of Besnard's first game, *Bezman*. Others echoed the sentiment. So, in a small way, Besnard did. On a whim, he sent a copy to *Softalk*.

At *Softalk*, all staff members except game reviewers play games for breaks (game reviewers consider playing games as work; during breaks, they just grump a lot about having nothing to do). Pretty soon, *Snoggle* and *Gobbler* and *Snack Attack* were forgotten; everyone was playing *Bezman*. Which, unfortunately for Besnard, made *Softalk* unique in the world.

But a lot of people began watching what Besnard was doing for fun in his spare time. Not all his products were as good as *Bezman*, but each showed growth, improvement, and a developing style. After the first two or three, they began to show a strong streak of originality.

With his track record, it was inevitable that John Besnard would eventually come up with a game too good to keep under wraps. It wasn't at all inevitable that that game would be a strategy game or that it would be the most original game concept to come along since the first adventure and the first arcade game.

But it is all of those things, and it's called *Pensate*.

Pensate is a computer-age game; it cannot be played without a computer.

Pensate is a thinking game; it challenges you to plan far ahead while keeping more and more elements in mind.

Pensate is an exciting game; watching the computer's moves unfold after you've committed yourself can keep you on the edge of your chair.

Pensate is an addictive game; if you're winning, it's hard to resist upping your record one more notch—if you lose, it's almost impossible not to try that screen again and again until you conquer it.

Pensate is an enduring game; always changing, always challenging like a deck of cards, it's a game to enjoy year after year.

Pensate is elegant; it's simple and clean in concept and execution.

Sixty-four squares comprise the square playing field. Your opponents are pieces controlled by the computer. The objective: Move your piece to the top row of the field, a mere seven squares away, without landing on or being landed upon by an opponent piece.

At the game's beginning, at least four opponent pieces appear randomly within the grid at the game's beginning. The solitaire human may choose any unoccupied square in the bottom row in which to place his own game piece, and the human moves first.

The human moves one square vertically or horizontally and is limited by the sides of the field. For every human move, each opponent piece gets a move. The opponent pieces move in a random sequence that holds through one game. Because of the jumping, remembering the sequence is crucial. You can learn it only through observation.

Opponent pieces come in ten varieties. Each variety moves in a unique pattern: one square, always in the same direction, regardless of the human move (which reflects four varieties); one square in one of four directions dependent on the human move (four more); and one chesslike knight's leap in a direction dependent on the human move (the last two). Two varieties move diagonally. No opponent pieces are limited to the field; all wrap around the board.

The plot thickens. Although their move is defined as one square, opponent pieces can't land on occupied squares; so they jump any com-

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rades in the way to get to the next empty squares according to their patterns. The only occupied square they can land on is yours; if they do, you lose.

With each game you win, the computer increases its force by one and sets up a new field. Depending on the skill level at which you're playing, the computer will recognize your achievement when you survive eleven or more opponent pieces.

Skill level determines the varieties of opponent pieces you'll face. On easier levels, only staid, vertically and horizontally moving arrows oppose you. On the higher levels, opponent pieces can be any combination of varieties.

To top it off, *Pensate* challenges you to plan—and input—two, three, or four moves at a time. Committing to two moves at a time means determining how all the opponent pieces will move according to your first move and where they'll end up, then anticipating how they'll all move according to your second move so that you're sure to be safe.

That means that if you play in four-move mode on skill level nine against fifteen opponent pieces representing all varieties, you need to anticipate sixty opposing moves in at least ten directions (more unless your four moves are all in the same direction); and you must make your first set of moves with no idea of the sequence in which the opponent pieces will move. Ouch.

It really is a new game.

In two-human mode, it's the two humans in league against the computer. The second human chooses any square on the top row to start in and attempts to get to the bottom row. Either human's success is a win and either human's demise is a loss for both. Even when you're in league, it's hard; the computer pieces get to move after each human does—so you have to figure how they'll move according to your first move and how they'll move according to your colleague's move. Double ouch.

Little extras enhance the game: replay, which allows you to try the same screen again and again until you win; setup, in which you can arrange your own field; and a unique way of scoring records just for fun.

Pensate is gaming in the computer age. MCT

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Pensate, by John Besnard, Penguin Software (830 Fourth Avenue, Geneva, IL 60134; 312-232-1984). $19.95.

Fontrix. By Steve Boker and Duke Houston. Apple graphics often look much more impressive on the screen than they do printed out. A portrait on the CRT becomes a snapshot on paper. Most good hi-res dump programs allow you to print double size or larger, but the resolution stays the same. And while 280 dots blend together nicely when confined to four inches, each dot becomes a spot, distinct and with a life of its own, when you try to spread 280 of them across eight inches.

Most eighty-column dot-matrix printers can print larger, higher-resolution pictures than you can put on your monitor. So what's stopping them? The monitor is. You can't design graphics on a printer.

What you can do is use your monitor as a window to a much larger hi-res world. *Fontrix* gives you that world, which can be as large as sixteen hi-res screens and in whatever dimensions you like, so long as it is at least as tall and wide as one screen.

When you want to make one of these extended pictures, you open a graffile—a file on disk that behaves very much like a random-access text file. Thereafter, the picture will exist mostly on disk. You can edit the part you're looking at, then move the cursor to one of the four edges. Part of the picture will be saved, another part loaded into memory, and your window will scroll over onto a new part of the graffile. When you're finished, you close the graffile. You can come back to it later or print it from the screen-dump section of the program. (*Fontrix* can also create, edit, and dump ordinary hi-res pictures.)

That's the tricky part of *Fontrix*. The font part is almost as impressive, and is the main (but not the only) answer to the graphical question, "What can you draw on a graffile?" *Fontrix* comes with eleven fonts on disk. They range in size from one that is slightly smaller than the Apple forty-column text to an Old English font that is three or four times as tall. Any of these fonts, and fonts you design yourself, can be used to write on a graffile.

The system is imaginative, intelligent, and easy to learn. The menu arrangement is logical and simple. It would be possible to get lost in the graphic-writer section—there are twenty-six different control commands—were it not for the program's one well-placed help screen.

You can also sketch on a graffile, with varying degrees of ease, depending on the kind of hardware you have. *Fontrix* accepts graphic input from the keyboard, paddles, a joystick, a trackball, a mouse, or a graphics tablet. Keyboard and paddle graphics are, predictably, somewhat limited. However, you can load in a picture created with any other graphics system or with Basic, then add all sorts of text on and around it to create striking mixtures of graphics and text. This may be what *Fontrix* does best. DD

Fontrix, by Steve Boker and Duke Houston, Data Transforms (616 Washington Street, Suite 106, Denver, CO 80203; 303-832-1501). $75.

Triple Arcade Insanity. By Brad Rosen. Waiting for the breakthrough in computer games? A breathtaking combination of graphics, animation, sound, and playing strategies so total, so astonishingly unique, as to form a holistic, infinitely fascinating gaming experience from which you simply cannot tear yourself away?

Well, if you've waited this long, you can certainly wait a little longer. In the meantime, you could play a few rounds of . . . of this. (When there's one title on the package and a different one on the disk, your suspicions may be aroused as to the care with which the product was put together.) Evidently, this disk is now called *Triple Arcade Insanity*, the "triple" added to the original title to better bring to your attention the fact that there are three games on the disk. No one thought to change the tripleless title on the program title page.

Mind you, the original title may be a wee bit more honest. The "three games" can be considered separate largely due to the fact that you have to reboot the disk completely to go from one to another. But they all look awfully similar to each other.

Alien Onslaught has a scrolling starfield; you move left and right across the bottom of the screen, and you get no bonus ships at the completion of a level. *Galactic Conquerors* and *Andromeda Blitz* have no stars, but when shot, instead of vaporizing, the aliens mutate into various geometric shapes, household appliances, and whatnot, courtesy of Broderbund's *Arcade Machine*. Eventually, they go away. *Andromeda*

Blitz has a floating cursor, so your tank can go where it wants to get the job done. Also on *GC* and *AB*, your tank has a fancy pair of side-wheels that whirr decoratively whenever you move and serve the purpose of making you a larger target. Though both games award bonus ships, these tend to materialize in the exact spot where your last ship met its end. The screen does not reset; the enemy is still laying down the barrage that just zapped you; your reserves march to extinction in three seconds flat. Game over.

With that exception, these are all pretty well done of their type. The successive levels of difficulty feature different patterns of movement and firing, not just speed increases. So if you're not looking for the newest thing in arcade-style gaming, if you've been out of town for the last three years, or if you absolutely can't get enough of the alien-whomping school of gaming and your collection would be incomplete without it, this is the one to get. AC

Triple Arcade Insanity, by Brad Rosen, Avant-Garde (Box 30160, Eugene, OR 97403; 503-345-3043). $29.95.

Step by Step Two. By John Victor. A year ago, *Softalk* reviewed *The New Step by Step*, a very sophisticated program that teaches the elements of programming in Basic. It's a powerful, state-of-the-art teaching program, with only one drawback: If you have an Apple, and you want to learn Basic, you'll probably have learned much of this material on your own, from the *Applesoft Tutorial*, before you discover *The New Step by Step.*

Well, you don't have to be disappointed any longer. The sequel, *Step by Step Two*, covers things you'd be less likely to get into on your own. Heavy stuff: hexadecimal addresses, hi-res graphics, complex string manipulations—that sort of thing.

If you've been wanting to learn about such things, but not really wanting to tackle them by yourself, John Victor, with his collection of crystal-clear images and crystal-clear voices, will take your hand and guide you.

You'll need an audio-cassette player. The text material in the Step by Step series is in lecture form, carefully explained by a bright, intelligent *human* voice. This is not just a teaching program, it's a whole course, with lectures, demonstrations, lab work, quizzes, and homework assignments.

It works like this. The material of the course has been broken down into little chunks—simple concepts, each one complete and sensible (more or less) by itself. You're given these pieces, one at a time, like links in a chain; and then you're shown how they hook together.

First you hear, from the tape, a little background for the concept. Then the concept is demonstrated on the screen while the tape explains what's happening. Finally you're asked a couple of simple questions about the new concept, and you must type in the correct answers before continuing. Sometimes you are asked to write or verify a line or two of Basic.

The questions are not usually difficult, but they require you to *use* what you have just learned. The only difficult part is absorbing so much new stuff so fast—but it's too fascinating to stop.

The topics covered (besides those already mentioned) include binary numbers, the Apple memory map, poking and calling short machine language routines (such as a tone generator, with the music for several familiar tunes), the screen memory area(s) and other I/O functions, and a lot more.

A couple of minor technical problems are worth noting. Sometimes the voice is a little slow; you finish reading the line silently to yourself and have to wait for it to catch up. Think of it as the price you pay for having a real human voice to listen to instead of a machine-generated croak.

A more serious problem is the rigidity of structure—serious because it interferes with selective reviewing. The program needs a "fast-forward" control for the displays (skipping the prompts and responses) and an exit-to-menu from anywhere. But not to worry. Programmed instruction (which this is) has always had a problem with rigidity; and when it's done right (which this is), it teaches so effectively that the problems hardly matter.

Step by Step Two is not a "gut course"; it takes a good deal of time and a whole lot of attention (and you'd better do the homework). But this is a case where the payoff is in proportion to the investment. This one really teaches. JR

Step by Step Two, by John Victor, Program Design (95 East Putnam Avenue, Greenwich, CT 06830; 203-661-8799). $89.95.

Fighter Command. By Charles Merrow and Jack Avery. *The time is August 1940. The Battle of France, as Churchill calls it, is over and France lies crushed. Hitler is triumphant.*

The ragtag fleet of small boats that brought the British Army home left all the heavy equipment behind. Against the mightiest war machine ever created, Gehring's Luftwaffe, stand only the men and machines of the Royal Air Force. Led by Vice Marshal Sir Hugh Dowding, the RAF has only one-third the aircraft and few pilots with combat experience to match that of the Germans. This is the RAF that has to be crushed before Hitler can invade.

Fighter Command is a simulation of this desperate battle. It captures the essence of another time and place like few simulations do. A few minutes with *Fighter Command* and familiar surroundings disappear.

Fighter Command matches player against player or individual against a computer-commanded Luftwaffe in several scenarios, from the entire campaign of August 13 through September 15, 1940, to the single savage Eagle Day beginning of the battle. Every plane and pilot that was available to the combatants is here, including aircraft and pilot replacements at their actual historical rate. Variables include weather, intelligence, repair capacity, and chance. Each scenario begins with an accurate simulation of the condition of the combatants. As play progresses the toll on men and machines increases. Victory in the game, as in the actual battle, depends on endurance. Morale, experience, and combat potential fluctuate with the changing tide of battle.

Game play proceeds with a briefing phase in which you can evaluate intelligence (not always accurate) from the previous day's combat. So detailed is the simulation that there's even occasionally ultrasecret intelligence from the successful breaking of German codes.

Depending on weather and previous losses, the Germans may make token raids or none at all. When a raid is spotted, the location and altitude of the raiders is posted on a colorful hi-res map of southern Eng-

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land and the channel area. British fighters may be kept at varied states of alert or patrol. As more German formations are located, they are tracked as well. The German raids are marked with a swastika and the British squadrons with the Rondel. As play proceeds, the tension mounts. Eight separate raids are tracked as they head toward their targets. No history book could begin to convey the drama and tension as, day after day, the outnumbered RAF fights for survival.

Fighter Command is among Strategic Simulations's best efforts to date. The attention to detail, in game design and in support materials, is first-rate. The large game map and counters that accompany the game disk echo the war room as Dowding watched the German armadas approach. Graphics and sound are also superb. The hi-res maps of Britain are first-rate and the sound effects add greatly to realism. When an RAF squadron successfully intercepts a Luftwaffe Geshwader, you can hear machine-gun fire as the screen updates the battle results. When the Heinkels and Junkers break through the defenses, you hear the thud of the bombs falling.

Internally, the game logic is very sophisticated. In solitaire mode, for instance, the computer may deliberately feint toward a target, then turn away at the last moment to lure British fighters away from their bases. With all this complexity, game play is almost simple. The computer is a super administrator, allowing only legal moves while faithfully recording the game's status. Combining haunting realism with palm-sweating excitement, *Fighter Command* is tops.

When finally the Heinkels and Junkers are driven from the daylight skies, the survivors count the toll. The German bombs have even shattered the old medieval city of Coventry. The ancient cathedral is a burned-out shell. Atop the altar, carved in the charred and broken cross, are the simple words "Father Forgive." The people of Coventry will leave the ruined cathedral as a memorial to the Battle of Britain and to the courage of those who endured. WHH

Fighter Command, by Charles Merrow and Jack Avery, Strategic Simulations (883 Stierlin Road, Building A-200, Mountain View, CA 94043; 415-964-1200). $59.95.

Critical Mass. By Bob Blauschild. The evil Count Stuportino and his henchmen have hidden thermonuclear devices in five of the world's major cities. Unlike ordinary nuclear terrorists, the count does not want ransom; he wants revenge. So there is no negotiating with this fanatic. On June 1 at 8:00 a.m., a warning from the count is delivered to the United Nations building in New York City. The letter states that on June 5 at 8:00 p.m. the devices will be detonated and the cities destroyed. Your job is to find Count Stuportino and stop his diabolical scheme before time runs out and the devices explode.

In the style of Bob Blauschild's earlier hi-res adventure, *Escape from Rungistan*, *Critical Mass* is loaded with surprises and special effects. Animation and short arcade sequences abound, as do challenging puzzles.

New is the clock function. Actions take various amounts of game time. Each command alone uses up one minute. Walking takes one minute per screen; a taxi ride is an expensive thirty minutes. Sailing eats up thirty minutes at sea but only one minute near land. Nor does time stop when you just want to think; every ten real seconds costs a minute of game time. The clock looms over every scene, heavy with the threat of impending disaster.

The greatest chunks of time are spent flying about—to such places as Miami, London, Paris, Rome, and the Caribbean. Planes are notoriously late in *Critical Mass*'s world; your careful planning for a flight might well be for naught as you spend two hours waiting for your plane to depart.

From the beginning, *Critical Mass* is pressure. You're thrown into the thick of dangerous intrigue as soon as you leave the room in which the game begins. Almost as soon as the elevator starts to descend from the forty-seventh floor, it shakes and drops sharply, heading for the ground like a dead weight. Sabotage! Only your wits can save you from the impending crash.

In *Critical Mass*, Sirius takes the graphic adventure form to new heights. The game almost comes alive on the monitor screen. The blending of animation and arcade action into the traditional graphic adventure provides constant challenge and delight. RRA

Critical Mass, by Bob Blauschild, Sirius Software (10364 Rockingham Drive, Sacramento, CA 95827; 916-366-3228). $39.95.

KoalaPad. What is there about a bearlike marsupial that spends most of its time in eucalyptus trees eating leaves that makes it a likely symbol for a graphics tablet? Aside from its dietary preferences, it's cute and nonthreatening.

Graphics tablets tend to be big. But, where others are bulky in your lap, the Koala is comfortable in your hand. And where the most threatening thing about any piece of hardware is usually the price, the KoalaPad comes with a smaller tag than many software packages.

The KoalaPad is touch sensitive, so it doesn't require a special pen; your fingertip will do. Of course, that means you have to be careful to touch only one point on the surface. If you touch two points or more, the tablet averages them, which can have an adverse effect on the quality of your graphics work. KoalaPad plugs into the game I/O port, which is rare in the world of graphics input devices. Nevertheless, it is a considerable improvement over a joystick or paddles for graphics applications. In fact, it works with some software written for joystick and paddles, although it may make games harder to control.

There is software written especially for the Koala, including the *Micro-Illustrator* by Steve Dompier from Island Graphics, which comes with the pad. It is this program that makes the hardware immediately useful, apart from the great potential it has for games and educational programs.

And, in keeping with the koala image, *Micro-Illustrator* is fun and friendly. From a picture-based, Koala-driven menu, you can pick any of a number of drawing modes. Good use is made of the concept of rubber banding, in which you set a point on the screen to be the starting point of a line, one corner of a box, or the center of a circle, and then move the line, box, or circle around on the screen until it's where you want it. Of course there's a freehand-drawing mode too. All these things can be done with a cursor to draw thin lines, or you can use brushes to create different thicknesses and textures.

When *Micro-Illustrator* is compared with other graphics systems, it comes up short in two or three areas. The magnification mode preserves the hi-res colors but it's difficult to work with. It provides no higher resolution, in terms of points on the pad translating to points on the screen, than the normal full-screen mode. The fill routine in the package is effective, but it allows the use of only sixteen different colors. The freehand-drawing mode is fine for broad strokes, but not quite accurate enough for closely detailed work. It's good—head and shoulders above anything that uses a joystick—but not perfect.

Whatever its shortcomings, *Micro-Illustrator* is incredibly easy to learn and use. It just falls short of being a professional graphics tool, but it's terrific for kids or budget-conscious hobbyists.

And let not the limitations of the software be visited upon the hardware. Koala Technologies has other applications on the market and in the works for use with its pad. The pad itself is a marvel and the price is a breakthrough. It isn't difficult to imagine KoalaPad software to equal graphics systems costing considerably more. DD

KoalaPad, Koala Technologies (4962 El Camino Real, Suite 125, Los Altos, CA 94022; 415-964-2992). $124.95.

Legacy of Llylgamyn. By Andrew Greenberg and Robert Woodhead; scenario design by Robert Del Favero, Jr., Samuel Pottle, and Joshua Mittleman. The story begins many years after the heydays of Werdna and the Knight of Diamonds. The great heroes of those legendary adventures have been long gone. But, when disaster threatens the peaceful kingdom of Llylgamyn, it's the descendants of those valiant forebears who rise to meet the situation.

Mysterious aberrations of nature are devastating the countryside surrounding Llylgamyn. The wise elders of the Kingdom are baffled about the cause of the upheavals. When the runes are cast, it's prophesied that only an ancient mystical orb has the power necessary to solve the mystery. The task of finding the orb falls upon the new adventurers.

The youngsters, all level-one characters fresh from apprentice adventure training, don't start on the adventure without succor. In a mystical ceremony, the spirits of the characters' ancestors are called upon to pass on part of their skills and talents to their descendants.

Legacy of Llylgamyn does not stand alone in the *Wizardry* series. The ancestors of *Legacy* characters are your heroes from the *Proving Ground of the Mad Overlord* and *Knight of Diamonds*. A rite of passage

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confers hereditary ancestral titles and honors upon the descendants, as well as determining their beginning attributes. With these and a purse of several hundred gold pieces, the novice adventurers set out on their quest—after careful outfitting at Boltec's Trading Post, of course.

The quest for the orb is perilous. Long ago deemed too powerful for human use, the orb was removed by the great dragon L'Kbreth. L'Kbreth, one of the five children of the World Serpent and immensely powerful, has hidden the orb deep within her mountain lair on the outskirts of Llylgamyn. Neither good nor evil characters alone can prove worthy of receiving the orb.

Puzzles, riddles, and special items abound throughout *Llylgamyn*, far more than in *Overlord* or *Knight*. Often, the answer to a stumbling block on one level can only be found on a different level. The means of reaching the mysterious island on the first level eludes most characters for quite a while.

Careful mapping is a solid advantage in solving this difficult six-level scenario. Many important areas are hidden and seem inaccessible. Well-made maps gradually yield valuable clues. The third level of this game is one of the hardest to map in any of the *Wizardry* games. Besides working on the scenario, Woodhead and Greenberg have considerably enhanced the *Wizardry* gaming system. In their new graphics, they've managed to make *Wizardry* look like it's running on a Lisa. Dubbed Window Wizardry, the new graphic system enables the Sir-tech folks to show a full-screen dungeon; varied-shaped windows overlay the dungeon image to present information as needed. The hi-res images of many new monster types appear larger and enrich combat encounters.

Unfortunately, Window Wizardry extracts a price. It slows down the pace of the game. Movement through the dungeon is slightly slower—about as slow as the old dungeons with lomilwa in force. Worse, the combat buffer is gone; you can't give superfast combat commands anymore. "Fi fifi, parry pripri" becomes "fight . . . fight . . . fight . . ." and so on. You'll get used to it, and the game's worth it, but it's too bad. Still, the windows are neat, the full dungeon is pretty, and the scenario superior. The intermediate-level scenario is more difficult to solve and richer in character development than *Knight of Diamonds*, and, since characters begin as level-one people, it doesn't seem nearly as deadly.

Legacy of Llylgamyn is a worthy heir to the *Wizardry* mantle, but you may have to alter your perspective to solve its shifting patterns. RRA

Legacy of Llylgamyn, by Robert Woodhead and Andrew Greenberg, et al., Sir-tech Software (6 Main Street, Ogdensburg, NY 13669; 315-393-6633). $39.95.

Wiziprint. By Andrew Greenberg and Robert Woodhead. Ever been deep in a *Wizardry* dungeon, beset by a horde of monsters, and suddenly gone blank on what spells your characters can cast? You have no way to check for that information in the midst of combat. Panic sets in as the monsters sense leadership indecision and intensify their attacks. Many an adventuring party has been lost to just such a situation. Sometimes the right spell was available but forgotten in the heat of battle.

Sir-tech's *Wiziprint* prints out the character statistics of the members of a *Wizardry* party or even of an entire roster back at the Training Ground. The utility works with any of the three *Wizardry* scenarios: *Proving Ground of the Mad Overlord*, *Knight of Diamonds*, and *Legacy of Llylgamyn*.

The ability to print the whole roster is a great boon when you're at Gilgamesh's Tavern formulating a party or trying to remember which character back at the training ground has room to stash some of the good stuff your party gathered during an expedition.

The printout contains the full statistics on each character, including attributes, experience-point total, accumulated gold, possessions, magic power, and magic spells. As the party progresses through the dungeon, you can update the statistics by hand, thereby keeping an always current picture of the health and wealth of the party. Then you can decide better whether to fight, run, or return to the surface.

Wiziprint is a very handy utility disk for ardent *Wizardry* players. It is also an excellent means for comparing notes on characters with *Wizardry*-playing friends. Learn what you might have missed by comparing honors, rewards, and special items found in the dungeon. Does anyone have a Damien stone, or the Blade Cuisinart? RRA

Wiziprint, by Andrew Greenberg and Robert Woodhead, Sir-tech Software (6 Main Street, Ogdensburg, NY 13669; 315-393-6633). $24.95.

Disk-Lock. Sometimes, when it's important that you have a piece of data available, it's also important that some other person or persons (competitors, agents of foreign powers, the IRS, your spouse) not be able to read that information.

Enter data encryption. If you scrambled the data, it would be safe from prying eyes, would it not? It would also be safe from your own, which defeats the purpose. What if you could scramble your data in such a way that only you knew how to unscramble it? That's what *Disk-Lock* does.

A plastic-sealed, plug-in, slot-independent card for your Apple, the *Disk-Lock* contains a unique access code and all the necessary firmware to read data, scramble it, and write it back to disk under DOS 3.3. No extra software is necessary, so you can encrypt material from the keyboard or from within a program. Under the Pascal and CP/M operating systems, loading and saving procedures are different and the *Disk-Lock* requires special software on disk to encode Pascal or CP/M files. The disks are included.

The access code for the card is entered as a password. The password on each card is unique and unchangeable. To encode a file, you also need to enter a key of from one to eight characters, which can be anything you like. Once encoded, a file can be decoded by any *Disk-Lock* card, but only by means of the same key. This means you can send data over the phone or by mail on disk without worrying about its falling into the wrong hands. An eight-character code should be reasonably safe; using only numbers and upper-case letters, you can achieve almost three trillion combinations.

The encoding works on any kind of DOS file. In the catalog, encoding changes the file type to S, and decoding changes it back to whatever it was originally.

All in all, *Disk-Lock* is pretty easy to use. The only thing to be aware of is that the key code is sacred. If you type in the wrong code to decrypt, your file will become more scrambled, perhaps beyond reconstruction. If you forget the code you specified, you have as good a chance of getting your file back as anyone else. It takes a long time to type three trillion combinations. DD

Disk-Lock, Orange County Technology Associates (29 Tanglewood Drive, Irvine, CA 92714; 714-559-5381). $345.

Double Trouble. By John Besnard. The word *schizo*, literally meaning divided or split, usually carries a pejorative connotation. More often than not it's used to refer to an affective state that characterizes Western man in the late twentieth century. Observable manifestations include such things as indecisiveness masquerading as flexibility, callousness to others as a foil to one's self-depreciation, a propensity toward repeating behavior patterns that aren't ultimately in one's self-interest, and so forth.

Whew! If this is reality, wouldn't you rather be playing games?

Tut, tut—escape from this mortal coil (which may be best thought of as the consummate game anyway) will not prove so easy. This is especially true now that *Double Trouble*, another offering from the perversely inventive mind of John Besnard, has hit the software stands. With its mindless scenario, which is *de rigueur*, and well-executed animation, this game successfully crosses beyond the ken of the usual fast-action exercise of one's motor skills. Not only does it fulfill its promises—providing that sorely needed escape we crave from the mire of existence—it also somehow manages to reflect the essence of life's mire back to us, thus compelling us to reckon, in microcosm, with many of the very same ambiguities from which we would seek to escape.

This may sound like a contradiction to you now, but it's merely a taste of that particular brand of bidirectional doublethink you'll acquire after a few hours of playing two different games at the same time, viewed side by side on the computer screen. Schizo, you say? It makes for double challenge, double fun, yes, *Double Trouble*. (All chewing gum jokes are hereby dispensed with.)

It's been suggested that the optimum strategy for racking up the highest possible score in *Double Trouble* is to focus your left eye on the left side of the screen, shooting the balloons and rocks for points before they fall upon you, while at the same time keeping your right eye on the maze to the right as you move through it, grabbing candles to score. This is the wall-eyed approach.

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... sneers Meritre Tutankhamen from her ancient grave.

"Yes, you pathetic mortal, 'Tutankhamen'. Lady Tut, as you say. You may curse the day you ever heard the name, for I am back to repay a debt to all mankind — you included! Do not ask me "how", you cowering dog, but "when"...and I tell you only this: Before you can run, before you can hide, I am upon you. I am with you as you sleep and wake. As you drown in your own fear, I will be holding you under. Unless...

"Unless there is one among you with the cunning, wit, strength and valor to reach me in my chambers in the heart of my pyramid. Just one.

"Ha! I amuse myself with the thought. To imagine a mindless man being stung by my winged serpents and pet spiders...crashing through the dozens of trap doors...fighting off the spirits of my palace guard! And to see what happens when he tries to use his conventional weapons in the magnetic maze of my sarcophagus!

"No, goats do not yet fly and dogs cannot read. Nor shall you succeed. Yes...I will come to you in the night...in your worst nightmare of nightmares!"

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Assembly Language (48K); Requires an Apple II, II+, or IIe computer with DOS 3.3; Sound Enhanced for optional use with the Mockingboard™.

Apple II is a trademark of Apple Computer, Inc.; Mockingboard™ is a trademark of Sweet MicroSystems.
Lady Tut, ©1983 by California Pacific Computer Co.

Another tack is to direct your left eye to the right side, skillfully maneuvering a moth around the moving barriers that intervene as you attempt to score by reaching two lit candles, one at either end. Simultaneously, with your right eye concentrated to the left side, you must keep the little man on the platform that vacillates back and forth so that he can successfully grab the descending balloons and rocks for points. This is commonly known as the cock-eyed approach.

After you've made it through all these different challenges—played simultaneously, of course, using whatever strategy has worked best for you—one side of the screen will revert to a free-for-all shoot-out of those damn balloons and rocks. But now you've also got a time limit. How you did on the previous challenges determines how much time you get for this final and easier one.

Obviously this is no simple eat-the-dots-in-the-maze or shoot-'em-up-type game. Those will just seem like child's play to you after you've played *Double Trouble*. We're talking both hemispheres full-on here, sometimes even distinct neurons firing in parallel! And when you've got the hang of it, this is a sensation that really makes you feel good. It's a vacation from the usual patterns of linear thinking, dare say logical thinking, that one is taught to prize so highly. *Double Trouble*'s premise, having to play two games at once (often with contradictory objectives), simulates how real life operates more closely than any other game that bases its play on motor-skills coordination.

Playing *Double Trouble*, you come to experience the importance of making meaningful choices and the consequences of making bad ones. (Which side of the screen should you be watching?) Not to decide is to decide. Completely ignoring a game on one side of the screen may have disastrous effects on the outcome of an entire round. You may find that the best strategy for playing one pair of games is the worst for another pair that comes up. You'll discover that you can't rely on a single formula; different approaches have equal validity given the range of changing circumstances. Sure, it may seem schizo, but you may find it makes you aware of that little bit of schizo in you. And as you come to discover that it's intriguing, to appreciate the value of its benign aspects, your awareness may turn a potential handicap into an asset.

The bottom line is, boot the disk (Apple drives recommended), grab the joystick, and have more fun than humans should be allowed saying bye-bye to old thought patterns. Just wait—you'll find yourself really identifying with the little man on the moving platform. (With the joystick, you can even make him dance!) Don't be surprised by the way the game tallies your score; it has a logic all its own, and it too can be figured out.

While playing *Double Trouble* you may be inclined to conclude that this publisher has a flair for the diabolical; this thought will be dispelled forever when you do a double-take at seeing the game's price tag. Here's a real value—worth all the troublesome fun you'll have with it. TC

Double Trouble, by John Besnard, Bez (4790 Irvine Boulevard, Suite 108B, Irvine, CA 92714). $15.

RDF 1985. By Roger Keating. *RDF 1985* is the second in Strategic Simulations's innovative four-part series, "When Superpowers Collide." The Soviet Union, while advancing on the central front in Germany, has dispatched forces to the Persian Gulf. Its goal is to seize the Saudi Arabian oil fields and choke off NATO's vital oil supply during the desperate struggle in Europe and the North Atlantic. In response, the United States has dispatched the vaunted Rapid Deployment Force. The paratroopers, marines, and mechanized infantry of the RDF have a three-part mission. They must take the strategic air fields, seize the vital oil wells, and hold off the superior Soviet forces advancing from their bases in Syria. The war gets hotter still.

Soviet troop morale is very high, making them difficult to defeat. When a young Soviet soldier is inducted into the army, there is an emotionally moving ceremony before the heroic Stalingrad War Memorial. Towering above the soldier is an immense statue depicting Mother Russia. Her sword held high, she is prepared to throw back the invaders of another war in another time. The player is given two things, one very old, one very new: foot cloths, unchanged from the Napoleonic Wars, and a red belt buckle in the shape of a five-pointed star. The hammer and sickle on the buckle stand for the union of workers and peasants, the red for

WHEN YOU'RE BAN



the color of revolution, and the five points of the star for the five continents of Earth.

RDF 1985 is a battalion-level simulation of a conventional struggle between the United States and the Soviet Union. The struggle is for control of the strategic Persian Gulf and the vital Saudi Arabian oil fields. *RDF 1985* uses the basic game system developed for *Germany 1985*, the opener to this series. Having the manual for *Germany 1985* is essential for playing *RDF 1985*; it contains the rules governing commands and game play. *RDF 1985* contains only a rule-book supplement that outlines the game's scope and strategic setting. The command structure of the two scenarios is identical and the graphic displays employ similar unit counters and functions with the same scrolling technique. *RDF 1985* improves on an already impressive game design, with a system that's been updated to use global command keys; you can update your *Germany 1985* scenario directly from the *RDF* disk.

With the exception of two new unit types, airborne and naval, *RDF 1985*'s features are identical to *Germany 1985*'s. The computer can ably command either the United States or Soviet forces. The innovative concepts of divisional integrity and variable movement as well as all the conventional elements of morale, fatigue, variable terrain, and movement remain. Several levels of difficulty and hidden movement may be selected. There is no nuclear option.

There are several automatic commands to help deploy forces and allocate fire support. The terrain of the Saudi Arabian peninsula dictates dramatically different tactics than the central front in Europe. The Sabkhah salt flats, oasis, and deserts provide for rapid sweeping movements reminiscent of the North African campaigns of World War II. *RDF 1985* is a game of tactical movement and strategic possession.

Victory belongs to the side that can take and hold the strategic air bases and oil fields. The RDF is more than a match for the first Soviet forces dispatched to the region, due to its superior firepower and air support. While vital reinforcements approach by sea and airlift, the Soviet forces grow stronger. Soon the RDF is fighting for more than the barren sands and oil of Saudi Arabia—it's fighting for its life. Can the RDF hold on until reinforcements arrive, or will NATO's vital oil reserves fall under Soviet control? A few hours with *RDF 1985* will drive home just how vulnerable the Persian Gulf really is and how close *1985* is to reality. WHH

RDF 1985, by Roger Keating, Strategic Simulations (465 Fairchild Drive, Suite 108, Mountain View, CA 94043; 415-967-1353). $59.95.

Axis Assassin. By John Field. Perhaps the best part about *Axis Assassin* is that it doesn't try to fool you. "The Army of the Master Arachnid," the packaging reads, "it attacks without reason." Isn't that what most of these blast-away games are about—fighting for the sake of fighting?

Many games will try to trick you into thinking there's an actual point to the game by including a story line. Not this one.

Axis Assassin is obviously patterned after the coin-op game *Tempest*, which bred such Apple versions as *Tunnel Terror* and *Tubeway*. This time, though, author John Field has added a few things not found in either game. Nor even in *Tempest*.

The screen shows you a 3-D perspective of your fighting area (grid). You're at the near end, firing toward the opposite end at the Master Arachnid's fighters. Spinners build webs that can inhibit your horizontal movement if they reach high enough. So far, not much is different.

A new touch in *Assassin* is that in addition to moving across the top of the grid you can move down it. From that position, you can continue firing toward the bottom, or you can turn around and shoot behind you.

Another new aspect of this game lies in its requirements for gaining that coveted extra ship (assassin). There are no minimum points to achieve in this game; if you really want that extra ship, you're going to have to fight for it. You can try for one at any time between screen advancements by timing exactly the detonation of your pulse bomb.

Setting off the bomb takes you to the Master Arachnid's nest, where he is holding a previous assassin captive. Here, you have to maneuver your ship a la *Asteroids*, fend off fighters, break through the Master Arachnid's nest, and link up with the captive assassin. The risk here is that, if you're unsuccessful, you will lose the assassin you sent in to the rescue. Good luck. Lots of it.

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Gamers who have grown accustomed to the vast flexibility that computer games offer might feel limited by the game's difficulty-level selection. When the game boots up, you're allowed to select one of three degrees of difficulty, but if you don't choose within about ten seconds the game will choose for you. Next, you're allowed to pick your starting grid and zone from twenty different grid shapes and five different zones.

You're given this much flexibility only when you first boot the disk. After that, you're only allowed to choose a grid and zone that's as high as or lower than the one you last completed.

But these frustrations are mostly the result of our having gotten used to games that are so generous as to give us difficulty options in the first place. You won't find such benefits in the arcades too often.

Such annoyances are trivial. The goat-getter is *Assassin*'s high-scores list. "Great score. Enter your initials," you're told. Of course it's a great score; all the rest of the scores are zeros. *Assassin*, you see, doesn't save any scores to disk.

Fortunately, none of these shortcomings takes away from the game itself, which is quite enjoyable. The problem with *Axis Assassin* is that the extra features—difficulty selection, grid selection, and high scores listing—which are supposed to make us like the game more, fall just short enough to the point of being either unnoticeable or noticeable in such a way that we like the game less.

Ignoring these aspects of the game and focusing on the game itself are the keys to enjoying *Axis Assassin*. MTV

Axis Assassin, by John Field, Electronic Arts (2755 Campus Drive, San Mateo, CA 94403; 415-571-7171). $35.

Mach III Joystick. The first thing you notice about the Mach III—it literally sticks out like a sore thumb—is the oversized stick with the button on top. There are still two buttons on the base, one of which duplicates the function of the one on the stick; but having one stick-mounted makes it a more convenient fire button for some games.

The next thing you notice is that the stick is too small to grab in your fist and still press the button with your thumb. There's a reason for that. All too often, the temptation with joysticks with buttons on top is to wrest them back and forth with all the strength in your arm as if you were coming out of a power dive. This tendency seems to be related to watching *Battlestar Galactica* too much as a child.

Apple games don't tend to work too well when this method is used, but it's not the joystick's fault so much as it's your arm's. The joystick is built to detect differences in position of less than a quarter of a degree of arc. The arm isn't designed for control this fine, but the fingers are. All of which explains why it's best that the Mach III stick is too small to hold in your fist. With a little practice, it becomes natural to use the index finger on the fire button and grasp the stick between the thumb and the other fingertips.

The artistically inclined may appreciate the fact that the Mach III seems to have better control over a hi-res cursor than some other joysticks, although this may just be a result of increased leverage from the longer stick. The button, too, is useful to anyone using a graphics program that requires both joystick and keyboard input.

Aside from all that, the stick seems to have all the features associated with the best of its competitors. It offers trim adjustment slides for both axes, a feature that seems to have become standard these days. The Mach III's are inset slightly to make it harder to move them accidentally during more strenuous gaming sessions. The pins on the plug, traditionally a weak point on many joysticks, are less susceptible to bending and breaking than you might expect.

The self-centering mechanism can be defeated by turning four small knobs on the bottom. Not only is this a very reliable method of switching, but it also allows individual control of all four directions. If, for instance, you wanted to use the joystick in a game designed for a paddle, you might make only the unused axis self-centering.

The only potential problem worth mentioning is that the placement of the buttons on the base might prove a bit awkward for left-handers. But the road to a better joystick is paved with little improvements, and Hayes has managed to avoid most of the potholes its predecessors have hit. DD

Mach III Joystick, Hayes Products (1558 Osage Street, San Marcos, CA 92069; 619-744-8546). $49.95.

Pinball Paradise. By Jim Stockla. The thing about BudgeCo's *Pinball Construction Set* is that it's so much fun building and play-testing pinball games, you don't feel like playing the finished product; you'd rather go on and build another game.

If that's truly a problem, then the solution is here. Golden Knight has put together eight pinball games (four to a disk) constructed with BudgeCo's software toy. Eight games you can enjoy because you didn't build them yourself.

Pinball Paradise can be thought of as a sales tool for the *Pinball Construction Set* more than as a product from Golden Knight. Each game shows off some of the creative things you can do with the *Construction Set*, and they're shown off well. *Zontar*, for example, contains a pinball game within a pinball game. Once the ball drains from the first game, it goes into the ball launcher of the second, smaller game. Nice touch.

The only thing missing from *Pinball Paradise* is the elaborate graphic design that's possible with the *Construction Set*. Game logos are nicely done, but each game has much the same color scheme as the next.

If you're a high-score fanatic, these games are your ticket to glory. In *Power Play*, for instance, it's not hard to score in the millions, racking up hundreds of thousands in bonus points.

To list and describe the nuances of each game would be lengthy and take away from the fun of playing. Suffice it to say that author Jim Stockla has taken a tool and stretched it to its near limits, giving us eight pieces of art that resemble original programming efforts. MTV

Pinball Paradise I and *II*, by Jim Stockla, Golden Knight Software (11 Lark Lane South, Huntington, CT 06484; 203-929-6004). Each disk, $24.95.

Power of Words. By Peter Funk. Okay, all you word fiends, philologists, and vocabmeisters, here's the bad news. You'll not find this program a galvanizing medium for advancing your study of abstruse neologism—for a very good reason. *Power of Words* is a practical-minded word builder geared to high-school-through-college-level vocabularies. It isn't designed for folks who have the dictionary memorized.

Now here's the good news. Anybody can enjoy and learn from the *Power of Words*. The ten vocabulary games on two disks accomplish a lot more than dredging up obscure words, throwing them at you, and informing you whether you guessed right. Most of the terms are used regularly in newspapers and magazines and are important in understanding your world, not Webster's.

No lucky guesses are passed over, either. You don't learn that way. After choosing a short definition from a pick of four, you're treated to a full dictionary definition so you know *why* you made the correct choice. Then the word is used in a sentence and antonyms and synonyms are provided and defined. If none of this stumps you, the word roots might.

For example, you might know what *caucus* means, but unless you're Pocahontas, you probably don't know that the word is derived from the Algonquin term *caucauasu*, meaning "counselor."

Power of Words has some nifty little features. The screen is attractive and the program is even considerate. For instance, after defining a word, it might introduce another that you could mix the first word up with. Both words are clearly defined, and confusion is dissipated. And *Power of Words* won't let you pronounce our language wrong if it can help it. Each word is also spelled phonetically.

Not everything about this program is straight-faced, however. Somewhere in his long career of writing "It Pays To Enrich Your Word Power" for *Reader's Digest*, Peter Funk discovered the educational value of humor. That shows in one of the program's strongest assets: Cute, smoothly animated children in funny hats demonstrate words so graphically and humorously that you're bound to remember their meanings. For example, while demonstrating *fetish*, "an overpreoccupation with a subject," the little byte boy is shown dreaming of *Pac-Man*; and *oblivious* finds him playing ball at the edge of a cliff.

When you finish the words in one game, the program gives you your score, your percentage of words defined correctly, praise if you did well, and encouragement even if you didn't. Then, after an optional review, it's on to the next game. The sections are all basically the same (except for the political one), and this can lead to tedium if you know most of the words; but the cute figures help liven things up when momentum lags. Now, if only Funk would include an option for the more advanced students to skip over familiar words. . . .

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Power of Words is designed for both classroom and home use and includes a teacher's manual, worksheets, and a final quiz. Educationally it's great, and the humor, sound effects, and amusing graphics can probably reach students in a way no dry definition could. In terms of entertainment value, it's not bad either.

The program even offers something to the most blase wordaholic—a chance to show off. Although you might not find the games piquant or challenging enough, your less verbal friends will be amazed by your daring brilliance and eclat as you get every word right. And if they ask you about *caucauasu*, tell them that you knew the definition beforehand. Of course. (P

Power of Words, by Peter Funk, Funk Vocab-Ware (4825 Province Line Road, Princeton, NJ 08540: 609-921-0245). $49.95.

In Search of the Most Amazing Thing. By Tom Snyder. This is a learning experience of the first magnitude. Geared for kids from ten to fifteen years old, the program seeks to develop social skills in an age group that is struggling to define such values. To succeed in the quest for the Most Amazing Thing, players must discover how to interact with alien cultures; trading, reading sign language, exchanging currency, and reading maps are among the skills introduced.

The game's journey begins in Metallica, where Uncle Smoke Bailey lives. He tells stories about his successful search for the Most Amazing Thing many years before, and how he finally lost it. He asks the player's help in recovering this artifact, which may hold the secret of the meaning of life.

Uncle Smoke offers the use of his B-Liner for the trip. The B-Liner is a combination of a hot-air balloon and a dune buggy. The first task involves outfitting the balloon with all the essential equipment. The Galactic store has lots of items for sale, but the player needs chips to buy them. Uncle Smoke gives the player items, gathered on his previous trips around the world, to sell to the finicky aliens at the Metallican Auction. It takes shrewd appraisal of each item and careful sizing up of the bidders to sell successfully. After each sale, you must go back to Uncle Smoke for another item to sell, until you've enough chips to buy what you need.

The quest begins when the B-Liner is fully loaded and you've learned all you can from Uncle Smoke. You travel around the Darksome Mire, outside the underground city of Metallica, in the B-Liner or by jetpack. During your travels, you must find fuel for the B-Liner and drill for it; conveniently, the back platform of the B-Liner is an oil-drilling platform. You need food, too—and you can get it just by shaking the popberry trees.

Twenty-five small countries make up the land of the Darksome Mire, each with a unique culture including its own language, currency, and taste in music. Music is the lingua franca of trading. With one of the computer modules you get at the store, you can compose songs, simple or complex, long or short. When you figure out what type of music a culture likes, you can design a piece of music its people will trade for.

From a special computer dictionary, also available at the store, you can learn the sign language of each culture—learn how to say, "I am a friend," or, "Do you want to trade?" If you can win the confidence of the culture, its people will sell you valuable clues to the location of the Most Amazing Thing.

Tom Snyder's simulation of flying a hot-air balloon is superb. Winds of varying strengths and directions blow at various altitudes. Using the burner carefully to maintain the proper altitude conserves fuel and keeps the balloon on course—usually. Watch out for sudden storms that can blow the craft off the map into the "Outbrak" country. Make sure you have gotten an autopilot at the store or the B-Liner may be lost forever!

The beginning of the game is very, very slow. Getting items one by one from Uncle Smoke, auctioning them off, and buying supplies takes a long time. Young children (Snyder tests his games extensively at his school) become absorbed in the repetitiveness and in the challenge of outfoxing the aliens at the auction. But it's boring for adults. So help the kids get started, then go do something else for a few hours. The rest of the game is fast-paced and full of challenges for all ages.

Overall, *In Search of the Most Amazing Thing* is a rewarding program on many levels. Tom Snyder continues to write fine programs that teach living skills far beyond those implied in the term *educational*. RRA

In Search of the Most Amazing Thing, by Tom Snyder, Spinnaker Software (215 First Street, Cambridge, MA 02142; 617-868-4700). $44.95.

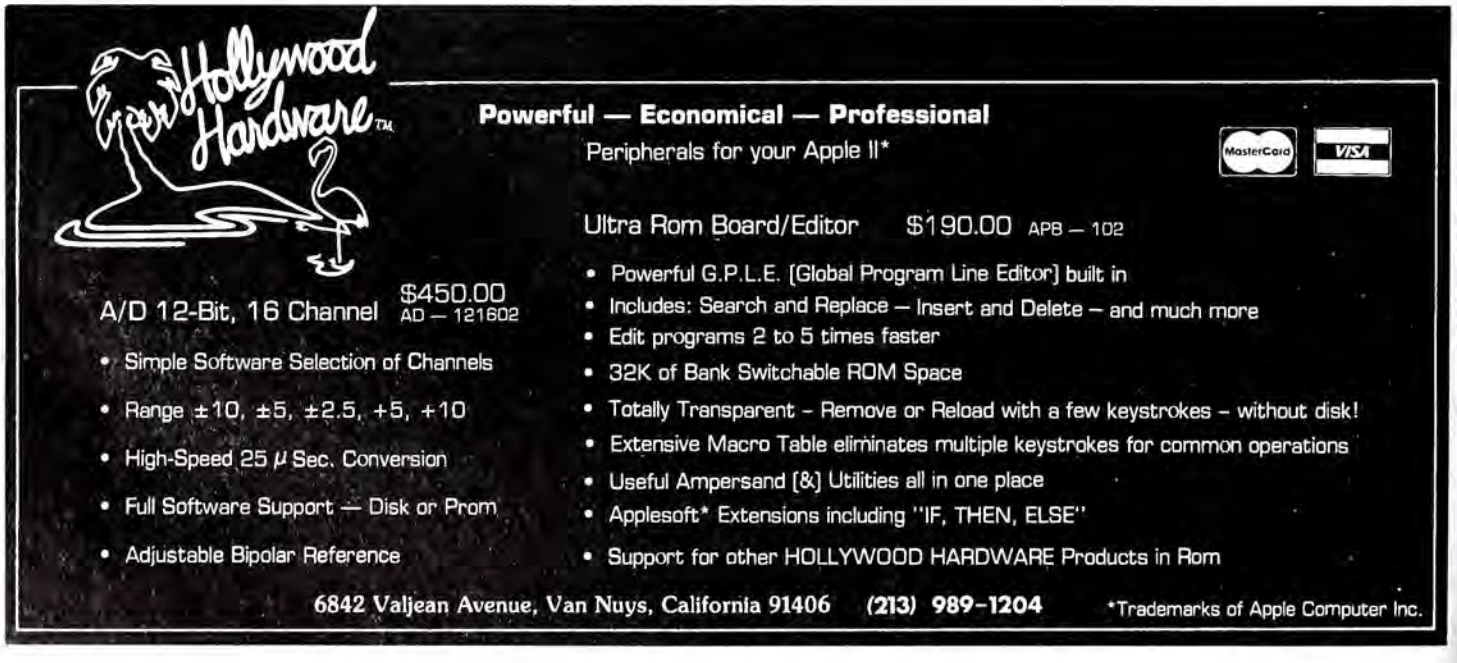
Hands On Basic. By Neil Bennett, Ph.D. This is an odd one. It's a special version of Basic, designed as a training language for beginners. It has an amazing collection of built-in conveniences—but it has several important limits and restrictions as well.

On the plus side, you get an awesome array of tools for seeing what goes on in a running Basic program. You can interrupt a program at any point to find what it's doing with loops and subroutines; step it forward at various reduced rates, with a display of what's happening at every step; set and remove breakpoints; and so on and so on.

The system does its error checking on input, so it won't let you enter a line with a syntax error in it—and this is where the problems begin: The system is very fussy about what it will accept, and it doesn't go by the same rules as Applesoft.

For example, *Hands On Basic* requires a space after any command word and doesn't permit spaces in an arithmetic expression; Applesoft doesn't care. *HOB* allows only single-letter string names (A$ through Z$), and strings can be only 18 characters long; in Applesoft, a string can be up to 255 characters long and so can its name. And so on.

To sum up, the idea was lovely, but the result leaves something to be



Nestar Plan 4000. The refinements in microcomputer hardware and software over the past two or three years have caused the microcomputer to expand its horizons from the confines of the hobbyist's den into the more affluent world of corporate midmanagement. This has brought a lot of attention among system developers to the problem of maintaining an efficient library of software and data files that these micros can share without requiring the endless shuffling of floppy disks.

The Nestar Corporation has come up with a rather impressive answer: its Plan 4000 System, a network system that allows up to 255 micros—Apple IIs, Apple IIIs, and IBM pcs—to share the same mass-storage devices! With a price tag of close to thirty thousand dollars (depending on the configuration) it's not for every Apple or IBM user; but for a company that is serious about combining corporate-sized data-storage capabilities with the ease of microcomputers, it might be a dream come true.

The heart of any of the various micronetwork systems is the file server, a microcomputer system designed to communicate with user systems on the network and manage their storage on the system's mass-storage devices. The Plan 4000 file server's components are a Codata M68000 board with 16MHz clock and 256K of onboard RAM, a peripheral interface card (PIC), and up to three internal line isolation devices in a multibus card cage. Running on this hardware is the Merlin operating system and UCSD Pascal IV.0. The actual file server software that handles disk storage for the users, as well as other functions such as peripheral sharing, is written in Pascal. In fact, it was adapted from the earlier Cluster One version, which was written to run on an Apple II.

The file server handles two types of mass-storage devices: hard disks and tape drives. The system can use either 60-megabyte or 137-megabyte hard disks. It can handle up to four of either type, but it cannot currently mix the two types. So, on a four-137-megabyte-disk system the total storage is 548 megabytes, or about the same as 4,281 Apple disks.

On a fully expanded 255-user system, that's the equivalent of 16.8 disks per user.

The file server handles several types of files on the disk: directory and subdirectory files, binary files for the file server, and virtual disks for the user systems. The virtual disks can be Apple II DOS 3.3, Apple II Pascal 1.1, Apple II CP/M, Apple III SOS, IBM PC DOS 1.1, IBM PC UCSD Pascal IV.0, or system-independent text files. Any virtual disk may be mounted on any virtual drive in any operating system, so transportability of information is totally dependent on the operating system being used. This means that the two Pascal systems and Apple III SOS may easily share each other's text files and recompile programs written on other systems. For systems that do not have compatible file structures, the system-independent text files provide a means for an operating system to write data that may be read by another operating system.

The system's tape backup facility can be either a twenty-megabyte or forty-five-megabyte tape drive. The Plan 4000 has a software package called the *Incremental Archiver* that can back up the entire hard disk or backup by files used since the last backup. The system also provides the ability to boot the file server from tape in the event that the operating system becomes crashed on the disk. If the file server is outfitted with a Hayes Smartmodem, Nestar can run remote diagnostics on the system. This feature could save a lot of downtime for a company with a trained technician and adequate replacement parts on hand.

The Nestar Plan 4000's topology (physical link) is a ninety-two-ohm coaxial cable connecting the system's line isolation devices (LIDs) and user systems. These LIDs provide isolation that will keep a bad card from hanging the entire system. There are two types of LIDs, active and passive. Active LIDs can be internal or external to the system's multibus card cage. The internal ones have ten ports for connecting to users and external LIDs. External LIDs are standalone boxes that can have eight or sixteen ports. These active LIDs can drive two thousand feet of coaxial cable. The passive LIDs are simply voltage divider boxes that provide two isolated ports. These can drive only two hundred feet of cable.

The Plan 4000 is a synchronous system that passes data at 2.5 megabytes per second. To reduce capacitance on the line, the 4000 uses a dipolar signal. For station recognition, the system uses a token-passing scheme instead of polling or interrupts.

This method provides a significant time advantage over a straight polling system, which would have to ask the using system if it was through transmitting and then give the next system permission to transmit.

When a micro on the net is turned on, it looks for a token for 68 microseconds. Then it jams the system the next time the token is put on the bus. The file server recognizes the jamming signal as a new system on the bus and remaps the system. During creation of the map, each system is given 68 microseconds to respond. If it doesn't respond, it is not included in the map. So the maximum time for polling for all 255 possible systems on the net is 17.34 microseconds.

To tie into the system, IBM pcs and Apple IIIs must boot a special disk that activates the Nestar interface card. The Apple II series computers will boot directly from the hard disk as long as the Nestar interface card is in a slot with a higher number than any slot containing an Apple Disk II or equivalent interface card.

The network commands allow the user to create, delete, mount, and unmount virtual disks on virtual drives. In Apple's DOS the user can use drives numbered 1 through 255 in the slot that the interface is in as well as drives 1 and 2 in slots with real disk controller cards. The other computers and operating systems recognize virtual drives in ways that are consistent with their own conventions. There are also network commands for listing directories and subdirectories and performing other housekeeping functions.

All files on the system, whether directories, virtual disks, or any other type of file, are specified by a path name. The first element of the path name specifies the disk on which the file resides. On a one-drive system this will always be /Main. Within the directory of /Main, subdirectory files can be specified, reflecting the use of their contents. Some examples of subdirectories: /System (for system utility programs); /Lib (for libraries containing sub-subdirectories of applications programs); and /Users (for users' directories). The next level of the path name could be used to specify the type of computer, operating system, or anything the system manager desired. So, a complete path name, such as /Main/Users/Joe/Pascal, could specify a Pascal disk in Joe's personal sub-subdirectory in the user's subdirectory on disk /Main. /Main/Lib/Apple2/CPM/WS could be used to specify a *WordStar* disk in the CP/M sub-sub-subdirectory of the Apple II sub-subdirectory in the library subdirectory on disk /Main. Nestar offers a four-day hands-on training class in Palo Alto, California. It can take most of the four days just to figure the system out; so if it seems confusing at first glance, don't worry—it is.

A company implementing the network doesn't have to send to the class every person who's going to use the system. Nestar also offers an advanced-applications class. The company can send one or two people to the two classes (preferably people with Pascal programming experience), and they can learn to tailor the file-server software to the company's specific needs. They can write a turnkey system that conceivably could ask the user for an access code and then offer a menu of applications programs, with the file server taking care of the mounting of all the virtual disks the user might need. Then the *Net* program doesn't have to be available to the users. RR

Nestar Plan 4000, Nestar Systems (2585 East Bayshore Road, Palo Alto, CA 94303; 415-493-2223). Minimum package (including 60-megabyte hard disk, 45-megabyte tape drive, and support for Apple DOS and Apple Pascal): $25,000. Expanded system (including 137-megabyte hard disk, support for DOS Pascal CP/M, two extra LIDs, electronic-mail software, IBM Pascal and PC DOS): $40,000.

desired. Even with all its impressive capabilities for self-analysis, *Hands On Basic* is too limited to be very useful as a programming language, and too different from Applesoft (or any other Microsoft-type Basic) to be a great deal of use as a trainer. JR

Hands On Basic, by Neil Bennett, Ph.D., Edu-Ware Services (Box 22222, Agoura Hills, CA 91301; 213-706-0661). $79.

Pentapus. By Jeremy Sagan. For those of you who have been simply dragging yourselves through each successive pointless day of a dully meaningless existence, having given up all hope of ever seeing a free-floating version of *Space Invaders*, the wait is over.

Pentapus understands your long-suppressed desire to take your lone, tiny, valiant cannon from its vulnerable position scooting back and forth at the bottom of the screen, wrench it free, fly up there, and really mix it up with the invading cheesenips from the planet Chowdown. The price of this mobility is a joystick, plus the sacrifice of the enchantment that distance lends—you don't get to stand back and blast away; you now have to get right on top of the enemy. Your opponents—assorted Drangels, Eagulls, Nagas, and Whirrs—do not feel compelled to maintain close-order drill while you're waling on them; they break ranks immediately and the whole thing degenerates into a rather uncivilized free-for-all. Occasionally, just for laughs, a thundercloud creeps in to the galactic melee and throws around some lightning bolts. The cosmos, as we've come to know it, was certainly nothing like this.

Gone is the cannon (or "tank," in game programmer's parlance), and in its stead is a set of framed crosshairs—a floating window of vulnerability, if you will. And that window is pretty vulnerable. You can only take so many hits on your frame, growing progressively thinner as it's whittled away, before oblivion takes you. The push of a button enables you to shrink your exposed area from bay-window to port-hole size, but this, alas, is allowed only as a temporary maneuver, and you'll spring back to your full "please shoot me" proportions at any moment, usually a bad one. Your shots are monitored, and using them up indiscriminately uses you up. Every four levels (twelve to a game), you will gain audience with the heavily defended cosmic mollusk of the title. Take him out three times and the universe is your oyster.

The graphics are . . . plentiful. The ambition behind them is obvious, but where one could get by with animating a character on a black square and moving it across the screen in most games of this type, where no two characters ever meet, the flickering and fading in and out in *Pentapus* is noticeable as characters are continually passing each other. The sound is as plentiful as the pictures. It has an off option, but if you are drawn to this game in the first place you'll probably leave it on. AC

Pentapus, by Jeremy Sagan, Turning Point (11A Main Street, Watertown, MA 02172; 617-923-4441). $29.95.

The Graphic Solution. Wiping the nervous perspiration from your brow, you consult your watch for the fifth time in as many minutes; the board meeting begins in ten minutes.

Yesterday, Davis, that cutthroat from the accounting section, delivered a presentation that was just a bit too well received. Imagine using both slides and printouts; that guy must really want your job. Well, not this time, old boy!

Entering the panel boardroom, you can see the great oval conference table surrounded by the dozen venerable men in blue upon whose whims your career, your very corporate survival, depends.

You move, with far more confidence than you actually possess, to the Apple computer waiting at the end of the table. Opening your briefcase, you remove a disk from within it and boot it up.

Within seconds, all movement within the boardroom is stilled. Your voice is steady, and your audience enthralled. No mere slide show and unadorned computer printout for this elite group. No way! Far more graphic than any static slide show could ever be, your presentation uses a state-of-the-art visual aid: *The Graphic Solution*'s computer animation.

Computer animation has been around for a long time, and has, in fact, become a fundamental ingredient of one of the world's fastest-growing new industries: the video arcade. As more and more computers are finding their way into small businesses, for applications never before suspected (often creating entirely new businesses along the way), the ability to create better and more graphic business displays and presentations must become just as accessible.

The Graphic Solution is designed to address that need. It's an animation package that enables Apple users to create exciting computer-animated sequences frame by frame. Each frame, created individually either in hi-res-graphics mode or in the lo-res-magnified mode, may be played in sequence and modified for image continuity and pace. A nice touch is the capacity whereby each frame can be assigned its own display speed for slow motion and freeze-frame effects.

The Graphic Solution offers many advanced capabilities: animation and scrolling of much larger images than most graphics packages can handle, single or multiple frame insertions; top quality, flicker-free animation over fully colored backgrounds; and use of mixed text and graphics so that you can write and animate custom fonts on the same screen with film sequences.

The demo mode of *TGS* shows, quite impressively, how you might apply these techniques for interactive graphic demonstrations, animated flow charts, moving graphs, and time-motion relationship studies. A tutorial provided in the *TGS* manual is well written and easy to follow.

The Graphic Solution isn't intended for every graphics application. There are no readily apparent collision tables or status flags for arcade-type applications, nor is there a provision for real time manipulation of the sequences under joystick, paddle, or keyboard control.

However, for presentations, demonstrations, title pages, and a wealth of other applications in business, education, or sales, *The Graphic Solution* may be just the solution you need to keep that competitive edge you gained when you brought home your first computer.

Better luck next time, Davis! HAS

The Graphic Solution, Accent Software (3750 Wright Place, Palo Alto, CA 94306; 415-856-6505). $149.95.

Delta Squadron. By Gilman G. Louie. *Delta Squadron* simulates a tactical space war in the far future. The scenario is based upon a fictitious Legion Alliance in rebellion against the Cetusites battle station. It seems that this impregnable battle station has one vulnerable spot, a small power induction inverter at the end of a long trench that runs along the circumference of the battle station. (You know, they really ought to make a movie like that. . . .)

The player, as alliance squadron commander, must lead a small group of fighters down the length of the trench. The desperate mission is to bomb the power inverter while the Cetusites launch fighters to intercept the squadron. Succeed and the Alliance lives; fail and it's good night Irene.

If the *Star Wars* idea is familiar, the implementation is anything but. Hi-res 3-D graphics are used extensively throughout the game. You can look at unit types in 3-D while they rotate on all three axes. Plus, you can see three aggregated views of the trench at different magnifications, offering tactical and strategic views. Graphics are fast and colorful.

Victory in *Delta Squadron* is determined solely by your ability to attack and destroy the power inverter. In the guise of the evil Cetusites, the computer will launch numerous attacks, often in formation, on the Alpha and Beta Attack fighters. Fortunately, auto move of Alliance fighters is provided.

Tactics in this game are surprisingly sophisticated. Not only do vessels possess varying capabilities, but individual pilots vary in experience and ability. Some of the fighters have to be assigned to fly escort for the remaining attack vessels. Deploying fighters and selecting the optimum strategy to penetrate the Cetusite defenses offers no small challenge even in the simpler scenarios.

Game play, which occurs in discrete game turns between the player and the computer, may last up to three hours with provision to save one ongoing game to the game disk at any time. *Delta Squadron* offers nine separate scenarios, ranging from mildly difficult to mildly impossible. A minor annoyance is the necessity to readjust the location of graphic arrows to specify the proper trench location at higher magnifications.

Nexa, although a new company, has the distinction of being the first to dare to require 64K for a game. Nexa's made good use of it, and it backs its product with very good customer support—including a special telephone number to answer questions concerning game play. Of all the *Star Wars* simulations, *Delta Squadron*'s hi-res tactical combat comes closest to capturing the feel of piloting a trusty fighter down that well-known trench. May the Force be with you! WHH

Delta Squadron, by Gilman G. Louie, Nexa Corporation (Box 26468, San Francisco, CA 94126; 415-387-5800). $39.95.

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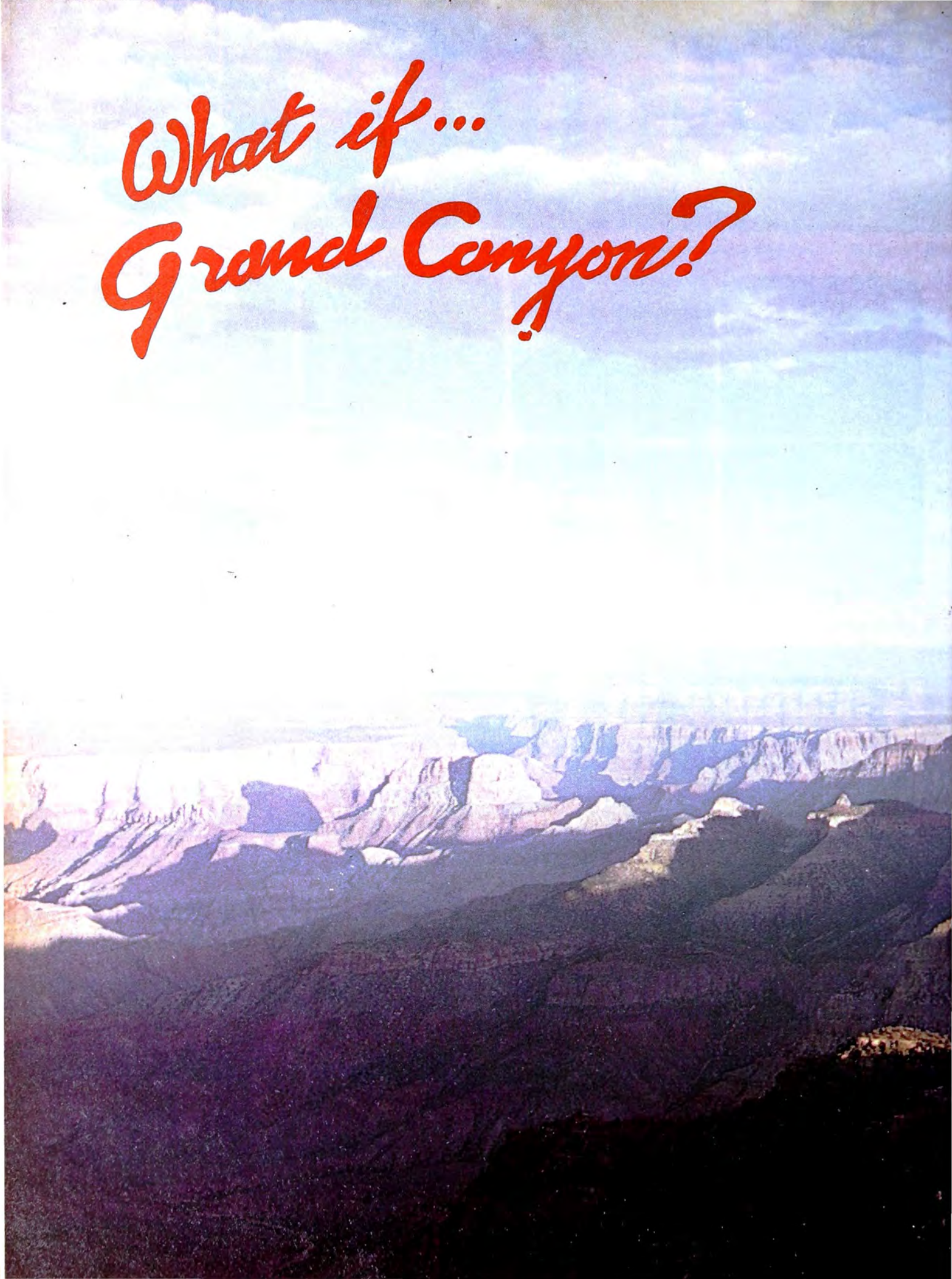
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What if... Grand Canyon?



Post Card

A Spreadsheet Template for Summer Travelers

By Scott Swords

Have you ever returned from a long vacation and wondered what the distances were between various points on your trip or how far different points you visited were from your starting point? Have you been curious to know how much time you spent at stops, the elapsed time between points, or how many miles per hour you averaged with stops and without? Have you wished you could determine your fuel efficiency? Calculating this information would be time consuming, even if you used a calculator. For example, time expressed in hours and minutes would have to be converted to a decimal equivalent, and that alone would take some time for a long trip with many stops.

So rather than trying to figure out all these things using a calculator, why not use your Apple and your favorite spreadsheet program to create a travel-log template in which to collect the necessary data? Then, by entering this data into a second template, you can obtain a rather interesting report. This report can then be used in future trip planning.

In the course of this article, we'll develop both of these templates. The conventions and command structures we'll refer to and use are those employed



Photo by Rik Ergenbrite/West Light

in *VisiCalc*, *MagiCalc*, and some other spreadsheet programs. With a bit of effort and ingenuity, however, you can create these same basic templates using other programs.

Keeping Track—Template 1. The first template gives you a form (reproduced on this page) on which to enter trip data while you're on the road. Sure, you could use a plain old piece of paper instead, but we're in the computer age—use your Apple and have some fun! Then, when you get home, you can enter the trip data you've recorded into the template as well.

As you'll see when you begin creating it, this template consists only of labels. Entering them should be easy, so we won't go into a step-by-step explanation of it here. Feel free to experiment and to redesign this template any way you would like; just be sure not to leave out any of the requested data.

When making entries in the Time field, be sure to use military time. This is important for calculation purposes. Here's an example of military time: 9:00 p.m. = 21:00 hours; 2:00 a.m. = 2:00 hours. In other words, you are using a twenty-four-hour clock. One word of warning: Entering times for travel that takes place after midnight must be done in a special way.

Suppose you were to leave home at 9:00 p.m. and arrive at location #2 at 2:00 a.m.; how would you enter these times? If you were to enter your leave time as 21.0 and your arrival time as 2.0, the program would calculate an elapsed time of nineteen hours on the road. You only traveled for five hours, though. There's an easy way to prevent this from happening. When you're recording information about travel that happened after midnight, just remember to enter your arrival and leave times as numbers greater than 24. In our example, then, you'd enter 2:00 a.m. as 26.0, since two in the morning is two hours past midnight.

If you're reading closely, you should have noticed that a period was used in place of a colon to separate the hours from the minutes. This is a good habit to get into now; when you go to enter your data into template B, the period is mandatory. The reason: calculation purposes.

When entering your mileage, enter the figures from your car's odometer—not those from the resettable trip odometer.

Enter stops #1 and #2 on a Leave line under the line for that stop's arrival time.

The Big Report—Template 2. If your spreadsheet program allows variable column widths, by all means take advantage of them. Otherwise, the second template (a filled-in, finished version of which is shown on the facing page) will not fit onto a standard sheet of 8½-by-11 paper. If you do have this feature, then set columns D, F, K, O, and P to a width of 0 after you've entered all of the formulas.

The formulas in the columns just mentioned are used to convert hours and minutes to their decimal equivalents (and vice versa) and for the calculation of miles per gallon. Therefore, it's not necessary that these columns be visible either on the screen or on your printout. By setting them to a width of 0 and setting your printer to print 17 cpi, you'll be able to fit the model onto an 8½-by-11 sheet.

The only columns into which you'll be entering data are columns A, B, C, E, H, Q, and R. If you do not use all of the rows for a day, then all succeeding rows will be filled with zeros. This is controlled by the IF statements and therefore eliminates the ERROR messages and errone-

STOPS: 1 FOR GAS
2 FOR OTHER

FROM:

TO:

ROUTE:

COMMENTS:

DATE	LOCATION	MILITARY AR/LV	TIME	STOPS	MILE-AGE	GAL	COST

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[ ] Apple [ ] IBM-PC software.
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Address _____
City _____ State _____ Zip _____
Phone ( ) _____
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Please enclose $2.50 for mailing to foreign countries. ST

STOPS: 1 FOR GAS
2 FOR OTHER

FROM: PEORIA, IL
TO: LONGBOAT KEY, FL
DATE: MARCH 1975
ROUTE: I74-I65-I24-I75-I4-41
COMMENTS:

DATE AND LOCATION	LV/AR	TIME HRS/MIN	TIME DECIMAL	STOPS	ELAPSED TIME DECIMAL	ELAPSED TIME AT STOP HRS/MIN	MILES	RUNNING DISTANCE	ELAPSED MILES	ELAPSED TIME DECIMAL	TOTAL ELAPSED TIME HRS/MIN	AVERAGE MPH STOPS	AVERAGE MPH NO STOPS	FOR MPG COMP.	MILES ON TANK	GAL OF GAS	TOTAL GAS COST	AVERAGE MPG
MARCH 27, 1975 !																		
PEORIA, IL	LV	4.3	4.50				20703							20703				
INDIANAPOLIS, IN	AR	9.15	9.25		0.00	0.00	20925	222	222	4.75	4.45	46.74		20703	0			0.00
GREENWOOD, IN	AR	9.4	9.67		0.00	0.00	20939	236	14	.42	.25	33.60		20703	0			0.00
(GAS)	LV	9.5	9.83	1	.17	.10	20939	236	0	.17	.10	0.00		20939	236	16.6	10	14.22
LOUISVILLE, KY	AR	11.35	11.58		0.00	0.00	21042	339	103	1.75	1.45	58.86		20939	0			0.00
BOWLING GREEN, KY	AR	13.3	13.50		0.00	0.00	21158	455	116	1.92	1.55	60.52		20939	0			0.00
(LUNCH & GAS)	LV	14.2	14.33	1	.83	.50	21158	455	0	.83	.50	0.00		21158	219	13.5	7.8	16.22
CHATTANOOGA, TN	AR	17.4	17.67		0.00	0.00	21355	652	197	3.33	3.20	59.10		21158	0			0.00
CARTERSVILLE, GA	AR	18.5	18.83		0.00	0.00	21421	718	66	1.17	1.10	56.57		21158	0			0.00
(GAS)	LV	19	19.00	1	17	.10	21421	718	0	.17	.10	0.00		21421	263	15	8.5	17.53
ATLANTA, GA @ I20	AR	19.45	19.75		0.00	0.00	21468	765	47	.75	.45	62.67		21421	0			0.00
ON I75	AR	20.3	20.50		0.00	0.00	21506	803	38	.75	.45	50.67		21421	0			0.00
(DINNER)	LV	21.3	21.50	2	1.00	1.00	21506	803	0	1.00	1.00	0.00		21421	0			0.00
MACON, GA (SLEEP)	AR	23	23.00		0.00	0.00	21568	865	62	1.50	1.30	41.33		21421	0			0.00
			0.00		0.00	0.00		0	0	0.00	0.00	0.00		21421	0			0.00
			0.00		0.00	0.00		0	0	0.00	0.00	0.00		21421	0			0.00
DAILY TOTALS:					2.17	2.10			865	18.5	18.3	46.76	52.96		718	45.1	26.30	15.92
MARCH 28, 1975 !																		
MACON, GA	LV	8.25	8.42				21568	865						21421	0			
ON I75	AR	9.5	9.83		0.00	0.00	21657	954	89	1.42	1.25	62.82		21421	0			0.00
(GAS)	LV	10	10.00	1	.17	.10	21657	954	0	.17	.10	0.00		21657	236	13.9	7.75	16.98
@ I10 INTERSECTION	AR	11.45	11.75		0.00	0.00	21774	1071	117	1.75	1.45	66.86		21657	0			0.00
GAINESVILLE, FL	AR	12.4	12.67		0.00	0.00	21827	1124	53	.92	.55	57.82		21657	0			0.00
(GAS & LUNCH)	LV	13.2	13.33	1	.67	.40	21827	1124	0	.67	.40	0.00		21827	170	10.7	5.75	15.89
TAMPA, FL @ I4	AR	15.25	15.42		0.00	0.00	21954	1251	127	2.08	2.05	60.96		21827	0			0.00
LONGBOAT KEY, FL	AR	16.5	16.83		0.00	0.00	22012	1309	58	1.42	1.25	40.94		21827	0			0.00
(GAS)	AR	16.5	16.83	1	0.00	0.00	22012	1309	0	0.00	0.00	ERROR		22012	185	13.1	7.2	14.12
			0.00		0.00	0.00		0	0	0.00	0.00	0.00		22012	0			0.00
			0.00		0.00	0.00		0	0	0.00	0.00	0.00		22012	0			0.00
			0.00		0.00	0.00		0	0	0.00	0.00	0.00		22012	0			0.00
			0.00		0.00	0.00		0	0	0.00	0.00	0.00		22012	0			0.00
			0.00		0.00	0.00		0	0	0.00	0.00	0.00		22012	0			0.00
			0.00		0.00	0.00		0	0	0.00	0.00	0.00		22012	0			0.00
			0.00		0.00	0.00		0	0	0.00	0.00	0.00		22012	0			0.00
DAILY TOTALS:					83	.50			444	8.42	8.25	52.75	58.55		591	37.7	20.70	15.68
GRAND TOTALS:					3.00	3.00			1309	26.92	26.55	48.63	54.73		1309	82.8	47.00	15.81

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One part is the "hardware," the machinery itself. The other is the "software," which tells a computer what to do, the way a driver tells a car what to do.

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Buy the software first.

Since the reason you're buying a computer is to get the capability the software gives you (remember it's the software that tells the computer what to do), it makes good sense to pick the software first.

Start by making a list of the things you want the computer to do. Possibilities include word processing, inventory control, accounting, graphics, recordkeeping—you name it, there's probably software that does it.

Next take your list into a computer store and ask the salesperson to demonstrate software that will do the things you want.

Even though you'll need a computer for the demonstration, keep in mind the computer is just a vehicle. The software is the driver. Once you've decided on software, picking the rest of the computer system will be that much easier.

The simpler the better.

Some people will tell you that software has to be complicated to be powerful. Nothing could be further from the truth.

Good personal software should be, as the computer people say, "friendly." Meaning that it helps you do what you want to do without getting in the way.

Good software keeps the complications in the computer, where they belong. And keeps the capability at your fingertips. It's that simple.

Simply see for yourself.

You can read any number of interesting books and magazines about personal computers. You can ask your friends who have them.



Or look at all the sales literature you can get your hands on.

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ous sums in the Daily and Grand Totals rows.

We're now ready to begin creating our template. First, set recalculation to manual; when the time comes to enter your trip data, you surely don't want to have to wait for calculations to be made before you can enter your next number. Next enter all of the labels in column A and the headers across the page (columns B through S). Now enter the formulas listed below and replicate them as directed. (The formulas shown are for *VisiCalc*; yours may differ.) After this, blank the cells indicated.

Formulas

Cell	Formula
B21	/FR (replicate range: B22...B57)
D21	/F$ (C21−@INT(C21))/.6+@INT(C21) (replicate range: D22...D57—all relative)
F22	/F$ @IF(E22>0,D22−D21,0) (replicate range: F23...F57—all relative)
G22	/F$ (F22−@INT(F22))*.6+@INT(F22) (replicate range: G23...G57—all relative)
H42	This value should be the same value as the last mileage figure entered on day #1 (do not use a formula here).
I22	@IF(C22=0,0,H22−H21) (replicate range: I23...I57—R R N)
J22	@IF(C22=0,0,H22−H21) (replicate range: J23...J57—all relative)
K22	/F$ @IF(C22=0,0,D22−D21) (replicate range: K23...K57—all relative)
L22	/F$ (K22−@INT(K22))*.6+@INT(K22) (replicate range: L23...L57—all relative)
M22	/F$ @IF(C22=0,0,J22/K22) (replicate range: M23...M57—all relative)
O21	+H21
O22	@IF(C22=0,O21,@IF(E22=1,H22,O21)) (replicate range: O23...O57—all relative)
O42	+O36
P22	+O22−O21 (replicate range: P23...P57—all relative)
P42	+O42−O36
S22	/F$ @IF(Q22=0,0,P22/Q22) (replicate range: S23...S57—all relative)

Now make these cells blank by using the /B command:

Range	Cell
D37...S37	F42
D38...S38	G42
D39...S39	
D40...S40	
D41...S41	
J42...N42	
Q42...S42	

Daily Totals—Day #1:

Cell	Formula
F38	/F$ @SUM(F22...F36)
G38	/F$ (F38−@INT(F38))*.6+@INT(F38)
J38	@SUM(J22...J36)
K38	/F$ @SUM(K22...K36)
L38	/F$ (K38−@INT(K38))*.6+@INT(K38)
M38	/F$ +J38/K38
N38	/F$ +J38/(K38−F38)
P38	/F$ @SUM(P22...P36) (replicate range: Q38...R38—all relative)
S38	/F$ +P38/Q38

Daily Totals—Day #2:

Cell	Formula
F59	/F$ @SUM(F43...F57)
G59	/F$ (F59−@INT(F59))*.6+@INT(F59)
J59	@SUM(J43...J57)
K59	/F$ @SUM(K43...K57)
L59	/F$ (K59−@INT(K59))*.6+@INT(K59)
M59	/F$ +J59/K59
N59	/F$ +J59/(K59−F59)
P59	@SUM(P42...P57) (replicate range: Q59...R59—all relative)
S59	/F$ +P59/Q59

Grand Totals:

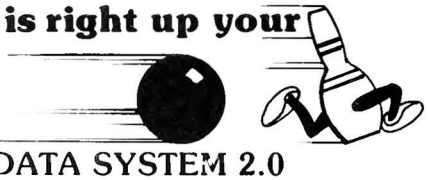
Cell	Formula
F61	/F$ +F38+F59
G61	/F$ (F61−@INT(F61))*.6+@INT(F61)
J61	+J38+J59
K61	/F$ +K38+K59
L61	/F$ (K61−@INT(K61))*.6+@INT(K61)
M61	/F$ J61/K61
N61	/F$ +J61/(K61−F61)
P61	+P38+P59 (replicate range: Q61...R61—all relative)
S61	/F$ +P61/Q61

Summary Reminders. Here are a few pointers to keep in mind as you create these templates. To begin, be sure to recalculate manually. It will speed up the data entry process. Once you get started, remember to use military time (special version for travel after midnight) and to separate hours and minutes with a period. If at all possible, use variable column widths. And remember, use your car's odometer reading rather than its trip odometer's.

And finally, here are some file-saving recommendations. Save the first template under the file name Travel Log Template, and the second one under the name Travel Log. When you save your actual trip data, use a file name other than Travel Log. This way, whenever you load Travel Log your "slate" will be clean and ready for another trip's data.

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THE HANDY &

Machine Language & the Basic

BY JOCK ROOT

If you're just beginning to feel comfortable with Basic, you probably haven't wanted to get into assembly language just yet. You might be thinking that the "threshold" is too high—you have to learn too much weird stuff before you can get any use out of it.

That ain't necessarily so. There are a few tricks you can use "cookbook fashion"—that is, just following the instructions—that will give you some of the power of assembly language without having to do most of the work.

One of them is the "& hook," technically known as the *ampersand vector*—the character &.

This little character, all by itself, is an Applesoft command statement. It tells the Apple something like this: "Go to a certain mailbox in memory and find the address stored there. Then go to that address and find some instructions. Do what they tell you; when you're finished, come back here."

What's important about this is, *you* can provide the instructions. You don't even have to write them yourself; you can borrow a lot of useful routines from Applesoft. This article will show you how to connect the & hook to any Applesoft routine, using the following as examples:

CURSUP—Cursor up one line
CLREOL—Clear to end of line
CLREOP—Clear to end of page and the BELL.

You can find other useful routines in the Apple II manual, particularly Appendix J; and, of course, if you're into assembly language you can write your own.

Memory. To start off with, you should know a little about how the Apple's read/write memory is organized. (The read/write memory is also called RAM; never mind why.) You can think of it as a great mass of mailboxes, rows and rows of them, each with its own particular address. Most of the real nitty-gritty-level activity of the computer consists of storing information in these mailboxes and reading it out again.

Each mailbox can hold one *byte* of information, also known as eight *bits*. A bit is a binary digit—any number from 0 to 1. That's right, there are only two of them. A byte looks like this: 0101 1010—eight digits, each of which is either 0 or 1.

But we can worry about that later. All you need to know, in order to use the ampersand vector, is that each mailbox can hold a number. That number can represent many things: a letter or number in ASCII code, a machine instruction, part of a memory address. . . . The important thing is, each mailbox can hold a number.

Each mailbox is identified by its address, and the address is (of course) a number. It would be nice if we could store the address of one mailbox in another mailbox, but that usually isn't possible. There are so many mailboxes—more than forty-eight thousand of them in a 48K Apple—that the addresses are too big to fit in one mailbox.

However, the answer to that turns out to be simple: You just use two mailboxes—next door to each other.

Inside the Ampersand Vector. Applesoft has reserved three mailboxes, side by side, for the exclusive use of the & hook. The first one contains an instruction to jump to the following address—one byte of machine language—and the next two contain the address of the instructions you want the machine to follow. The addresses of these mailboxes are 1013, 1014, and 1015.

Whenever Applesoft finds an & character, either in a running program or in the input from the keyboard, it immediately jumps to mailbox number 1013. There it finds the jump-to-address instruction, so it jumps to the address contained in the next two mailboxes. (Note: When the Apple is turned on, Applesoft plants the address of a return instruction here; so if you type &, nothing seems to happen.)

HOOK Interface

Try it for yourself—turn on your Apple and type & followed by return. Nothing will happen. The cursor will simply move down a line, and you'll get another] prompt. But this is a case where no news is good news—if you did that with any other character in the top row (! or " or # or $ and so on), you'd get a "syntax error" message. The fact that & does not produce an error message shows that it is a legitimate command, even if it isn't connected to anything yet.

Now, let's connect it to something. We'll use the bell—control-G, also known as CHR$(7).

The Applesoft routine that beeps the speaker—what the Apple has instead of a real bell—begins at address −198 (decimal), the right address but the wrong format. We'll get to the reasons why in a moment; in the meantime, here's what to do:

```
POKE 1013, 76: POKE 1014, 58: POKE 1015, 255
```

Enter that, then try typing &, and see what happens.

Now that you see how it works, here are the pokes for the other Applesoft routines mentioned previously:

```
CURSUP—poke 1013, 76: poke 1014, 26: poke 1015, 252
CLREOL—poke 1013, 76: poke 1014, 156: poke 1015, 252
CLREOP—poke 1013, 76: poke 1014, 66: poke 1013, 252
```

Of course, doing it this way means you can use only one routine at a time. Each set of pokes wipes out the previous set. There's a way around that, but you're going to need to know a bit more about assembly language—and hexadecimal addresses—to use it. Hang on. . . .

Hexadecimal Numbers. The decimal number system, the system we normally use, is based on the number ten. This is probably because Early Civilized Man, who did not have a pocket calculator, had to count on his fingers a lot. But suppose we had all been born with eight fingers on each hand instead of five—we would probably have developed hexadecimal numbers, which are based on sixteen (hex is Greek for six, and dec is Greek for ten—so hexadec means six and ten).

A voice from the audience cries out, "So why do we need to mess around with a number system for sixteen-fingered people?"

Because it makes it easier to talk to our computers.

"What? You mean my Apple has sixteen fingers? Where are they?"

No, no, let's start over. You remember that each memory location, or mailbox, can hold one byte of information; and one byte equals eight bits. That gives us a range of numbers from 0000 0000, which is 0, to 1111 1111, which is 255.

Why is the binary byte 1111 1111 equal to exactly 255 decimal? Well, because it's one less than 256, which is two to the eighth power—eighth because of eight bits, and two because each bit can have either of two values (0 or 1). But never mind that. We've got enough to deal with without getting into binary numbers.

The thing to remember is the number 256. That represents the maximum number of different combinations you can make with eight digits of two values each—in other words, the maximum number of different values you can store in one byte of memory (one mailbox). For Apples, 256 is a magic number—we'll refer to it a lot.

And what does all this have to do with hexadecimal numbers? You'll see in a minute. . . .

When we write a byte in bit form, it takes up nine spaces: 0110 1001. It's also hard to interpret—that byte equals 105, but it doesn't look much like it. We need to talk about bytes a lot, in computer literature, but we need a better way than binary.

What we need is a system that will express up to 256 different combinations in a clear and simple way. Well, it turns out that 256 is not only equal to two to the eighth power—which is what we need—it's also equal to sixteen squared.

Aha! Sixteen—*hexadec*!

Now we get into hexadecimal numbers. In computerese, we identify hex numbers by putting a dollar sign in front of them: $10 equals sixteen. You count like so: $1 $2 $3 $4 $5 $6 $7 $8 $9 $A $B $C $D $E $F $10 $11 $12. . . . Thus $A equals ten, and $14 equals twenty.

Now a byte of memory, in binary, is 0001 1000: two groups of four digits, with a space between. The nice thing about hex, for our purposes, is that each binary group of four is a single hex digit. The byte above is $18 in hex.

Note that that's not the same as 18, which is decimal. The decimal number 18 means 1 times ten plus 8; $18 means 1 times sixteen plus 8.

So now we can express any value (that is, any value that can be stored in one byte of memory) in two hex digits: from $00, which is 0, to $FF, which is 256 − 1, or 255. The hex value of 256, by the way, is $100 (1 times sixteen squared, plus 0 times sixteen, plus 0); but that takes two bytes, $01 and $00.

You now have nearly all you need to know in order to write your own pokes to connect a routine to the & hook; but there's one more very important—and peculiar—thing you must learn. In any 6502-based computer, such as the Apple, memory addresses are usually written *backwards*!

The Significance of Significance. In order to talk about that, we're going to need a couple of new terms: *most significant byte* (MSB) and *least significant byte* (LSB). You've probably seen these before, and you may know pretty well what they mean, but are you sure? Could you explain what "significant" means, in this context, without using the words right and left? If you could, skip the next few paragraphs—you don't need them.

Remember what we said about $100: The 1 represents sixteen squared times 1; the first 0 represents sixteen times 0; and the 0 on the end just represents zero. That's hexadecimal; but the same principle applies to decimal numbers, except you use ten instead of sixteen.

For example, take the decimal number 1,234—one thousand two hundred thirty-four. The 1 represents ten to the third power—a thousand—times one. The 2 represents ten to the second power—a hundred—times two. The 3 represents ten to the first power—ten—times three. And the 4 represents ten to the "zeroth" power (any number to the "zeroth" power equals one) times four. Thus each digit in 1,234 represents a different power of ten.

In the same way, each digit in $1234 represents a different power of

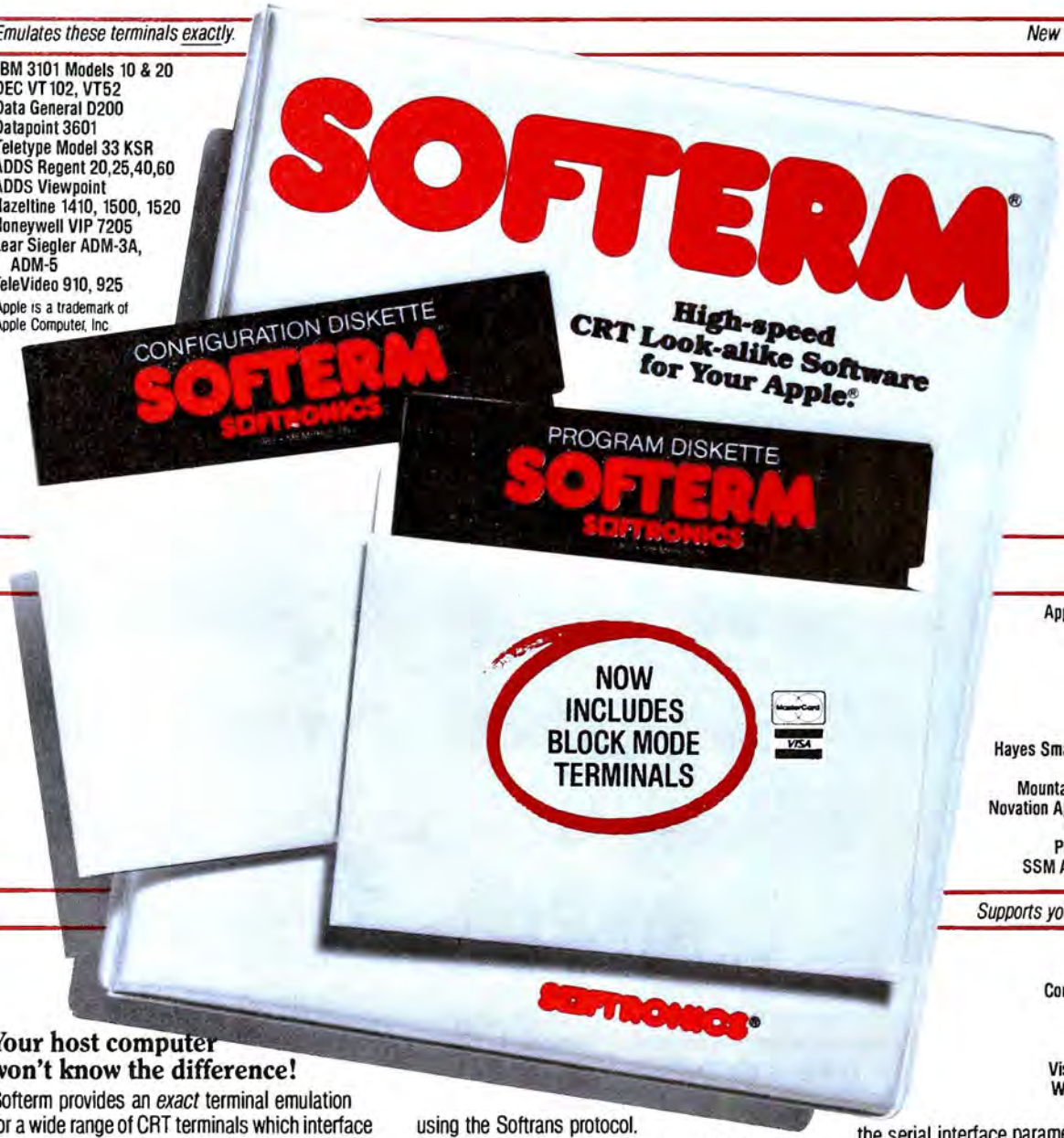
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sixteen—and, for that matter, each digit in the binary number 1010 represents a different power of two.

The *position* of each digit in the number tells you what power it represents: higher powers on the left, lower powers on the right, so that the rightmost digit always represents the power of zero.

Got that? Then, here's the last step in our definition: The "significance" of a particular digit means the size of the power it represents—the higher the power, the more significant the digit.

No surprises there, right? The idea is simple enough—the hard part is to explain it in words!

We normally write numbers with the most significant digit (MSD) on the left and the least significant digit (LSD) on the right—but you don't have to. Here's how to write the number 1,234 in reverse order of significance:

```
1,234 = 4*10 ^ 0 + 3*10 ^ 1 + 2*10 ^ 2 + 1*10 ^ 3
```

There, the most significant term (the one with 10 ^ 3 in it) is on the far right, and the least significant term (the one with 10 ^ 0) is on the left. But that technique is usually more trouble than it's worth; it's easier to go with the rule that everybody knows and put the MSD on the left, with the LSD on the right—1,234.

However, the Apple—in its innermost thoughts—doesn't do that. If we want to communicate with those inner thoughts (which is what assembly language is all about), we have to do it Apple's way.

Low Byte, High Byte. Most addresses take two bytes of memory: two mailboxes side by side. That's because one byte can only handle numbers smaller than 256, but the Apple's memory contains many more bytes than that. In fact, the maximum possible address space, in an eight-bit computer, is normally 256 times 256 bytes.

Why that particular number, 256 times 256? Because—you guessed it—that's the biggest number you can cram into *two* bytes of memory.

Now all we need is a rule for telling which of the two bytes holds the most significant part of the address and which byte holds the least significant part.

That's right, we call them the *most significant byte* (MSB) and *least significant byte* (LSB) respectively.

Well, to make a long story short (and it's about time, you're probably thinking), the normal rule for memory addresses is, "Low byte first"—the LSB comes before the MSB. If you want the program to jump to address $1234, you write "$4C $34 $12" in machine language ($4C is the jump instruction).

"Hey, wait a minute. I'm just beginning to feel comfortable with Basic. And you're giving me machine language? Come on, now!"

Oh. Sorry about that. The thing is, if you're going to go poking addresses into memory—which is what we're leading up to—you had better know what you're doing. We're nearly there. . . .

The thing to remember is this: If you want to poke an address into memory as part of a jump instruction, you have to put it in low byte first. Got that? Low byte, then high byte.

One more bit of background you'll need. The addresses of these routines are presented in hex, but you'll have to poke them in from Basic. Basic doesn't accept hex pokes, so each byte has to be translated into decimal.

It's possible to do that "by hand"—the low byte is easy: five times sixteen is eighty, plus eight is eighty-eight. But $FC? Let's not—we Middle Civilized Persons have a better way: We let the Apple do it!

The accompanying figure is a byte conversion chart, Apple-generated (you can have that program some other day), with the hex numbers from $00 to $FF and their decimal equivalents. Well, half of them, anyway—every other one. You can interpolate the missing ones in your head; you wouldn't want to be *too* dependent on your Apple!

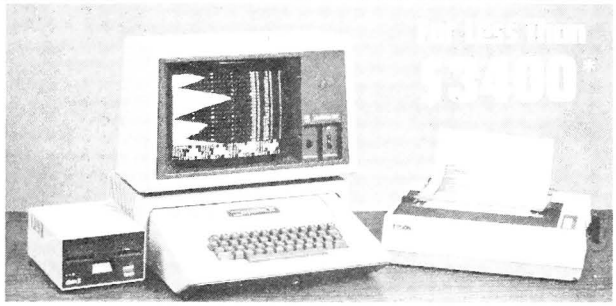
Design Your Own & Command. Let's take another look at those & connections we used before—and their hexadecimal addresses.

ROUTINE	ADDRESS	NUMBERS POKED
BELL	$FF3A	76, 58, 255
CLREOL	$FC9C	76, 156, 252
CLREOP	$FC42	76, 66, 252
CURSUP	$FC1A	76, 26, 252

HEX : DEC	HEX : DEC	HEX : DEC	HEX : DEC
$ 1 : 1	$41 : 65	$81 : 129	$C1 : 193
$ 3 : 3	$43 : 67	$83 : 131	$C3 : 195
$ 5 : 5	$45 : 69	$85 : 133	$C5 : 197
$ 7 : 7	$47 : 71	$87 : 135	$C7 : 199
$ 9 : 9	$49 : 73	$89 : 137	$C9 : 201
$ B : 11	$4B : 75	$8B : 139	$CB : 203
$ D : 13	$4D : 77	$8D : 141	$CD : 205
$ F : 15	$4F : 79	$8F : 143	$CF : 207
$11 : 17	$51 : 81	$91 : 145	$D1 : 209
$13 : 19	$53 : 83	$93 : 147	$D3 : 211
$15 : 21	$55 : 85	$95 : 149	$D5 : 213
$17 : 23	$57 : 87	$97 : 151	$D7 : 215
$19 : 25	$59 : 89	$99 : 153	$D9 : 217
$1B : 27	$5B : 91	$9B : 155	$DB : 219
$1D : 29	$5D : 93	$9D : 157	$DD : 221
$1F : 31	$5F : 95	$9F : 159	$DF : 223
$21 : 33	$61 : 97	$A1 : 161	$E1 : 225
$23 : 35	$63 : 99	$A3 : 163	$E3 : 227
$25 : 37	$65 : 101	$A5 : 165	$E5 : 229
$27 : 39	$67 : 103	$A7 : 167	$E7 : 231
$29 : 41	$69 : 105	$A9 : 169	$E9 : 233
$2B : 43	$6B : 107	$AB : 171	$EB : 235
$2D : 45	$6D : 109	$AD : 173	$ED : 237
$2F : 47	$6F : 111	$AF : 175	$EF : 239
$31 : 49	$71 : 113	$B1 : 177	$F1 : 241
$33 : 51	$73 : 115	$B3 : 179	$F3 : 243
$35 : 53	$75 : 117	$B5 : 181	$F5 : 245
$37 : 55	$77 : 119	$B7 : 183	$F7 : 247
$39 : 57	$79 : 121	$B9 : 185	$F9 : 249
$3B : 59	$7B : 123	$BB : 187	$FB : 251
$3D : 61	$7D : 125	$BD : 189	$FD : 253
$3F : 63	$7F : 127	$BF : 191	$FF : 255

Byte conversion chart: hex to decimal.

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See the pattern? The first number is the same for all four—that's the jump command, $4C, or 76 in decimal (Applesoft doesn't speak hex). The third number is the same for three, and nearly the same for BELL; but the middle number ranges all over the place: The high byte of three of the addresses is the same ($FC), and the fourth is not far off ($FF); but the low byte of each address is different.

In other words: poke 1013, jump command; poke 1014, low byte; poke 1015, high byte.

To create your own ampersand command, use the same format; just change the address numbers. All you have to do is find the hex address of the routine you want, separate it into two bytes, translate the bytes into decimal, and poke them into 1014 (low byte) and 1015 (high byte).

Let's walk through it once. We'll make an ampersand version of the Applesoft home command.

The address of the routine we want is $FC58. That gives us a high byte (MSB) of $FC and a low byte (LSB) of $58. Using the conversion chart, we find that the decimal equivalent of $FC (high byte) is 252, and the low byte is 88. So the pokes for HOME ($FC58) are:

```
POKE 1013, 76: POKE 1014, 88: POKE 1015, 252
```

Typing & will clear the screen and home the cursor.

Getting Them All Together. There is still that persistent problem: You can use only one routine at a time. As long as we have only one pair of address bytes (1014 and 1015), there is only room for one address.

But we can use that pair of mailboxes to store the address of a special selector routine, which will choose one of the routines we have been using and send the program there.

In order to do that, we will have to give some kind of name to each of the routines we want to use so that we can tell the selector which one we want. The simplest way to do that is to name each routine with a single letter: Thus &B will beep the speaker, &L will call CLREOL, &P will call CLREOP, and &U will move the cursor up. Then all our selector routine will have to do is look at the letter that follows the & and jump accordingly.

To keep things simple, we'll make the selector in the form of a series of steps, like this: "Is the letter a B? If so, jump to the BELL routine; if not, try the next letter."

In assembly language, that would be, "Compare the letter to B: If it doesn't match, branch to the next comparison; otherwise, jump to the BELL routine." A branch is something like a jump, except that it depends on some sort of test: in this case, the test for letter B. The next step is, "Compare the letter to L: If it doesn't match, branch to the next comparison; otherwise, jump to CLREOL." And so on.

Then, at the end of the chain of steps, we need a return statement. That takes care of the situation if you typed in the wrong letter by mistake and the program couldn't match it to anything.

There's also something else we need, which is not so obvious: Whenever the selector finds a match, it has to advance Applesoft's text pointer to the end of the input line.

What does that mean? Well, think of it this way: If we don't put the line JSR CHRGET at certain places in the program, we'll get a syntax error whenever we run it. The reasons for that are beyond the scope of this article. Don't worry—the line is there, in all the right places.

The Assembly Language Program. Listing 1 shows the selector routine in assembly language. It's included for information's sake only; you don't need to understand it in order to use it. However, the listing will be

```
                                1  ******************
                                2  *                *
                                3  *  HANDY '&'     *          &B   BELL
                                4  *                *
                                5  *  SELECTOR      *          &L   CLREOL
                                6  *                *
                                7  *                *          &P   CLREOP
                                8  *  JOCK ROOT     *
                                9  *    3/25/83     *          &U   CURSUP
                               10  *                *
                               11  ******************
                               12
                               13
                               14
                               15  CHRGET   EQU   $B1     GET NEXT CHARACTER OF INPUT LINE
                               16
                               17  BELL     EQU   $FF3A   APPLESOFT ROUTINE
                               18  CLREOL   EQU   $FC9C     "        "
                               19  CLREOP   EQU   $FC42     "        "
                               20  CURSUP   EQU   $FC1A     "        "
                               21
                               22
                               23           ORG   $300
                               24
0300: C9 42                    25  AND:B    CMP   #$42    IS IT LETTER B (HI BIT OFF)?
0302: D0 06                    26           BNE   AND:L     IF NOT, TRY NEXT ONE
0304: 20 B1 00                 27           JSR   CHRGET  MOVE TXTPTR TO EOL, ELSE SYN ERR
0307: 4C 3A FF                 28           JMP   BELL    SOUND THE BELL, AND RETURN
                               29
030A: C9 4C                    30  AND:L    CMP   #$4C    IS IT LETTER L?
030C: D0 06                    31           BNE   AND:P     IF NOT, TRY NEXT
030E: 20 B1 00                 32           JSR   CHRGET  MOVE TXTPTR TO EOL
0311: 4C 9C FC                 33           JMP   CLREOL  CLEAR TO END OF LINE, AND RETURN
                               34
0314: C9 50                    35  AND:P    CMP   #$50    IS IT LETTER P?
0316: D0 06                    36           BNE   AND:U     IF NOT, TRY NEXT
0318: 20 B1 00                 37           JSR   CHRGET  MOVE TXTPTR TO EOL
031B: 4C 42 FC                 38           JMP   CLREOP  CLEAR TO END OF PAGE, AND RETURN
                               39
031E: C9 55                    40  AND:U    CMP   #$55    IS IT LETTER U?
0320: D0 06                    41           BNE   MISSED    IF NOT, TRY NEXT
0322: 20 B1 00                 42           JSR   CHRGET  MOVE TXTPTR TO EOL
0325: 4C 1A FC                 43           JMP   CURSUP  CURSOR UP ONE LINE, AND RETURN
                               44
0328: 60                       45  MISSED   RTS           MATCH NOT FOUND — SYNTAX ERROR
```

Listing 1. Ampersand selector.

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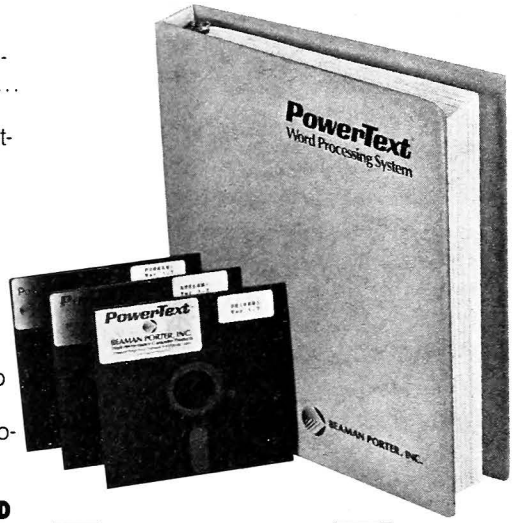
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helpful if you want to make any changes, such as renaming the routines with other letters or substituting routines of your choice.

We can't afford the space it would take to explain the routine in detail; but in case you're one of those people who insist on messing around with a recipe rather than using it just as it is in the cookbook, here are a couple of hints.

The most important part of the listing is the first four columns on the left. The first column, starting with *0300:*, is the memory address of the first byte in each line. This is in hexadecimal, even though it doesn't have a dollar sign in front of it. We are assembling this routine at the address $300 because . . . well, because that's a good address to use for short programs like this.

After each address, there are two or three bytes (or sometimes only one) of machine language, also in hex. These are the machine instructions that make up the selector routine.

After the four columns of hex numbers, there is a tall column of decimal numbers. These are simply line numbers used only in describing or editing the program.

The rest of the line consists of label, operator, and operand—for the assembly language people—and a comment, which is similar to a rem statement. It tells you what that line is doing.

Beyond that, you'll have to figure it out for yourself; this article is already too long.

The Basic Program. Now, finally, we come to the Simple Answer. Listing 2 is a Basic program that will poke the selector routine into memory at $300 and then poke that address into the ampersand vector's mailboxes. Just type this in (carefully!) and run it, and you will add the commands &B, &L, &P, and &U to your Apple.

```
5     REM HANDY '&' LOADER
6     REM
10    X = 0
20    ONERR GOTO 50
30    READ BYTE: POKE 768 + X,BYTE
40    X = X + 1: GOTO 30
50    POKE 768 + X,96: REM        FINAL RTS
60    POKE 1013,76: POKE 1014,0: POKE 1015,3: REM
        SET VECTOR
70    POKE 216,0: REM    CANCEL ONERR GOTO
80    PRINT "YOU HAVE  &B: BELL      &L: CLREOL"
90    PRINT "          &P: CLREOP  &U: CURSUP"
95    END : REM
100   REM  EACH DATA STATEMENT IS ONE COMPARE-AND-JUMP
        STEP
110   DATA  201,66,208,6,32,177,0,76,58,255:  REM    BELL
120   DATA  201,76,208,6,32,177,0,76,156,252: REM    CLREOL
130   DATA  201,80,208,6,32,177,0,76,66,252: REM     CLREOP
140   DATA  201,85,208,6,32,177,0,76,26,252: REM     CURSUP
```

Listing 2. Ampersand loader.

Here's how it works. Each step of the selector program has been converted into a data statement starting with 201 (which is decimal for $C9, which in turn is machine language for "compare the following byte") and ending with 255 (which is $FF, the high byte of BELL's address) or 252 ($FC, the high byte of all the others).

Exercise for serious students: Check it out. Compare one step in listing 1 against the corresponding data line in listing 2 (the chart will help). Once you understand how the pattern works, you can add your own steps.

So all the program has to do is to read these statements into memory, byte by byte, and set the & jump address to point to that part of memory.

Here's what happens: Line 10 sets the address index to 0. Applesoft is supposed to initialize all variables to 0 anyway, but if there's anything wrong with this number, the whole program may crash, so let's take out some insurance.

Line 20 is a little convenience feature that adjusts the program automatically if you ever add or remove a data statement. It doesn't care how much data there is; it waits for an out-of-data error and then sends the program on to finish things up at line 50.

Line 30 is the workhorse. Over and over again, it reads a byte of data and pokes it into memory. It starts (when X = 0) at address 768, which is decimal for $300.

Line 40 increments X, to select the next memory address, and then goes back to line 30 for another byte. This loop continues until the data is all used up and an error signal causes a goto 50.

Line 50 pokes a return statement into memory at the end of the routine in case no match was found to the input letter. Line 60 puts the selector's address in the & mailboxes, line 70 cancels the onerr goto, and lines 80 and 90 tell the user about it.

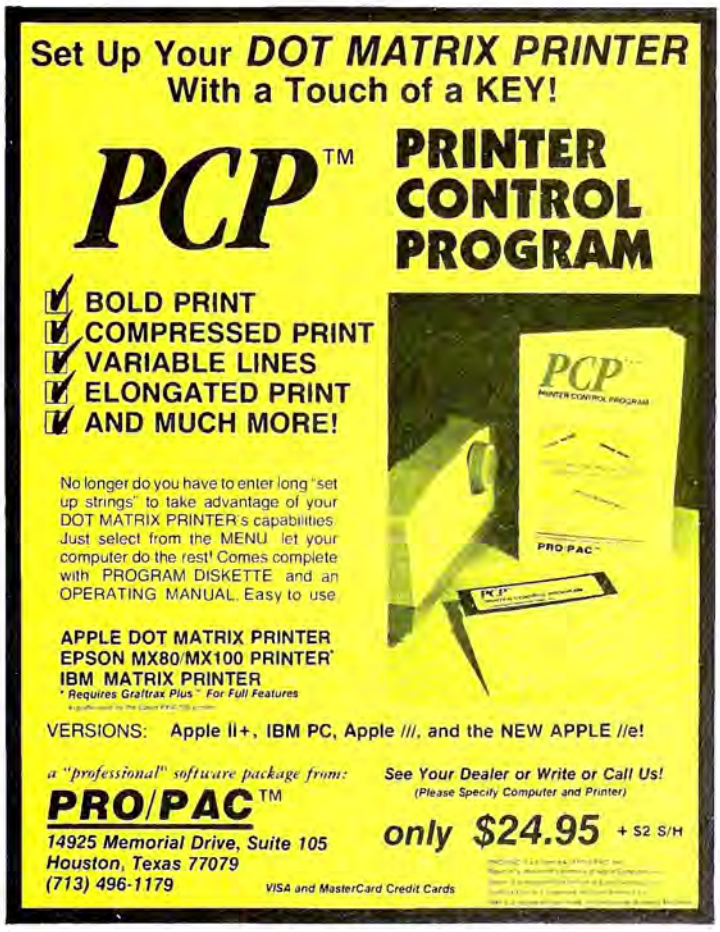
In Case of Difficulty. There are a lot of opportunities for typing errors in this program. What's worse, it bypasses most of the Apple's normal safety checks. It's quite possible that the first time you type in an & command the Apple will just hang up and sit there. Usually you can recover from this by pressing reset. If that doesn't work, just turn the machine off and back on again; it will start fresh.

Of course you will lose what you typed in, so you had better save the Basic program before runing it. And just to be extra safe, put a scratch disk (not a precious one) in the drive. It's very unlikely that a disk will be damaged by a program crash, but why take the chance?

If you do have a crash, or a lock-up, the odds are you made a typo somewhere. Double-check the data statements: They should all be the same length (ten bytes), and the values should correspond to the hex bytes in listing 1.

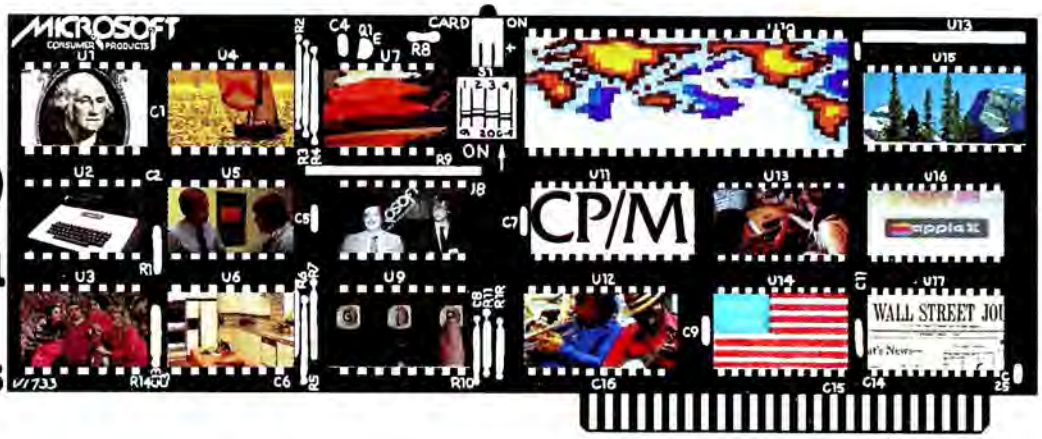
These warnings are probably unnecessary; but it's always a good idea, when trying new things on a computer, to guard against Murphy's Law as much as possible.

And now you know a way to add new commands to your Apple's vocabulary. ◨



SOFTCARD Symposium

by Greg Tibbetts



Welcome to the July installment of SoftCard Symposium. This month we'll continue our in-depth discussion of the disk drive portion of the SoftCard BIOS. We'll look into the disk data structures and will also describe the organization of data on the disk media. Our goal this month is to clear up some of the mystery surrounding the data used by BDOS and the methods that it employs during disk access. For this reason, our discussion will be far more detailed than we've attempted in the past.

As mentioned last time, there are three tabular structures that BIOS (and BDOS) use for each drive. These are the disk parameter header (DPH), the disk parameter block (DPB), and the sector translation table (XLT). In addition, BDOS and the various BIOS disk routines use a number of temporary variables and data collections in the performance of their functions. We'll take on the tabular structures and data collections first and save the temporaries for a time when we have more information on the routines themselves. Before we begin, however, we need to examine how the disk surface is organized.

The terms *track* and *sector* were introduced and defined last month. To recap briefly, we said that information is stored on the disk surface in tracks. We also said that tracks are concentric circles at fixed distances from the center of the disk surface, which are similar to the grooves on a record.

As we discussed, tracks on a disk surface are broken up into *physical sectors*—equal-sized portions containing a fixed number of bytes of data. The number of tracks on a disk, the number of physical sectors in a track, and the number of bytes in a physical sector are not the same for all disks. In order to provide for compatibility, however, a number of standard "formats" are in wide use.

Even though there are some standards, CP/M must still be made aware of the nature of the format of a given disk in order to know how to access the drive and organize the data being read from and written to the media. With all the many combinations of bytes per sector, sectors per track, tracks per surface, and so on, it would be very difficult simply to take these numbers and make a coherent system that applied to all formats. To help further standardize this process, CP/M requires all BIOS designers to create a set of numbers that describe the disk format in common terms. For example, don't say how many tracks a disk has; rather, say how many fixed-size blocks of information will fit on the entire disk surface. Handling things this way ensures that everyone's disk format can be dealt with in the same way.

CP/M, then, looks at the disk as a surface made up of some unknown number of tracks, of which a small number at the beginning are reserved for the storage of CP/M itself. The number of reserved tracks is part of the data CP/M requires, and CP/M itself will not make use of these reserved areas. CP/M considers the remainder of the disk surface (the usable portion) as being made up of 128-byte sectors (regardless of the actual physical size of the sectors themselves). Obviously, CP/M needs to know how much actual storage space there is on the surface, but rather than using the number of sectors (which could be huge!), it uses a more convenient unit called the *allocation block*. An allocation block may be 1, 2, 4, 8, or 16K in length; consequently, the total number of blocks a disk contains is a much more manageable number than the number of sectors it contains.

So far, then, we know that CP/M divides the disk surface up into 128-byte sectors and 1, 2, 4, 8, or 16K blocks (the size is chosen by the BIOS designer). The blocks are numbered from 0 through the maximum block number that the disk can contain. Zero is at the very beginning of the usable area of the disk and the maximum block number corresponds to the very end of the last track. CP/M also uses internally a three-byte value called the *absolute sector number*. This value is not the sector in a given track but rather an absolute sector within the entire media. The first sector of block 0 is sector 0 and the sectors are numbered sequentially throughout the entire disk.

The absolute sector number is difficult to deal with for some operations. The reason this value is used, however, is that if blocks are numbered sequentially and if the number of sectors per block is known, it is much easier for BDOS to calculate the absolute sector number of the first sector in a specific block than it would be to try to calculate tracks from block numbers. It is also much easier for BDOS to calculate the track number and the sector within that track (which the BIOS needs) once the absolute sector number is known. Making this calculation only requires knowing the number of 128-byte sectors that make up a track. This whole arrangement will become much clearer when we discuss the DPB later on; for now, just remember that we will use the term *absolute sector number* to mean this three-byte value that may range from 0 to the total number of sectors on the disk surface.

This system of dividing up the disk surface works well when it comes to accessing portions of the disk's media. CP/M's primary purpose in using the surface, however, is to store information. That being the case, there must also be a system of units for dealing with the information itself.

The primary unit of information CP/M deals with is the disk file. A disk file is an individual collection of data that may be anywhere from one byte to eight megabytes in length and which is identified by a single name. Whether the files are programs, data, or transient commands, their formats insofar as CP/M is concerned are identical to one another, as are the units they are divided into.

CP/M keeps track of where the various portions of files are on the media by means of the *directory*, a section of the disk surface that contains information identifying a file, the various attributes it may have, and what areas it occupies. The disk directory is located at the very first usable portion of the disk surface (not counting the reserved tracks), and a certain number of blocks (beginning with block 0) are set aside strictly for this purpose. The number of blocks the directory may occupy (its maximum size) is also chosen by the BIOS designer; this information is given to BDOS as part of the tabular data.

If files were always stored in perfect sequential order on the disk, CP/M would be able to keep track of them by simply storing a file's starting sector in the directory and the length of the file in blocks. That method would be grossly inefficient, however. After the disk media had been accessed many times, with many files written and deleted, there

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would be several areas of free space, but it's possible that none of these would be large enough to hold the next complete file that was to be stored. The result would be that the disk wouldn't be full, but neither would it be usable for further storage. Consequently, some smaller units that could be more easily manipulated were required.

The smallest of these units was made necessary by the fact that CP/M must read and write to the disk in the form of 128-byte sectors. In keeping with this, the smallest unit of a file was also given a length of 128 bytes. This unit was called the *file record*. Record numbers may range as high as 65,535 in an eight-megabyte file. If that were the only unit, it would make matters difficult, and the amount of directory space required to keep a list of these records would be considerable. Therefore, other units were created to make the whole process of storage and keeping track of that storage more manageable. The best known of these intermediate units is the *extent*. Each extent is 16K in length and comprises exactly 128 file records. It is these units that the CP/M STAT command displays when it is entered in the form

```
STAT filename.typ
```

Now that we are familiar with some of the terms used in discussing disk-surface organization, we can look at exactly what one of these directory sectors looks like. In CP/M, a directory sector, like all sectors, is 128 bytes long. It contains four individual directory entries, each of which is 32 bytes long. Every file has at least one directory entry, arranged as shown in figure 1.

The first sixteen bytes of the entry contain the header information that identifies a file to BDOS. The header information consists of several fields that completely identify the file (or the part of a file) that a particular entry is describing. The second sixteen bytes simply hold a block number list. If the disk has less than 255 blocks, it may consist of sixteen single-byte numbers, since any of the numbers from 0 to 255 can be represented in only one byte. Of course, if the disk has more than 255 blocks, two-byte numbers must be used. If two-byte numbers are used, they are stored the normal way, with the low-order byte of the number first and the high-order byte second.

Since there's room for either sixteen single-byte block numbers or eight double-byte block numbers, it made sense to relate the directory entry and the extent closely. For a disk with a 1K block size and 255 or fewer total blocks, exactly one extent of a file can be placed in the block list. A disk with a 2K block size and more than 255 total blocks can also contain exactly one extent of a file. By disallowing the combination of more than 255 blocks and a 1K block size, it was possible to make a full directory-entry block list describe no smaller a unit than the extent. This whole business gets more complicated as the block sizes go up, so let's leave it for now and go on to describe the header fields illustrated in figure 1.

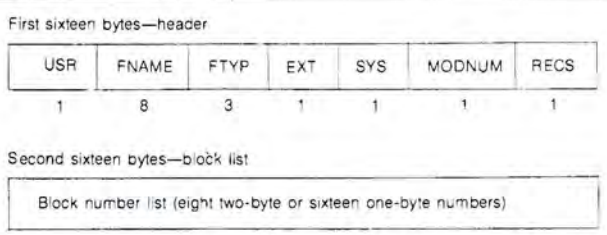


Figure 1. Directory entry arrangement.

The first field, USR, is simply the user number associated with the file we're considering. As you know, CP/M allows a single disk to contain up to sixteen separate sections in its directory. Each section is called a *user area* and for the most part can be accessed only by setting the user number via the CP/M USER command. Rather than setting aside space in the directory blocks for each user—space that might never be used—Digital Research chose to identify each directory entry with a user number and have the BDOS and CP/M utilities simply ignore user numbers other than the current one. The USR field contains the user number that was in use when this file or portion of file was created. The USR field for a particular entry is set to a hexadecimal E5 value when that entry is not

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in use and may therefore be reused by BDOS during the next entry-creation process.

The next two fields, FNAME and FTYP, are eleven bytes in length together and make up the eight-character file name and the three-character file-name extension. The name these fields contain is the name that is shown in directory listings and all other file accesses. The period that is typed in and often displayed between these two fields is not stored in the directory. Any "empty" character positions in the name fields are filled with spaces. PIP.COM, therefore, becomes PIP COM.

The next field, EXT, is a single byte only and represents the current extent of this file. From our earlier discussion of the definition of an extent, it is obvious that for formats that can contain only one extent in a full directory entry-block list, a file larger than one extent will need more than one directory entry. That being the case, BDOS needed a means of keeping entries in order. The EXT field fulfills that need.

Extent numbers range from 0 to 31. Within each extent, a file is made up of records. CP/M also keeps track of the number of records currently being used in the extent described by an entry. (In figure 1, this is the RECS field.) As a file grows, the record number is incremented until it reaches a maximum value of 128. This is exactly 16K and at this point the extent is full, so a new one (extent 01) is created. The RECS field in the new extent will start with 0. As the file grows, the new RECS field will be incremented in the same manner.

So far, then, we've found out that we can create directory entries that will describe a file with a maximum of thirty-two (0 through 31) extents, each of which will contain 128 records, or 16K. Those of you who are quick in math have already seen by now that thirty-two 16K extents does not equal eight megabytes, the number we said was the maximum file size. BDOS takes care of this by means of the MODNUM field. (We'll skip the SYS field shown in figure 1 altogether; it is used internally by BDOS and is not important to our discussion.)

Because files in excess of thirty-one extents could be created on the larger capacity disk drives, a means of identifying a larger unit was needed. This unit is the *data module*. Made up of thirty-two extents (0 through 31), the data module at 512K is the largest unit a file is made up of. A file can have sixteen modules (0 through 15), and it is the module number that goes in the MODNUM field.

It can now be seen that having sixteen modules of thirty-two extents each, which themselves contain 16K each, does provide space on disk for exactly eight megabytes. As it turns out, eight megabytes is also the space that is taken up by 65,536 128-byte records. And 65,536 is the largest number that can be represented in two bytes. This means that CP/M can also allow random access of file records by requiring only a two-byte absolute record number, which still allows access to all of the records in an eight-megabyte file.

Before going on, let's recap briefly. CP/M breaks files down into data modules, extents, and records. When a file is created, an entry is made and identified as Data Module 0 (MODNUM=0), Extent 0 (EXT=0), and Record Count 0 (RECS=0). When the first record is placed in that file, BDOS allocates (reserves) the first free block and places its number in the block list. (Remember that the block is the smallest unit that CP/M can reserve.) The record count (RECS) is then incremented to 1. As more records are added, they are placed in the same block (and the RECS field is increased) until that block is full. At that point, another block is allocated and added to the block list, and the process continues.

When 128 records have been added, a new entry, with an extent number of 1 and a record count of 0, is created. BDOS goes on from there to fill extent 1. Eventually, extent 31 is filled, at which point the new entry will have its MODNUM field incremented to 1, its EXT reset to 0, and its RECS reset to 0. The thirty-one extents of data module 1 are now filled. In this way BDOS can always tell which entry describes which portion of a file and can find an individual file record with a minimum of trouble.

We will now move on to the tabular data structures, but we'll refer back to this disk-data-organization discussion quite often. The three tabular data structures (the DPH, XLT, and DPB) have a very strict relationship to one another in which the DPH is the root structure. That is to say that knowing the location of the DPH enables a routine to use the information the DPH contains to locate both the DPB and the XLT for a particular drive. While each drive in the system must be associated with a set of these data structures (a DPH, a DPB, and possibly an XLT), it does not necessarily follow that there is a separate DPB, for example, for each drive in the system. In some cases the DPBs and XLTs are shared between one or more drives that have the same characteristics. We'll see the reasons for this later in our discussion.

The DPH, however, must be unique for each drive. As the root structure for a particular drive, the DPH acts as a pointer for BDOS to all other structures and storage locations relative to that specific drive. In addition, it also contains blank space that BDOS can use to keep track of temporary information relating only to that drive or to the operations being performed on that drive.

The DPB, which unlike the DPH may be shared by drives with the same format, is BDOS's main source of the disk-surface-layout information we spoke about earlier. As such, the DPB is more complex than either the DPH or XLT, and it is also more relevant to that discussion. For that reason, we'll tackle the DPB first, and in the process we'll point out the information that BDOS requires.

As its name implies, the DPB is a list of the parameters pertaining to the specified disk drive (or, more specifically, to the format currently in use in that drive). It consists of a number of eight-bit and sixteen-bit fields that describe these parameters. Figure 2 shows the organization of the DPB.

Having a standardized format for the DPB data enables BDOS to find any specific information it needs. BDOS does this by locating the beginning address of the DPB and adding an offset value to that address. Each field of the DPB is located at a known number of bytes from the beginning address, as shown in figure 2, in the row labeled DPB. To obtain the EXM value, for example, BDOS gets the address of the DPB and adds 4. It can then load the byte at DPB+4 and it will have the EXM value. Now let's take a look at each field in detail to learn more about how the DPB describes the disk format.

	SPT	BSH	BLM	EXM	DSM	DRM	AL0	AL1	CKS	OFF
	16b	8b	8b	8b	16b	16b	8b	8b	16b	16b
DPB	+0	+2	+3	+4	+5	+7	+9	+10	+11	+13

Figure 2. DPB data structure.

The SPT field, found at DPB+0, is the number of the 128-byte CP/M sectors in each track. Obviously, SPT in this case stands for sectors per track. Remember that as far as CP/M is concerned all disk formats have only 128-byte sectors regardless of the actual physical size of the sectors on the disk. A BIOS that accommodates formats with physical sectors that are 256 bytes or larger must handle reading and writing these sectors in such a way that BDOS still deals with only 128 bytes. This is called *blocking* and *deblocking*, in reference to the fact that the BIOS must read the physical sector into memory and then give data or get data from and to BDOS in 128-byte blocks. A format like SoftCard CP/M, then, with sixteen 256-byte sectors per track, has a value of 32 in the SPT field.

As we alluded to before, SPT is used by BDOS to calculate the track and sector numbers to give BIOS. BDOS accomplishes this by calculating an absolute sector number for a given block (such as the 159th sector on the media) and then dividing this absolute sector number by the SPT value. The result of the division is, of course, the track number in which that absolute sector will appear, while the remainder of the division is the sector number in that track. In this way, when it needs to request sector reads or writes, BDOS obtains the track and sector numbers to give the BIOS without having to do a great deal of complex calculation. SPT is also accessed by STAT and certain other programs that give disk format information.

The next field, BSH, located at DPB+2, is the tool used by BDOS to calculate the absolute sector number. Remember that the allocation blocks are 1, 2, 4, 8, or 16 kilobytes in length and are therefore made up of 8, 16, 32, 64, or 128 sectors respectively. BSH stands for block shift factor; to understand how it is used, we need to understand what the term *shift* means.

In binary mathematics, *shift* is the term used to describe a process whereby every bit in a binary number is moved to either the left or the right, for either a left or a right shift. During shifts, we are dealing with binary numbers of fixed length—an eight-bit byte or a sixteen-bit word, for example. If we shift an eight-bit number to the right, the rightmost bit (bit 0) is discarded and a 0 is usually brought into the leftmost bit (bit 7). Conversely in a left shift, the leftmost bit (bit 7) is discarded and a 0 is usually brought into the rightmost bit (bit 0). The shift operation is how multiplication and division by 2 is performed on binary numbers.

To illustrate this, take a three-digit decimal number—a 2 followed by two 0s, making 200. If you move all these digits to the left one place and add another 0 on the right, you have performed a left shift on the decimal number 200. In fact, you have now produced the number 2,000. In other words, you have multiplied the original number by 10. The multiplication is by 10 in this case because decimal numbers are base 10. Division by 10 in decimal can be done the same way with a right shift. If we perform a right shift on 2,000, discarding the rightmost digit and adding a 0 on the left, we are back to 200. The same principle holds true in binary, but since binary is base 2 the multiplication and division that takes place is by 2. Shift right one place to divide by 2, shift left one place to multiply by 2.

What happens if we shift right more than one place—say, two places, for example? Well, what we're really doing in that case is dividing by 2 twice. Expressed another way, we are dividing by 2*2—in other words, dividing by 4. This also works for shifting right three places; we are dividing by 2*2*2, or 8.

You should be seeing a pattern by now. We know that 4 is 2 squared (or 2 with an exponent of 2), while 8 is 2 cubed (or 2 with an exponent of 3). When we multiply or divide using shifts by a number that is a power of 2, such as 4, 8, 16, 32, or 64, we are really shifting right a number of places equal to the exponent. The number 16, for example, is 2 with an exponent of 4. Dividing by 16 therefore, involves shifting the number four places to the right. Multiplication by powers of 2 is performed exactly the same way, except that shifts are made to the left instead of to the right. Obviously, multiplication and division by numbers other than powers of 2—such as 6, 21, 35, or whatever—cannot be done this easily. However, so long as we keep to powers of 2, this is a fast and easy method of calculation.

With this information under our belts, it is now easy to describe BSH. BSH is the exponent of 2 that is equal to the number of sectors in a block. For example, if the block size is 1,024 bytes, or 1K, then there are eight sectors in the block, or 2 with an exponent of 3. A 2K block contains sixteen sectors, or 2 with an exponent of 4. The BSHs in these two cases are 3 and 4 respectively. The BSH will range up to a maximum of 7 for the maximum 16K block size.

Now this may not seem like a really valuable thing to know. Thought of another way, however, the BSH is the number of left shifts required (for multiplication) in order to find the number of sectors in a given number of blocks (if there are eight blocks in a sector, for example, we find the number of sectors in ten blocks by multiplying 10 times 8, meaning that we shift 10 to the left three places). Now BSH becomes useful. To use BSH, BDOS takes the block number for a given block and shifts the number to the left BSH times. The result is the sector number of the beginning sector of that block.

To illustrate this, let's find the starting sector number for block 6 in a system with 1K block sizes (and therefore, a BSH of 3). To do this, we merely shift the block number to the left three times, as shown below:

```
start:    00000110B = 6
shift 1:  00001100B = 12
shift 2:  00011000B = 24
shift 3:  00110000B = 48
```

It is easy to check our work by remembering the fact that there are eight sectors in each block; so block 0 is 0 through 7, 1 is 8 through 15, 2 is 16 through 23, 3 is 24 through 31, 4 is 32 through 39, 5 is 40 through 47, and 6 is 48 through 55. The first sector in block 6 is obviously absolute sector number 48, exactly the number we calculated using shifts from the block number.

As we saw in our discussion of file directory entries, BDOS keeps a list in the directory entry of all the block numbers it has allocated to a given file. Therefore, when BDOS wishes to begin reading in the file, it simply gets the block number it wishes to access and shifts the number left BSH times. The result is the absolute sector number of the first sector in that block.

Now that BDOS has the absolute sector number, it can use SPT to perform the calculations for track and sector-within-track that are required to access that file through BIOS. Note that BDOS uses the block number for all of its internal calculations and file-manipulation procedures. It reverts to track and sector numbers only when it needs to issue commands to the BIOS for disk reads or writes.

Well, we know how BDOS calculates the first sector in a given block. But what happens if we want record 10 of the file? Remember that because of the inefficiency of always having to have free space in very large chunks, files are not stored on continuous blocks. Luckily, though, so long as BDOS keeps the block number list in the directory entry in order, it can also use BSH to find the block in the list that contains record 10 (or any other record, for that matter). To do so, BDOS merely takes the record number being sought and shifts it right by BSH; in other words, it divides the record number by the number of records in a block. Record number 10 divided by 8 (for a system with 1K block sizes) would equal 1 with a remainder of 2, meaning that the record we want is record 2 of block 1 in the list. Remember that block 1 is the second block and record 2 is the third record, since (again) we always start with 0.

Hold it, though. If BDOS shifts the record number to the right three times in order to get the block number in the list, we won't have a remainder, since dividing by shifting discards the bits that would be a remainder to the division. That was a pretty good method for finding the block, and even for finding the first sector of a block, but how do we go about finding a sector within a block? This is where the BLM field at DPB+3 comes in.

BLM stands for block mask. It is the tool that BDOS uses to determine which sector within a given block is the one requested. Likewise, masking is the tool used for finding the remainder in a division done by shifting.

Suppose, for example, that we had a file that used four complete 1K blocks in the directory entry block list and the first three records (0 through 2) of the fifth block. Since there are eight sectors per block, there are (4*8)+3—or thirty-five—records in this file. RECS in this directory entry would therefore be 35. Suppose we now wanted to add another record to the file, making our record count 36. We know how to find which block number in the list the record would be in, but how would we go about finding the relative record number within the block? BDOS does it by using the BLM value.

In order to understand masks, we must first understand the logical AND operation. Like add, subtract, multiply, and divide, AND is an operation performed on two numbers. In this case the numbers are binary, and the operation is logical rather than mathematical. The AND operation is concerned with individual bits in a binary number. To illustrate, let's take single-bit binary numbers and see how AND operates. The definition can be expressed as follows:

0 AND 0 = 0; 0 AND 1 = 0; 1 AND 0 = 0; 1 AND 1 = 1

This is more easily seen by means of something called a truth table. It looks like figure 3.

To get the value produced by ANDing two bits (which is the same as two single-bit numbers), find the first number in one of the overhead columns and the second number in one of the left-side rows. Where that row and column intersect is the answer. ANDing two numbers that contain more than one bit is no more difficult to do. The two numbers just have each of their bits ANDed with the corresponding bit in the other number, as shown here:

```
bit number    76543210
          7 = 00000111B
AND       6 = 00000110B
answer      = 00000110B
```

When the numbers 7 and 6 are ANDed, all bits where there are zeros in both numbers automatically equal 0, so that the first five bits in the an-

	0	1
0	0	0
1	0	1

Figure 3. Truth table for logical AND.

swer will automatically be 0s. Bits 0, 1, and 2, then, are the only ones we need to worry about. In bit 0, 7 has a 1, while 6 has a 0. 1 AND 0 = 0, so bit 0 in the answer will also be 0. Both 7 and 6 have 1s in bits 1 and 2. Since 1 AND 1 = 1, bits 1 and 2 of the answer will be 1s. Therefore 7 AND 6 = 00000110B, or 6. Try doing some other numbers on your own to get the feel of it. The logical AND is generally used in programming to strip away unwanted portions of numbers. As you should have seen by now, a 0 in any bit position automatically means a 0 in that position in the result.

Another purpose of logical AND (and the one we are most interested in) is to isolate the remainder in division. As we've seen, division by shifting in binary is rather imprecise. As we said, dividing a binary number by 2 is equivalent to shifting all bits one place to the right. But what if the number were not even (meaning that there was a 1 in bit 0)? Shifting all bits one place to the right would destroy bit 0! What would happen to our remainder? Dividing 3 by 2 should equal 1 with a remainder of 1; doing this operation via the right shift method gives us 1 all right, but no remainder.

There are all sorts of tricks one can use to salvage the remainder as each successive shift is made, but by far the quickest way is simply to look at the bits that will be shifted out and lost. For example, in our 3/2 division, 3 in binary is 011. If we look at bit 0, we see the 1 that will be shifted out and lost, and so we know that we will have a remainder of 1. The processor, however, cannot simply "look" at the number and "see" a remainder of 1. Remember, the processor must have a method of isolating these bits into a single value, which it can then interpret. We can come up with a specific number and a specific operation to isolate these bits for a specific divisor. But isn't there some way this approach can be more generally applied?

Yes, if we AND the number we're dividing by one less than the divisor, we'll be left with the remainder! For example, 3 = 00000011B, and since we want to divide it by 2, we need to AND it with one less than 2, or 1. We know that 1 = 00000001B, so what is 1 AND 3?

```
          1=00000001B
AND       3=00000011B
          ----------
answer    1=00000001B
```

From the above, we can see that 1 AND 3=1. Our remainder, therefore, will equal 1, which is exactly what we said it should be.

Dividing by shifting to get the primary answer and masking with one less than the dividing number works for division by any power of 2 (4, 8, 16, 32, and so on). Provided we know the BSH exponent of our number, n, and the BLM $(n-1)$ value, we can use these to obtain the primary result and remainder.

In our example earlier, we wanted to find the block in the list and the relative record in the block for the record we were adding to the file. Let's review the information we have:

Block list:	3 4 5 6 9
Sector count:	35 (means valid sectors allocated)
BSH:	03
BLM:	07
Problem:	Allocate the next sector. Find the block number in the list, the sector within the block, and the total relative sector number on the media.

We said the record count was 35, and we wanted to add another record to the count, making our count 36. In binary, 36 is 00100100B. Shifting this value right three places produces the number 00000100B. Thus we want allocation block 4 in our list. Allocation block 0 in the list is 3, block 1 is 4, and so on, so that allocation block 4 in the list is number 9. Now, to find the record within the block, we must AND the record number with the BLM value. In this case the BLM is 07—one less than 8, the number of sectors in a block. Let's do the AND:

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```
Record to seek:  36 = 00100100B
BLM:             07 = 00000111B
                 ----------------
36 AND 7 = 00000100B = 4
```

Based on our calculations, then, we are looking for the fourth record in the block. The sector we want, therefore, is the fourth sector in allocation block 9. Going back to our first use of the BSH value, we shift the block number three (BSH) places left to produce the absolute sector number that is equal to the starting sector of that block. Shifting 9 three places to the left produces the number 72. This, then, is the relative starting sector for that block on the media. Since we want the fourth sector of that block and 72 is the first, we add 3 to 72 to produce the actual relative sector of this record of the file, or sector 75. This is the way BDOS calculates the absolute sector number for any file record that it is allocating or that is requested by user programs or other system operations. As we've said before, all BDOS calculations have their basis in the allocation block and its number. Using these and the BSH and BLM values, BDOS can easily calculate the relative sector of the desired data, using this number eventually to find track and sector numbers to be issued to the BIOS SETTRK and SETSEC routines.

The next field in the DPB, located at DPB+04, is the EXM field. EXM stands for extent mask. It is used similarly to the BLM value: to mask selected bits. In this case, BDOS uses EXM to mask the EXT field of the directory entry when trying to locate the entry for a particular portion of the file. Remember that in our discussion of the directory entry we said that each filled entry can contain at least one extent. This is so because there are sixteen bytes available for the block list—sixteen single-byte numbers or eight double-byte numbers. A format with 1K block size and less than 256 blocks (one-byte block numbers) could have sixteen such blocks in the list, while a format with 2K block size and more than 255 blocks (two-byte block numbers) could have eight blocks listed. What about 4K block sizes? These blocks would not require block numbers of more than two bytes; therefore, eight block numbers would still fit in the block list. Obviously, eight 4K blocks are more than a single 16K extent. Remember, too, that there are also formats with 8K and 16K block sizes. How does BDOS equate large block sizes with single directory entries?

The answer, of course, is to put more than one extent in the directory entry. How many extents will fit depends on two factors—the block size and the number of block numbers in the single-byte or double-byte block numbers in the list. For the moment, let's assume that we are dealing only with double-byte block numbers so that a maximum of eight blocks will fit in the list. In that case, two extents will fit into an entry where block size is 4K, four extents will fit into an entry with an 8K block size, and eight extents will fit into an entry with a 16K block size.

You'll remember how we described the process whereby BDOS modifies the directory entry as it adds records to the file. We talked about how the record count (RECS) is incremented from 0 to 128, then a new entry is created with RECS equal to 0 and EXT equal to 1. When this occurs with formats that have more than one extent in an entry, the same thing happens to these two fields, but no new entry is created. Saved on a format with 4K block sizes, a file with four full extents and part of a fifth would have only three entries—one with the EXT field equal to 01 and the RECS field equal to 128; a second with EXT equal to 03 and RECS equal to 128; and a final entry with EXT equal to 04 and RECS equal to the record count of extent 4, the partially filled extent.

This being the case, how does BDOS manage to locate the entry containing extent 00 or the one containing extent 02, since there will not be entries with EXT equal to 00 or EXT equal to 02? It does so using the EXM value. EXM is set to be one less than the number of extents that can be contained in an entry. Using this value, BDOS can manipulate the EXT value and the number of the extent it is seeking so that they match. To see how this is done, let's suppose BDOS is looking for extent 12 of a file with twenty-one extents on a disk format with a 16K block size (eight extents per entry and an EXM value of 7). In such a system, there would be three directory entries whose headers look like figure 4. (Note that we are not showing the block list in this diagram, and you are seeing the hex bytes on the left and ASCII representation of those bytes on the right.)

When you examine figure 4, you'll notice that the headers are identical except for the EXT fields that are 07H, 0EH, and 15H, and the RECS field of the third entry, which shows that there are only 35H records in extent 21. The task at hand is to find an easy method for BDOS to locate extent 12 in these entries.

```
00 41 41 41 20 20 20 20 20 43 4F 4D 07 00 00 80  .AAA     COM.....
00 41 41 41 20 20 20 20 20 43 4F 4D 0E 00 00 80  .AAA     COM.....
00 41 41 41 20 20 20 20 20 43 4F 4D 15 00 00 35  .AAA     COM....
                                    |
                                   EXT
```

Figure 4. Simulated directory entries for file AAA.COM.

We said earlier that EXM is a mask. Do you see how EXM will be used here to find extent 12? This example is not as simple as the one for BLM, but it is still fairly trivial. What is done instead of simply ANDing the EXM and EXT values is to use the complement of EXM. The complement is a very simple idea; it means only that all bits in the number complemented are changed to their opposite: Bits that are 1 are made 0 and vice versa. The eight-bit complement of our EXM (7), then, is 11111000B (or 248 in decimal). Now what happens if we AND the EXT values with the complement of EXM?

```
          07H = 07 = 00000111B
AND         248 = 11111000B
          ----------------------
answer:     00 = 00000000B

          0EH = 14 = 00001110B
AND         248 = 11111000B
          ----------------------
answer:     08 = 00001000B

          15H = 21 = 00010101B
AND         248 = 11111000B
          ----------------------
answer:     16 = 00010000B
```

Well, that doesn't look promising, does it? We're no closer to 12 than we were before. But wait. What happens if we now AND the record we're seeking (extent 12) and the EXM complement?

```
            12 = 00001100B
AND         248 = 11111000B
          ----------------------
answer:     08 = 00001000B
```

That's better; we now have a match. The 08 result of our AND with 12 matches the 08 result of our AND with the EXT value in entry number 2. Let's take the procedure in sequence. When BDOS wishes to find an extent, it first locates a directory entry. BDOS's next step is to AND both the EXT value of the entry and the number of the extent BDOS is seeking with the complement of EXM. If the two results match, BDOS knows it has found the proper entry. If there is no match, it goes on to the next entry and so on until it finds a match or there are no more directory entries left. EXM is also used by BDOS for other purposes related to finding absolute positions in the file, but we will defer that discussion for now.

Our next DPB field is DSM, which is located at DPB+05. This is a two-byte value (low-order byte first and high-order byte second). The letters stand for disk size maximum, and the DSM represents the maximum allocation block number that will fit on a given drive's media. This is not the same as the total number of blocks, since we number them starting at 0. The total number of blocks, therefore, is DSM+1; and we can now see that if we were to multiply DSM+1 by the block size, we would get the total storage capacity of the media.

BDOS uses DSM in a number of ways, but primarily BDOS uses DSM to determine when it has reached the end of the disk surface and the disk's storage capacity is exhausted. It's important to note that the reserved operating system tracks at the beginning of the disk are not included in the DSM value, although the directory area immediately after that is included. When calculating DSM, the BIOS designer takes the number of physical sectors contained on all the tracks, divides by the number of sectors in 1K, and then divides that result by the block size. This is often not an even result, and since CP/M can deal only in complete blocks, there is occasionally some small amount of disk space at the very end of the disk that goes unused.

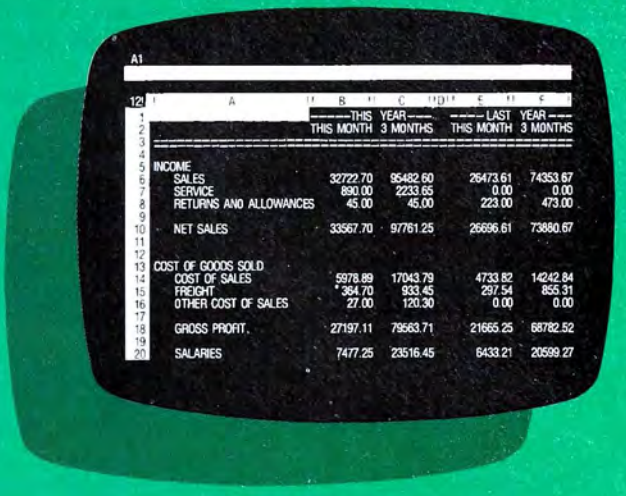
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The next field, DRM, found at DPB+07, is also a two-byte number. It is the maximum directory-entry number contained in the directory area of the drive's media, and its name is directory maximum.

Like DSM, DRM is one less than the total number of directory entries. BDOS uses DRM during directory searches to determine when it has reached the end of the directory entries. DRM is not an arbitrary number; there is a definite maximum number of entries that will fit on the disk, and that number is determined by the block size. We will see how it is determined when we examine the next two fields, AL0 and AL1.

These two fields are responsible for reserving storage space for the directory area. They are part of a larger area called the *allocation vector.* This area is a map showing which blocks on the media are already being used and which are free to be used for new file storage. The map contains one bit for each block, and for this reason it is called a *bit map.* Put another way, the area of memory containing the map has one byte for every eight blocks on the media. When a certain block is used, BDOS sets the bit in the map that corresponds to that block. Similarly, when a block is freed, usually because a file is deleted, BDOS resets the bit corresponding to that block to 0. In this way, the bit map constantly shows used and free blocks, allowing BDOS to allocate new storage space easily by scanning the map for 0 bits when writing information to the drive.

AL0 and AL1, at DPB+9 and DPB+10 respectively, are designed to be a part of that bit map. As you can now see, setting bits in these two bytes reserves blocks for the directory so that BDOS will not allocate the directory portion of the disk when writing new files. AL0 and AL1 are taken together as a single sixteen-bit field, as shown in figure 5.

From figure 5, you can see that for each bit set in the two AL*n* bytes, one block will be allocated in the bit map for directory space. Now we can see what puts a limit on the number of directory entries it is possible to have. Since there are sixteen bits in the map, only sixteen blocks may be thus reserved. Since there are thirty-two entries possible in 1K (four for each 128-byte sector), the maximum number of directory entries is 32 times 16 times the block size. The smallest maximum number allowed would be 512 for a format with 1K blocks, ranging up to a largest maximum number of 8,192 for a format with 16K blocks. Obviously, this allows for far more than would be needed; consequently, the number is limited to a more realistic figure in most cases so that unneeded space is not tied up. Typically, these figures range from 32 entries for many five-inch disk formats up to 1,024 entries for some of the larger-capacity rigid-media disks.

Name:	AL0								AL1							
Bits:	00	01	02	03	04	05	06	07	00	01	02	03	04	05	06	07
Bit map position:	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15

Figure 5. Directory allocation map.

BDOS uses AL0 and AL1 by simply loading them from their positions in the DPB and installing them directly into the bit map on every warm boot. First, BDOS zeros the entire map, using DSM to indicate the number of zeros to write. Then BDOS creates the map itself by reading through the directory, noting the used blocks, and setting those bits in the map. We'll point out the location of the map at a later time.

The next field in the DPB, found at DPB+11, is the CKS field. CKS is also a two-byte number and is stored low-order, then high-order. This value represents the size of another sort of scratchpad area, similar to the allocation map mentioned previously. In this case, however, the area is used for storage of checksum values and is called the *checksum vector.*

As we've discussed before, checksums are bytes representing a unique number created from a complete group of other bytes. BDOS creates checksums, for example, by starting with 0 and adding to it each byte of a string of data bytes. Any overflow from the addition operations is discarded. When all bytes have been added, a result is left that is to some degree unique for that set of bytes. A different series of data bytes would probably result in a different number. No checksum is truly unique, but for all intents and purposes it can be said to be so.

BDOS uses the checksum technique on the directory in this case, performing a checksum calculation on each directory sector. This is the information stored in the checksum vector. Since there must be one checksum byte for each sector, the checksum vector must contain the same number of bytes as there are directory sectors. CKS, then, must equal the number of directory sectors.

BIOS designers calculate CKS by taking the DRM value plus 1 and dividing it by 4, the number of entries in a sector. BDOS could certainly calculate this value itself; but for a system with few drives it takes fewer bytes to store the information in a table like the DPB than it would to calculate the value. As BDOS writes more records, deletes files, or otherwise alters the contents of the disk, it modifies the disk directory as well. With each directory modification it makes, BDOS goes on to update the byte in the checksum vector corresponding to the modified directory sector.

The warm boot (or BDOS reset-disk system call) causes BDOS to disregard the checksum values in the vector and to re-create them from whatever media is currently in the drive. This is the reason for performing a warm boot immediately following a disk change. CKS is the value that BDOS uses to determine how many sectors to checksum during warm boots. What may not be so obvious is why this is done. Essentially, by periodically performing checksums on the directory of the disk in the drive and comparing them to the values in the checksum area, BDOS can determine if the media has been changed since the last checksum was done. Thus, BDOS has an independent method of determining media changes.

It should be obvious by now that BDOS spends considerable time doing calculations and other operations on the disk's directory. Most of the information used to decide where to write on the media is kept in memory. If the media were to be changed and BDOS were not made aware of the change via a warm boot, the media could be ruined by having information written in the wrong place. Trusting the user always to remember to warm-boot is dangerous. But forcing BDOS to recheck the directory before each and every disk write would slow things down considerably. Providing an independent method for BDOS to check for media changes at appropriate times, however, maintains safety while sacrificing only a small amount of efficiency. A method of eliminating the process altogether—for drives such as fixed disks whose media cannot be changed—has also been provided. In such a case, the CKS value is set to 0, and BDOS does not perform the checksum calculations at all. Proceeding in this fashion in a floppy environment, however, is not recommended.

This brings us to the last DPB field (at DPB+13), the OFF field. This field contains a value that is equal to the number of reserved tracks (remember that we spoke about these earlier when we discussed the disk media organization). These are the tracks that are usually used for storage of the operating system. Since they are reserved and the block numbers begin after these tracks, BDOS cannot access anything in this reserved area.

Other than to say that BDOS uses the absolute sector number and SPT value to calculate track numbers, we have not spoken much about tracks. That notwithstanding, the OFF value is very important.

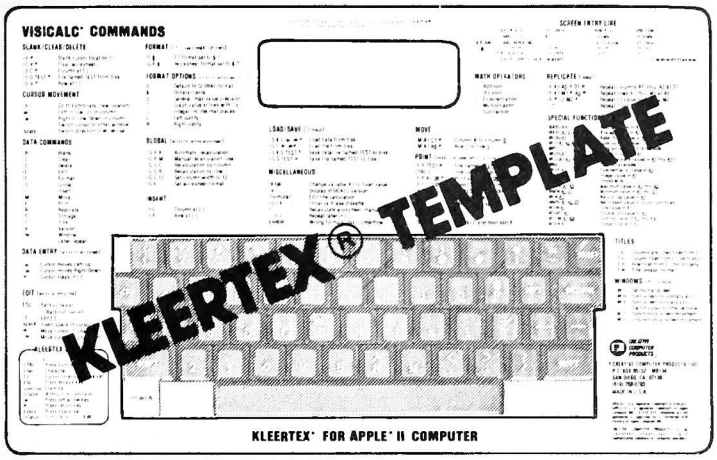
Most floppy disk formats that are "standard" within the industry have a set number of reserved tracks. Most 5-inch disks reserve three tracks, while most 8-inch disks reserve two. A BIOS DPB that describes a format with OFF values other than these will have real difficulty reading any other formats than the one created by its system. Consequently, little alteration is normally done in this area in the floppy arena. Rigid disks, however, which have no "standard" formats to emulate, can make use of OFF to divide a rigid disk's media into several smaller units. These new "subdrives" look to CP/M like separate disk drives of a smaller capacity. This can have advantages of all kinds by way of increasing the speed at which data can be copied from one drive to another.

The reason that OFF can be used in this fashion is that when calculating the track number BDOS creates a number based on track 0, sector 0 being the first sector of the first allocation block on the disk. This value wouldn't do the BIOS much good, since the BIOS is aware of the reserved tracks and must count them. BDOS, therefore, adds the OFF (reserved track) value before passing the track number to BIOS. Setting OFF for one drive to the first track after the system on the rigid disk and setting OFF for a second drive to a track number that is halfway through the rigid disk's media gives you two drives that are half as large as your

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original. Note that the DSM (and possibly other values) has to be changed as well.

We have now covered the DPB in considerable detail. To see, then, exactly how the SoftCard DPB appears, refer to figure 6.

	SPT	BSH	BLM	EXM	DSM	DRM	AL0	AL1	CKS	OFF
	32|00	3	7	0	127|0	47|00	192	000	12|00	03|00
DPB	16b +0	8b +2	8b +3	8b +4	16b +5	16b +7	8b +9	8b +10	16b +11	16b +13

Figure 6. SoftCard disk parameter block.

Let's take a look at how the DPB is put together. First, the Apple's Disk II controller reads and writes 256-byte sectors, sixteen to a track. Although the drives can position themselves at seventy different track positions, because of their construction they cannot write tracks that are that close together. Consequently, they are capable of reading and writing on only thirty-five distinct tracks. Thus, each disk is capable of holding 35 times 16 sectors of data—or 560—256-byte sectors.

Since there are four such sectors in 1K, the capacity of the disk will be 560 divided by 4, or 140K. Since the smallest unit CP/M can allocate is one block, and since most files are relatively small, there is a penalty associated with large block sizes. In fact, the only reason to select a larger block size is to keep the size of the allocation bit map down to a relatively small number of bytes. Since the SoftCard disk capacity is so low, there's no problem on that score with making the block size 1K.

That being the case, we can begin filling in some of the values in the DPB. Since there are sixteen 256-byte sectors, the value we must select for SPT is 32. This is a two-byte field, so the high-order byte in this field will be 00. The next field, BSH, is the exponent required to make 2 equal to the number of sectors in a block. Since there are eight sectors in our 1K block, the exponent of 2 required to make eight is 3. Therefore the BSH value is 3. The BLM value, as you'll recall, is one less than the number of sectors in a block, meaning that BLM for the SoftCard is 7. Finally, EXM for 1K blocks depends also on whether there are more than 255 such blocks on the disk. SoftCard can have only 140 blocks even if no system tracks were reserved, so the number will have to be less than 255. (Actually, Digital Research does not allow more than 255 1K blocks, due to problems that would cause BDOS during some calculations of extent numbers.) Since we're dealing with single-byte block numbers and can have sixteen 1K blocks in the block list, we can get only one extent per directory entry. Since EXM is one less than the number of extents in each entry, EXM for SoftCard is 0.

So far we have filled in the first four fields of the Softcard DPB. To do the next field (DSM), we need to know how many of the disk's tracks that BDOS can use. To know that, we need to know how much space is needed for the operating system. Because the Disk II controller will not read a disk created by a standard floppy disk controller chip, we don't need to be concerned about making the disk format compatible with anyone else's, since we couldn't read it anyway. We are therefore free to design our own. Actually, in this case, the number of tracks to be reserved is dependent on the size of the BOOT code and BIOS plus CCP and BDOS, since these must all be contained on the system tracks. From earlier columns we know that all of the various BOOT, BIOS, and CP/M sections take up thirty-nine 256-byte pages. At sixteen such pages per track, the system will take up two full tracks and seven sectors of the third track. We now know that there will be three reserved tracks and that our OFF field will contain a value of 3.

Since we now know the number of data tracks remaining, we can calculate DSM. With a total of thirty-five tracks on the disk, three of which are reserved, the number of data tracks will be 32. Since there is 4K per track, the disk capacity is 4 times 32, or 128K. Since we are using a 1K block size, we will have block numbers from 0 to 127, so our DSM value will be 127. One hundred twenty-seven is a single-byte number, and consequently the high-order byte of DSM will be 00.

The next value to calculate is DRM. Again, we are not worried about matching someone else's format, so we can pick what we think might be a logical number of directory entries required. Allowing for too large a number of entries would waste space, while providing for too small a number would fill the directory with space still remaining on the media. Microsoft chose forty-eight entries, thereby making the DRM value 47, one less than the number of entries allowed.

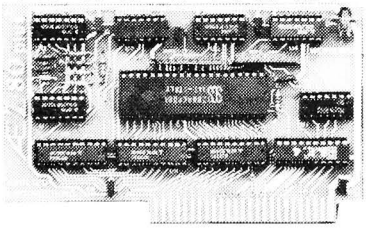
We can now use DRM to calculate AL0 and AL1 for the SoftCard With 1K blocks, we know that we can fit thirty-two directory entries into one block. Since we are requesting forty-eight total entries, this will require that two blocks be reserved. If we had used sixty-four entries, however, we still would have required that only two blocks be reserved, and we would not have wasted any space in the directory. Obviously, setting things up this way would have required slightly more checksum space, but not much. Perhaps it would have been better to go with sixty-four. In any case, reserving two blocks means setting the two leftmost bits in AL0 so that the first two bits in the bit map will show as used at all times. AL0, with its two high bits as 1s, equals the number 192. AL1, of course, has no bits set, so it remains 00.

The next field, CKS, a function of the number of directory entries, requires one byte for each sector of the directory in which to store the checksum. Since we have forty-eight entries, and there are four entries to a sector, the number of sectors is 48 divided by 4, or 12 sectors. Our CKS value, then, is 12. Had Microsoft chosen a sixty-four-entry directory area, it would have been 16, thereby costing four more bytes for each of the six disk drives allowed in the system.

This completes our creation of the SoftCard DPB. You should by now be thoroughly familiar with each field, how the fields are determined, and how they are used. The SoftCard DPB is shared by all six drives, since there is only one model of the Disk II drive and therefore only one format in use in both 56K and 44K SoftCard CP/M. The DPB is located in a 56K system at 0DA93H (0AA93H in 44K). You can look at it using DDT if you wish to verify the numbers given here.

This month's discussion has been very long and complex. That being the case, we'll postpone further discussion of the remaining data structures for another column. In the meantime, perhaps what we've covered so far has provided some insight into what is often a confusing area. Until next month. . . .

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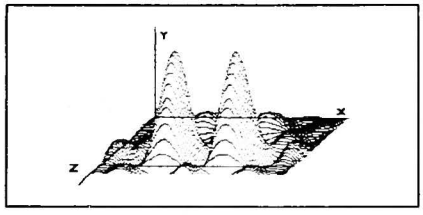
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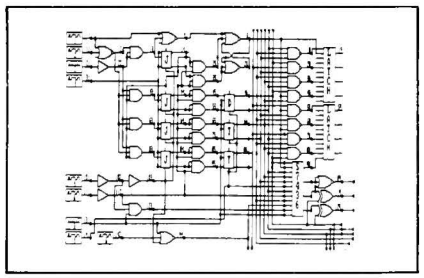
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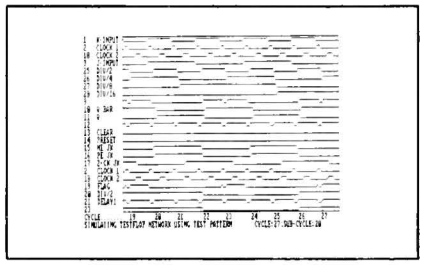
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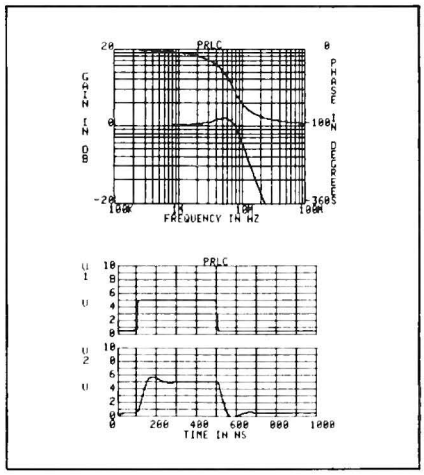
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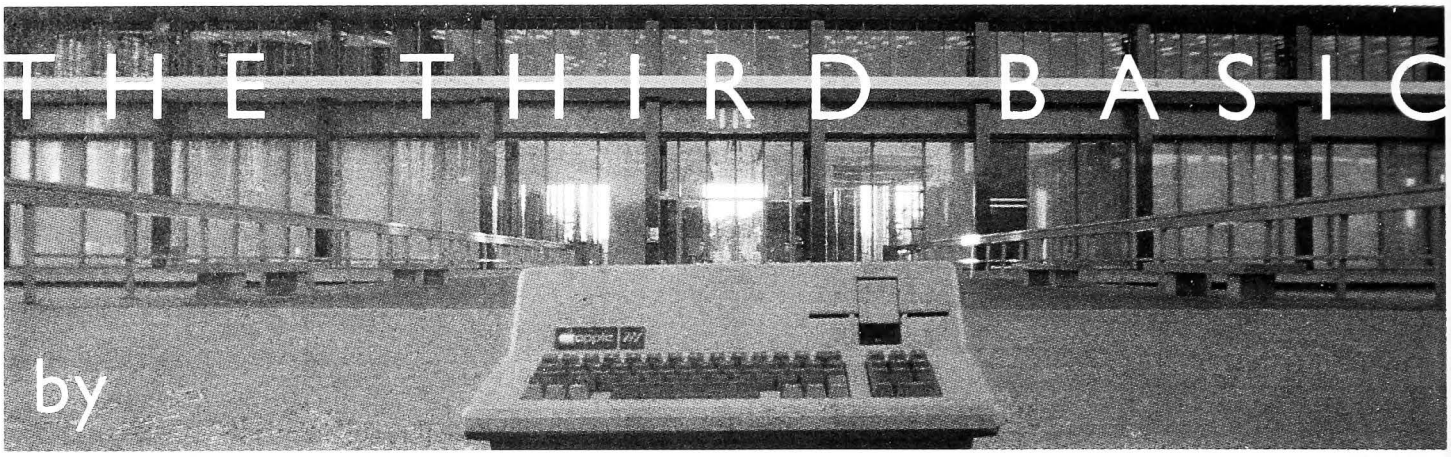
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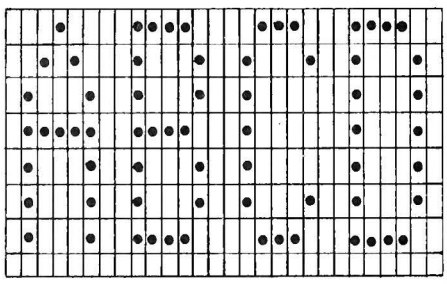
Exploring Business Basic, Part 22

Last time we wrapped up our discussion of graphics (for a while) and envisioned some more practical activities with which to spend our programming hours. Somehow Bugmania and the bouncing squid brothers seemed frivolous at the time, but definitely fun. In this article we will put together some of the tricks we learned in the graphics world to demonstrate a really superior input environment that you can use as a general-purpose data-entry routine.

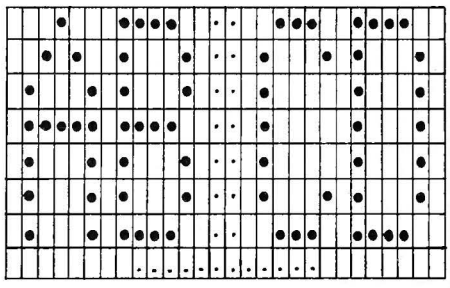
Getting Some Utility from Basic. Everybody who has used the Apple III has had occasion to use the *System Utilities* program. But not everybody has used one of its special capabilities, one that we will copy extensively for this article. This function is the insert mode in input fields within the program.

Boot *System Utilities* and select something simple, such as listing a file. When the default file name appears in the file-name field at the bottom of the screen, press open-apple-I to put the field into insert mode. You will immediately see a strange-looking shape at the beginning of the field, resembling an upside-down T. It looks something like this: ⊥. By moving this new cursor, you can place it between two characters in the input field. If you watch carefully, you will see that the characters appear to ripple—to quickly expand and contract—as you pass over them with this new cursor. Any characters typed when this cursor is on will appear to the right of the cursor location, inserted between the two screen characters that were divided by the cursor. Using open-apple with the left and right arrows, you can delete characters to the left or to the right of the cursor respectively.

Shift to the Left, Shift to the Right. The rippling effect is a clue to how the insert-mode editing works. Normally there is one row of blank pixels on each side of a character definition. That is, the normal character cell is seven pixels wide by eight high, but normally the characters use only five horizontal pixels and seven vertical ones (the bottom row is reserved for lower-case characters with descenders, such as g and p). By packing the characters more tightly in text mode, we can create enough space between them to put a vertical cursor line and thereby indicate exactly where the insertion of a character will occur. The following example will summarize the possibilities:



The diagram shows how the letters "ABCD" are presented on the screen as five-by-seven character definitions within a seven-by-eight-character cell. Notice that there are two blank rows between adjacent characters. If we could squeeze two of the characters apart slightly, there would be room to put a cursor between them, like this:



Notice that all the letters are legible and separated, but the B is moved to the left and the C is moved to the right to make room for the cursor in the middle. This leaves one space between A and B and between C and D, but everything works out.

Getting There Is Half the Fun. Now that we know that we can put a cursor between text-mode characters without destroying the character definitions, the next big trick is determining how to accomplish the task. A solution to this problem was described in several previous episodes. It involves creating different character definitions of each character, one definition with the T-shaped cursor on the left and one with it on the right. Defining each character in this way will allow us to see how the compressed characters work. Fortunately, we don't have to start character definitions from scratch. The upcoming program shows how a given character font can be transformed into the compressed set with cursors installed:

```
10 DIM highr%(15),lowr%(15),carryr%(15),
   highl%(15),lowl%(15),carryl%(15)
20 DIM sleft%(255),sright%(255),char%
   (511),charl%(511),charr%(511)
30 INVOKE"/basic/request.inv","/basic/
   download.inv"
40 GOSUB 4000
```

The arrays in line 10 are used by the con-

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version routine that we will see in a minute, as are sleft% and sright%. Char%, charl%, and charr% are used to store font definitions, for regular, left-shifted, and right-shifted respectively. Line 30 invokes the request module, which will be used to make control calls to SOS, and download, which puts the converted fonts into the system character set. The gosubs to line 4000 are where all the excitement starts in the character-conversion process:

```
4000 DATA 0,2,4,6,0,2,4,6,8,10,12,14,8,
     10,12,14
4010 DATA 1,3,5,7,9,11,13,15,1,3,5,7,9,
     11,13,15
4020 DATA 0,0,0,0,0,0,0,0,1,1,1,1,1,1,1,1
4030 DATA 4,4,5,5,6,6,7,7,12,12,13,13,14,
     14,15,15
4040 DATA 0,0,1,1,2,2,3,3,4,4,5,5,6,6,7,7
4050 DATA 0,8,0,8,0,8,0,8,0,8,0,8,0,8,0,8
4100 FOR i=0 TO 15:READ highl%(i)
     :NEXT:FOR i=0 TO 15:READ lowl%(i)
     :NEXT
4110 FOR i=0 TO 15:READ carryl%(i):NEXT
4120 FOR i=0 TO 15:READ highr%(i)
     :NEXT:FOR i=0 TO 15:READ
     lowr%(i):NEXT
4130 FOR i=0 TO 15:READ carryr%(i):NEXT
```

Each constant in lines 4000 through 4050 represents the shifted version of one nibble (four bits) of an eight-bit-row definition of a character. The exceptions are the data in lines 4020 and 4050, which contain the quantity to carry in the event that a shift right or left needs to shift a value into the adjacent nibble. The nibble versions of this shift, along with the carry array, are used to simplify the problem of having all 256 possible shifted bytes in one big table. With the individual nibble shifts, it is easy to construct the table:

```
4150 FOR i=0 TO 15:FOR j=0 TO 15
4160 sleft%(i*16+j)=16*(highl%(i)+
     carryl%(j))+lowl%(j)
4170 sright%(i*16+j)=16*highr%(i)+
     lowr%(j)+carryr%(i)
4180 NEXT:NEXT
```

Lines 4150 through 4180 put the nibbles together and add the carry to build the conversion arrays sleft% and sright%. These are the constants that a character definition will utilize to perform the actual shift. To use the tables to translate a character font, we first need one:

```
4200 prompt$="Character font
     pathname: ":GOSUB 5000
4210 IF error THEN RETURN

5000 PRINT prompt$;:INPUT"";a$
5010 IF a$="" THEN error=1:RETURN
5020 error=0:RETURN

4220 ON ERR GOTO 4260
4230 font$=CHR$(34)+a$+CHR$(34):
     charset$="char%"
4240 PERFORM getfont(@font$,@charset$)
4250 OFF ERR:PRINT"Font loaded":
     GOTO 4400
4260 ON ERR GOTO 4300
4270 OPEN#1,a$:PERFORM filread(%1,
     @charset$,%1024,@ret%)
4280 IF ret%=1024 THEN OFF ERR:
     GOTO 4400
4300 OFF ERR:PRINT a$" is not a valid
     character font file"
4310 IF TYP(1)=0 THEN CLOSE#1:DELETE
     a$:GOTO 4200
4320 CLOSE#1:GOTO 4200
```

This routine is yet another variation on the familiar theme of loading in a font definition from a regular font file, or from a file created by a font editor that cannot change the file type to font. When it exits to line 4400, the font is contained in char%, which is then sent to line 4400 for the actual conversion:

```
4400 PRINT:PRINT"Preparing the character
     fonts"
4410 FOR i=0 TO 511 STEP 4
4420 FOR j=0 TO 2:a$=HEX$(char%(i+j))
4430 l=TEN(MID$(a$,1,2)):r=TEN
     (MID$(a$,3,2))
4440 charl%(i+j)=TEN(MID$(HEX$(sleft%
     (l)),3,2)+MID$(HEX$(sleft%(r)),3,2))
4450 charr%(i+j)=TEN(MID$(HEX$(sright%
     (l)),3,2)+MID$(HEX$(sright%(r)),3,2))
4460 NEXT j
4470 a$=HEX$(char%(i+3)):l=TEN(MID$
     (a$,1,2))
4480 charl%(i+3)=TEN(HEX$(sleft%
     (l))+"7F")
4490 charr%(i+3)=TEN(HEX$(sright%
     (l))+"FE")
4500 NEXT i
4510 RETURN
```

The routine above deserves some careful study. What's happening is that the font definitions of each character are stored in four consecutive integer values in the char% array. The routine converts the quantity to a hex value, then splits it into two bytes and passes those through a conversion and then a lookup of the corresponding value in sright% or sleft%, depending on the desired shift. Lines 4470 through 4490 take care of the special case of the underline (part of the bottom of the upside-down T), by forcing the line to contain all ones, no matter what character information was there. Now that we have definitions in charl% and charr%, we can proceed:

```
50 PRINT"Press ESCAPE to switch fonts,
   RETURN to exit"
60 array$="char%"
70 start=0
75 PERFORM loadfont(@array$)
80 GET a$
90 IF a$=CHR$(27) THEN 200
100 IF a$<>CHR$(13) THEN start=start+
    1:GOTO 120
110 IF start=0 THEN 300:ELSE:start=0:
    PRINT:GOTO 80
120 PRINT a$;:GOTO 80
200 IF array$="charl%" THEN array$=
    "charr%":ELSE:array$="charl%"
210 GOTO 75
```

After loading up the normal font in line 75, the routine accepts a character and checks to see if it's escape. If so, the character set is toggled between left and right-shifted characters by reloading the new set in line 75. Otherwise, the program allows you to type characters to observe them in this new definition. A carriage return as the first character on the line gets you out to line 300:

```
300 PERFORM loadfont(@charset$)
305 STOP
310 INVOKE
320 END
```

One thing you will notice quickly is that the screen in this program is ugly. Because each character, no matter what, is shifted and bordered by an L-shaped piece of the cursor, the whole screen appears to be made up of a grid in which you type letters. This is true even for spaces, since they get converted too. In a minute we'll see how to take these capabilities and make an attractive field editor out of them; for now you can remove the grid lines from the space characters by inserting this line in the previous program:

```
4505 REM FOR i=128 TO 131:charl%(i)=
     0:charr%(i)=0:NEXT
```

Two for T. Our objective when we began this was to determine a way to change the two characters surrounding the cursor (our upside-down T), thereby making what's going on in the editing process a lot clearer. The last example was designed to show that we really could convert character sets to have this shifted, embedded cursor. Now we want to use these characters in a much more subtle way.

Basically, the utilities program referred to earlier accomplishes the cursor insertion in the following way. Extra versions (left and right-shifted) of the current character set are stored away. When the cursor is to be inserted between two characters, say A and B, the program defines two special characters (we'll use ASCII 0 and 1) as shifted versions of A and B and prints them where the A and B were. The redefinition of the characters is done through a control call to the console driver, call 17 to be

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exact. This is the partial character set download, which can load a maximum of eight character definitions. More on how this works can be found in your *Standard Device Drivers Manual* and the article in this series appearing in the March issue, which used call 17 extensively to do graphics on the text screen.

The reason for redefining the special characters instead of A and B directly is that we don't want to affect any other occurrences of A and B that may be on the screen. As soon as the cursor moves on to some other characters, we print the old characters where they were originally and redefine the special characters according to the characters in the new location.

The Program. Our program starts with some of the same definitions and adds some new ones:

```
10 DIM highr%(15),lowr%(15),carryr%(15),
   highl%(15),lowl%(15),carryl%(15)
15 DIM lchar$(127),rchar$(127),flname$
   (9),vert%(9),horz%(9)
20 DIM sleft%(255),sright%(255),char%
   (511),fstart%(9),fend%(9)
30 INVOKE"/basic/request.inv","/basic/
   download.inv"
40 GOSUB 4000
45 GOSUB 6000
60 name$=".console"
75 PERFORM loadfont(@charset$)
```

Notice that the charl% and charr% arrays are replaced in this version with string arrays, lchar$ and rchar$. Each occurrence of the array contains a string defining an individual ASCII character. This was done because the Control invokable requires a string as a parameter for the call. Other new arrays are flname$, vert%, horz%, fstart%, and fend%. These arrays define the fields we will use in mocking up a simple data-entry screen as an example of how to use the field-editing commands.

Next comes the initialization routine at line 4000. You should copy lines 4000 through 4320 from the previous program, since nothing has changed in that part. That goes for the little entry routine in line 5000 as well. The changed part of the initialization is shown below, with the major modification designed to create the string arrays lchar$ and rchar$:

```
4400 PRINT:PRINT"Preparing the character
     fonts"
4410 FOR i=0 TO 511 STEP 4
4415 k=i/4:lchar$(k)="":rchar$(k)=""
4420 FOR j=0 TO 2:a$=HEX$(char%(i+j))
4430 l=TEN(MID$(a$,1,2)):r=TEN(MID$
     (a$,3,2))
4440 lchar$(k)=lchar$(k)+CHR$(sleft%
     (l))+CHR$(sleft%(r))
4450 rchar$(k)=rchar$(k)+CHR$(sright%
     (l))+CHR$(sright%(r))
4460 NEXT j
4470 a$=HEX$(char%(i+3)):l=TEN(MID$
     (a$,1,2))
4480 lchar$(k)=lchar$(k)+CHR$(sleft%
     (l))+CHR$(127)
4490 rchar$(k)=rchar$(k)+CHR$(sright%
     (l))+CHR$(254)
4500 NEXT i
4510 RETURN
```

Each element of the string arrays now contains the eight bytes required to define that particular character, either right or left-shifted. Next we have an initialization routine to set the field names and parameters described earlier:

```
6000 DATA 5
6005 DATA "Name: ",6,1,7,30
6010 DATA "Address: ",8,1,10,40
6015 DATA "City: ",10,1,7,26
6020 DATA "State: ",12,1,8,9
6025 DATA "Zip: ",14,1,6,10
6050 READ n:max.field=n-1
6055 FOR i=0 TO max.field
6060 READ flname$(i),vert%(i),horz%(i),
     fstart%(i),fend%(i)
6065 NEXT i
6090 lcursor$=CHR$(128):rcursor$=CHR$
     (129):cursor$=lcursor$+rcursor$
6095 blank$="
     ":REM 40 spaces
6100 RETURN
```

Notice that in line 6090 definitions are established for versions of the cursor, composed of the characters 0 and 1 (using the values 128 and 129 makes them printable). The single-character cursor definitions are for opposite ends of an individual field, and the cursor$ definition is for insertions in the middle of a field.

Now that all the definitions are established, it's time to put fields on the screen and start editing:

```
500 HOME
505 FOR field=0 TO max.field
510 VPOS=vert%(field):HPOS=horz%
    (field):PRINT flname$(field);
520 flen=fend%(field)-fstart%(field)+1
530 cpos=1
540 value$=MID$(blank$,1,flen)
```

These lines set up a loop to process all the fields and then position the cursor, print the name of the field, set cpos (the current position within the field), and clear the field value value$ to blanks.

```
550 HPOS=fstart%(field):PRINT value$;:
    HPOS=fstart%(field)+cpos-1
560 IF cpos>1 THEN 590
570 rval%=ASC(MID$(value$,1,1))
575 ctrlist$=CHR$(1)+CHR$(1)+lchar$
    (rval%)
580 PERFORM control(%17,@ctrlist$)
    name$
585 PRINT rcursor$;:GOTO 650
590 lval%=ASC(MID$(value$,cpos-1,1)):
    rval%=ASC(MID$(value$,cpos,1))
600 ctrlist$=CHR$(2)+CHR$(0)+rchar$
    (lval%)+CHR$(1)+lchar$(rval%)
610 PERFORM control(%17,@ctrlist$)name$
620 HPOS= HPOS-1:PRINT cursor$;
```

The routine in lines 570 through 585 handles the case of the current position being the extreme left-hand position in the field. Rval% is set to the first character in value$ and a control list is built in line 575, with the shifted definition of that character as ASCII 1. The control call in 580 redefines ASCII 1; 585 then prints it to the screen. Lines 590 through 620 handle the case of midstring positions and redefine the characters on both sides of the cursor position.

```
650 GET a$:a=ASC(a$)
660 IF a<32 OR a>127 THEN 800
670 IF cpos=flen THEN 750:ELSE:IF cpos
    > flen THEN 650
675 SUB$(value$,cpos+1)=MID$(value$,
    cpos,flen-cpos)
680 SUB$(value$,cpos)=a$
690 cpos=cpos+1
700 GOTO 550
```

Lines 650 through 700 accept input from the user, checking it for control characters and open-apple commands. If it is an ordinary character, it is inserted into value$ and the routine jumps back to 550 to display the new version of the string. Notice the check made in line 670 to see if the cursor is at the right-hand end of the field. That situation is processed in line 750:

```
750 SUB$(value$,cpos)=a$:IF cpos=1
    THEN 760
755 HPOS= HPOS-2:PRINT MID$(value$,
    cpos-1,1);
760 lval%=a:ctrlist$=CHR$(1)+CHR$(0)+
    rchar$(lval%)
770 PERFORM control(%17,@ctrlist$)
    name$
780 HPOS=fend%(field):PRINT lcursor$;:
    cpos=cpos+1:GOTO 650
```

This routine is the "flip side" of the routine at 560, setting up a single-character definition at the right edge of the field.

Up until now, the routines have handled simple character inserts. Now comes the control-character processing for all the fun stuff:

```
800 IF a>127 THEN a=a-128:GOTO 900
```


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```
805 IF a=9 THEN 970
810 IF a<>8 THEN 830
815 IF cpos=1 THEN 650:ELSE IF cpos<
    flen+1 THEN 825
817 HPOS= HPOS-1:PRINT MID$
    (value$,cpos-1,1);
820 HPOS= HPOS-1:cpos=cpos-1:
    GOTO 560
825 HPOS= HPOS-2:PRINT MID$
    (value$,cpos-1,2);
827 cpos=cpos-1:HPOS= HPOS-2:
    GOTO 560
```

Line 800 dispatches the use of open-apple keys to line 900, and line 805 sends the routine to the next field if tab is pressed. Next comes the routine for the cursor back arrow, ASCII 8. This must first restore the character on the right of the cursor by printing it from value$, and then it must jump back to 560 to do the new cursor display.

```
830 IF a<>21 THEN 860
835 IF cpos>flen THEN 650:ELSE
    IF cpos=flen THEN a=ASC(MID$
    (value$,cpos,1)):GOTO 755
840 IF cpos=1 THEN HPOS= HPOS-1:
    PRINT MID$(value$,cpos,1);:GOTO 850
845 HPOS= HPOS-2:PRINT MID$
    (value$,cpos-1,1);:HPOS= HPOS+1
850 cpos=cpos+1:GOTO 560
```

This routine does the same thing for ASCII 21 (forward arrow), and returns to 755 if at the end of the field or 560 if in the middle.

```
860 IF a=13 THEN SUB$(value$,cpos,
    flen-cpos+1)=blank$:cpos=1:GOTO
    550
870 IF a=27 THEN HPOS=fstart%(field):
    PRINT value$;:GOTO 990
880 GOTO 650
```

Line 860 handles the carriage return by chopping off anything to the right of the cursor and sending the cursor back to the beginning of the field, exactly as it would be done on a typewriter. Line 870 handles escape by restoring the field and then exiting to the wrap-up routine in line 990.

```
900 IF a <> 8 THEN 920
905 IF cpos=1 THEN 650
910 SUB$(value$,cpos-1)=MID$
    (value$,cpos)+" "
915 cpos=cpos-1:GOTO 550
920 IF a<>21 THEN 960
925 IF cpos>flen THEN 650
930 SUB$(value$,cpos)=MID$(value$,
    cpos+1)+" "
935 GOTO 550
```

Remember that lines 900 through 935 can be reached only if the open-apple key was pressed along with another key. In this case, lines 900 through 915 handle open-apple-left-arrow, which deletes characters from the cursor position back to the beginning of the field, one character at a time. Lines 920 through 935 handle the opposite, open-apple-right-arrow, which deletes characters in from the cursor position to the end of the field, also one at a time. In this way all the functions of the *System Utilities* editing are duplicated.

```
960 GOTO 650
970 HPOS=fstart%(field):PRINT value$;
980 result$(field)=value$
985 NEXT field
990 PRINT:PRINT:FOR i=0 TO max.field:
    PRINT result$(i):NEXT
```

Lines 970 through 985 wrap up the processing of a field by reprinting it to ensure correctness and storing the value in the result$ array for future use. Then 985 takes the program back to process the next field (or on to 990 to print out the accumulated data).

Into the Home Stretch. One last bit of wrap-up and we're finished. Since the program could use any font, we restore the standard font at the end, clean up the invokables, and end, like so:

```
2000 stdset$=CHR$(34)+"/basic/
     standard"+CHR$(34)
2005 PERFORM getfont(@stdset$,
     @charset$)
2010 PERFORM loadfont(@charset$)
2020 INVOKE
2030 END
```

There you have it. This is no "great shakes" as a data-entry program, of course. Its purpose is to give the editing possibilities of the new cursor insert mode a workout. With some spiffing up, you could use this as a decent routine, however, especially if the performance were improved. No real effort was made to streamline the character input, so you can easily get ahead of it if you're a fast typist.

Another possible improvement is to store the string arrays that define the characters in disk files and read them in at run time. This should take less time than generating the characters each time the program is run.

Finally, there are some differences in how this program works and the editing capability of the *System Utilities* program. One nice thing that *Utilities* does is to flash the underline part of the cursor. This is accomplished by setting the high-order bit in the bottom row of the character definitions and turning on inverse mode before printing the cursor. Since this also requires that you create the inverse version of the shifted character (so the inverse of inverse is normal, get it?), that got a little messy for this article. Those of you with patience may be able to duplicate exactly the *Utilities* program. Well, now that that's said, there is one more "little" thing. *System Utilities* also handles the problem of characters that have descenders. Our program ignores descenders on characters and just includes the underline regardless. *Utilities* actually moves the character up one row, which it can do since only lower-case letters have descenders. Some people find this bothersome, but it eliminates the legibility problem that sometimes occurs when the descender is cut off.

The suggestions in the preceding paragraph come under the heading of SMOPs. SMOP stands for "Simple Matter of Programming," which is roughly equivalent to "it can easily be shown that . . ." for mathematicians. There is no task you can't accomplish with a computer; it's just a SMOP.

Until next time, may all your SMOPs be little ones!

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All About Applesoft

by Doug Carlston

The flash-card routine we printed at the end of last month's column doesn't use any new tricks, but it's worth examining closely.

We started off by identifying the section with a couple of remark statements, then testing to make sure that we had some flash cards in memory:

```
1200  REM ****************************
1210  REM FLASH CARD ROUTINE
1220  REM ****************************
1230  HOME : IF S1$ = "" THEN GOSUB 30: GOTO 500
```

If we had not yet loaded flash cards from disk or entered any from the keyboard, the variable S1$ (which represents the label for one side of each flash card, such as "French verbs" or "state capitals") would be blank, so the program would run the subroutine at line 30. That subroutine chooses labels for each side of the flash cards and does some other setup work. Then program control reverts to the main menu, where we can load data from the keyboard or from disk.

Next we printed a title at the top of the screen so we could keep track of what we were doing:

```
1240  A$ = "FLASH CARD DRILL": GOSUB 50
```

Then we were ready to get to work. When you are drilling with flash cards, the first thing you have to decide is which side of the card is going to be face up. If you are learning French, for example, you might prefer to see the French side of the card and then guess the English meaning. This is probably a little easier than going from English to French, where you not only have to know the right answer but you also have to know how to *spell* it! (This consideration is less important if all spelling is foreign to you.)

Let's determine what an appropriate screen prompt might look like. We might want it to look something like this:

```
DRILL FROM:

E(NGLISH TO FRENCH
F(RENCH TO ENGLISH
```

The idea is that the cute little parenthesis after the lead letter in each line will serve as a clue for you to press E to select the first choice or F for the second. Line 1250 prints this screen and makes considerable use of the variables we defined in subroutine 30. These are the variables: S1$ is the side 1 label, possibly flushed out with leading blanks so that it is as long as S2$; L1$ is the first letter of S1$; and L1 is the number of characters in S1$.

We could say the same things about S2$, L2$, and L2.

```
1250  VTAB 5: HTAB 10: PRINT "DRILL FROM:": PRINT : PRINT
      TAB(12);L1$"(" RIGHT$ (S1$,L1 - 1)" TO " RIGHT$ (S2$,L2):
      PRINT TAB( 12)L2$"(" RIGHT$ (S2$,L2 - 1)" TO " RIGHT$
      (S1$,L1): PRINT : PRINT
```

This line looks pretty messy, but it makes lots of sense if you examine it closely. And it works, which has to count for something.

After we print the selection screen, we need code to accept the user's response:

```
1260  GET A$: IF A$ <> L1$ AND A$ <> L2$ AND A$ <> CHR$
      (13) THEN 1250
1265  IF A$ = CHR$ (13) THEN 500
```

Line 1260 accepts a single keypress as input. It takes only E (for English), F (for French), or the return key (ASCII 13). If it doesn't get one of these three keys, it jumps back to line 1250, reprints the menu, and waits for another keypress.

Note the use of the return key as an escape hatch. If the user presses CHR$(13) (the return key), program control shifts directly to the main menu. It's always a good idea to include escape hatches. People often do silly things like accidentally pressing the wrong key on the menu. Then, of course, they want to undo them. If the program doesn't let them, they get angry at the programmer. Caveat programmer.

Now that the user has made a choice, let's set a flag (C) to record that choice:

```
1270  C = 1: IF A$ = L2$ THEN C = 2
```

If the choice was side 1 up, then C is equal to 1; if it was side 2 up, then C is set to 2. Now it's time to start flipping over the flash cards. Let's see just how much French this user knows. Clear the decks, position the cursor, and zero all the counters:

```
1280  HOME : VTAB 12:KT% = 0
```

We could just run through the cards in order, one at a time, starting with the first one in the array and going straight through to the end. However, a learned friend says that this is *not good*. People remember that a certain word was second in the list and thus can answer correctly—even though they haven't learned the definition. Or they recall that *pommes de terre* was the definition that directly followed the one with those silly sounds (even though they're not sure what *pommes de terre* means). And so on. So we had better shuffle the cards.

Actually, what we do is pick a card at random from the group:

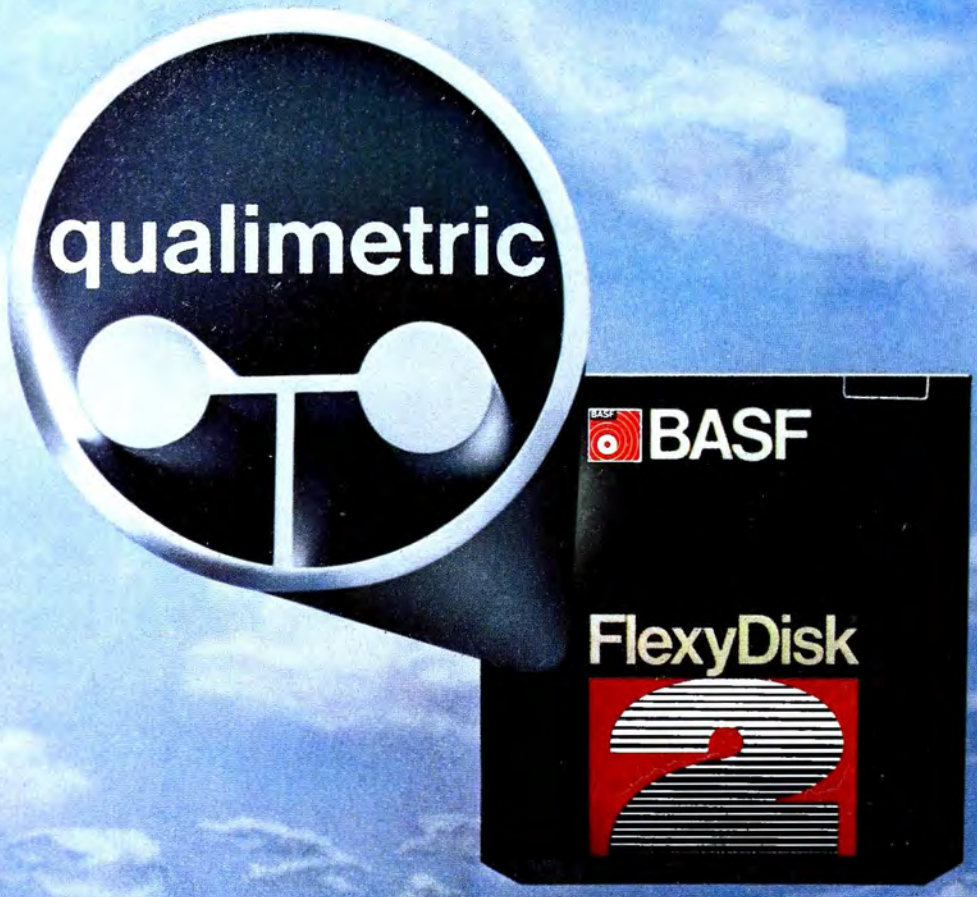
```
1290  A% = RND (1) * (K - .5): IF WRNG%(A%) <> 0 THEN 1310
1300  GOTO 1330
```

If we have K cards, then A% will be a number between 0 and K−1. Having picked the number of the card, we must check to see if we have already guessed that one correctly. WRNG%(X) is an array of flags. Each card has a corresponding flag in this array. For example, if there are ten flash cards in the pile and line 1290 returns a value for A% of 2, we have to check WRNG%(2) to see if this card has already been flipped. If WRNG%(2) equals 1, that means that this card was already shown and that the user guessed its flip side correctly. If the flag is 0, then either that card hasn't been shown yet or, if shown, its flip side was not correctly guessed. (This is a cruel and relentless system—if you guess a card incorrectly, it gets put back in the pile until, in the end, there is nothing left in the pile but the definitions you are constitutionally incapable of remembering. At that point, it is usually best just to turn the computer off.)

This part of the program is a tiny bit tricky. If we have never looked at a particular card before, then line 1300 will send us on to line 1330. But if we *have* (in other words, if the test on line 1290 succeeds), then we'll go to line 1310. Why not just go back to line 1290 and pick another random number?

The problem with making all of our selections with the random-number system is that it becomes less efficient as the percentage of unused cards decreases. If we have already successfully answered 99 out of 100 definitions, the random-number system may take a long time finding that last unused card. After all, there is only one chance in a hundred that it will pick the right number on any one pick, so it may have to spend a

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lot of time casting around until it comes up with the correct one.

We built in a little short circuit, a test that says to the computer, "If you have tried to come up with an unused card using the random-number system ten times in a row and failed, then it's time to try something else." This is what it looks like in programese:

```
1310  KT% = KT% + 1: IF KT% < 10 THEN 1290
```

So what is the "something else"? If the random-number system is working this poorly, we must be nearly finished. At this point, what harm is there in working directly through the file from beginning to end and picking up whatever definitions have been missed? That's what lines 1320 and 1325 do:

```
1320  FOR X = 0 TO K - 1: IF WRNG%(X) = 0 THEN A% = X:X = K:
      NEXT : GOTO 1330
1325  NEXT : GOTO 1400: REM GOT THEM ALL RIGHT
```

If this loop can't find any unused cards, then we have finished our drill. We go to line 1400, which resets all the flags back to 0 (in case we want to do the drill again) and then ships us back to the program main menu at line 500:

```
1400  FOR X = 0 to K - 1:WRNG%(X) = 0: NEXT : GOTO 500
```

If, however, the program does find an unused card, it's time to test the user on the flip side. The first thing to do is look at our flag (C) to see which side of the flash card is to be displayed (for the sake of convenience, we load the display side into A$ and the answer side into B$):

```
1330  IF C = 1 THEN A$ = ENG$(A%):B$ = FR$(A%): GOTO
      1345
1340  A$ = FR$(A%):B$ = ENG$(A%)
```

Now let's display the first word, nicely centered on the screen:

```
1345  HTAB 1: IF LEN (A$) < 39 THEN HTAB 20 - LEN (A$) / 2
1350  PRINT A$: PRINT
```

Note that line 1345 provides two htabs. If the word or phrase is less than thirty-nine characters long, it gets centered on the screen; if it is longer than that, we don't try centering it. What would happen if we tried to center a phrase longer than thirty-nine characters in length?

Next, let's set up the cursor in an appropriate position and wait for the user's guess (this particular routine also gives the user a hint as to the length of the answer):

```
1355  HTAB 1: IF LEN (B$) < 35 THEN HTAB 18 - LEN (B$) / 2
1360  INPUT ": ";AN$: PRINT
```

Now we have to analyze the user's response and display an appropriate message:

```
1365  IF AN$ = "XXX" THEN AN$ = "": GOTO 500
1370  IF AN$ = B$ THEN HTAB 16: INVERSE : PRINT "CORRECT":
      NORMAL :WRNG%(A%) = 1: GOSUB 60: GOTO 1280
1380  HTAB 6: INVERSE : PRINT "WRONG. THE CORRECT
      ANSWER IS:": NORMAL : PRINT : HTAB 1: IF LEN (B$) < = 38
      THEN HTAB 20 - LEN (B$) / 2
1390  PRINT B$: GOSUB 60: GOTO 1280
```

Line 1365 is another escape hatch. If the user types XXX as a response, the program will jump back to the main menu. Note that it does not clear the flags, so the user can restart in the same place.

This program does do one thing that good programs never should—it uses three different commands for the same function in three different parts of the program. In this part, you must type XXX plus a return to exit to the main menu. In other parts of the program, the escape key or the return key is sufficient. Standardization is important—it wasn't used here because we're trying to show off a variety of input routines. The input statement cannot recognize the escape key (or escape could have been used throughout). It is natural to press return during the flash-card program if you don't know the answer to a card (otherwise, return could have been used for our escape-hatch key).

If the user guesses the flip side correctly, then line 1370 prints a congratulatory message and changes the appropriate flag in the array WRNG% from 0 to 1. It then jumps to the pause routine at line 60 so that the user can digest the good news. At that point, pressing any key will loop program control back to line 1280 to pick up the next flash card.

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If the user guessed incorrectly, program control drops to lines 1380 and 1390, which inform the user of the correct answer, leave the flag set at 0, and then go back for the next flash card.

That's all there is to the program. It's an excellent way to get comfortable with string manipulation. It's also reasonably useful.

Next month we'll conclude the All About Applesoft series. Our final program is going to use hi-res graphics once again. Your task is to permit the user to enter an expression in the form:

```
Y = function (X)
```

and then graph it on-screen. Just to make this task really interesting, we are going to ask that you write the program using self-modifying code. In other words, you're going to poke values directly into your program as it runs, altering the program itself.

In order to do this you have to know a little about how Applesoft is stored in the Apple. We have mentioned previously that Applesoft programs normally start at location $800 (decimal 2048), so let's write a little program that peeks at itself:

```
10  REM TEST PROGRAM
20  FOR Y = 0 TO 100
30  A$ = STR$ ( PEEK (2048 +Y)): IF LEN (A$) < 3 THEN FOR X = 1
    TO 3 - LEN (A$):A$ = " " + A$: NEXT
40  PRINT A$;"  ";: NEXT
```

See if you understand what's going on in line 30. It's complicated, but it gets the numbers that are printed to appear in neat columns.

When you run this program, a sequence of numbers will appear on-screen. These numbers may not appear to bear much relation to your program at first, but they *are* your program as far as the Apple is concerned. Let's take a look at the first group of numbers and see if we can get them to make sense:

```
0  20  8  10  0  178  32  84  69  83  84  32...
```

These numbers are part of the first line of your program, stored in *tokenized* form. Every line in an Applesoft program starts off in the following manner:

```
0          20  8        10  0        178...

Always     Pointer to   Line         Basic
zero       next line    number       line...
```

Every line of Applesoft is preceded by a 0. The next two bytes are the address of the beginning of the following line in your Basic program. This information tells the Apple how many bytes there are in the current line. In our example above, the next line pointer is 20 8, which means that the low byte is 20 and the high byte is 8 (computers store everything backward, since they were invented by left-handed people).

Translating this into a decimal number is not hard—just multiply the high byte by 256 and add in the low byte to get the decimal equivalent:

```
8 (high) + 20 (low) = 8 * 256 + 20 = 2068
```

If you want to make sure that this works, type *print peek(2067)*, the address immediately before the start of the second line. It had better be 0.

The next two bytes are just the line number of the Applesoft line, also stored low byte, high byte. In this case, it means that the line number is 0 * 256 + 10 or just plain 10. If you want to play with this a little, change line 10 to line 15 and run the program again. See that fourth byte change?

The bytes starting with 178 are the Applesoft code itself. Applesoft commands, like home and rem, are actually stored as one-byte *tokens* rather than spelled out. This saves a lot of memory. A list of these tokens can be found on page 121 of the *Applesoft Basic Programming Reference Manual*. Look up 178. As you probably guessed it would, it stands for the rem command.

The numbers following the rem token are not tokens; they are the ASCII values of the letters we typed. The ASCII character codes are on pages 138 and 139 of the Applesoft manual. Or, if you like, you may ask your Apple:

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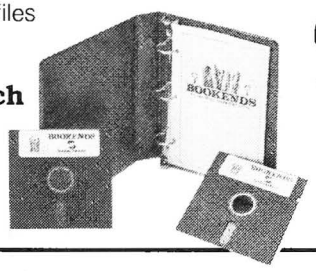
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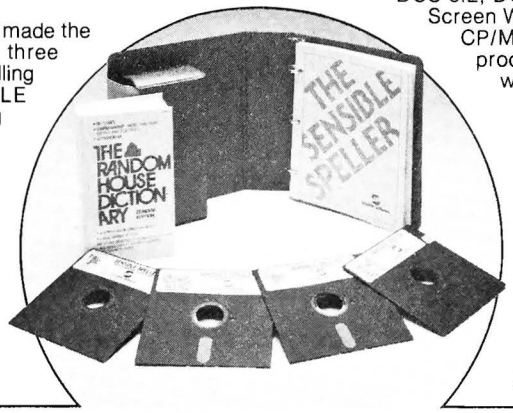
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```
PRINT ASC ("A")
```

and it will tell you. A little pencil work will convince you that

```
32  84  69  83  84  32  80  82  79  71  82  65  77
```

stands for:

```
T   E   S   T       P   R   O   G   R   A   M
```

all of which comes right out of line 10 in our Applesoft program. (In case you're worried about how you can tell which numbers are tokens and which are ASCII values, look closely at both tables. You'll notice that they don't overlap.)

Knowing this, it is possible to modify the message in line 10 without retyping the line. Try entering *poke 2055,82* from the keyboard. Then list the program. Figure out where the 2055 and the 82 came from on your own, then try changing the program further using nothing but poke statements.

Now you should be able to write a program that utilizes self-modifying code. Look at this final example:

```
10  PRINT"ALPHABET"
20  POKE 2055, PEEK (2055) + 1
30  K = K + 1: IF K< 20 THEN 10
```

Run this program and note what happens to the word "alphabet." Then list the program and look at line 10. Run the program again and see if you get the same results. Why not?

Your mission for next month (if you choose to accept it) is to create a program that allows a person to type in an algebraic formula that is then poked into the program code and used to draw a graph on the hi-res screen. Since poking is a fairly dangerous activity, it's a good idea to make sure that the disk in your drive (if you have a drive) is one that you can afford to lose.

As an example of what we're looking for, imagine that you want to create a loop that plots X and Y coordinates, with the value of X varying from a low of −100 to a high of +100. The code might look like this:

```
10  HGR2
100 FOR X = −100 TO 100
110 Y = X * X * X / 10000 + 101
120 HPLOT X + 101, Y
130 NEXT X
```

The trick will be to locate the area in memory where line 110 occurs so that you can poke in any formula you want. Since the actual memory location will change if you alter your program by adding or deleting anything *before* this line number, you might want to move line 110 to the beginning of your program and then jump to it when you're ready:

```
10  GOTO 100
20  Y = X * X * X / 10000 + 101
30  RETURN
100 HGR2
110 FOR X = −100 TO 100
120 GOSUB 20
130 NEXT
```

Another thing you will need to do is to put in harmless place savers on the formula line so that room is saved even for quite large formulas. Here is one approach:

```
20  ::::::::::::::::::::::::::::::::::::
```

This line will ordinarily be ignored, and if any part of it is converted into a formula the colons remaining at the end of the formula will also be ignored.

One last hint. Although you can poke in the ASCII values for numerals and letters, the various arithmetic symbols (such as +, −, *, and /) are tokens. You will have to process the keyboard input and substitute token values before you poke these values into your program.

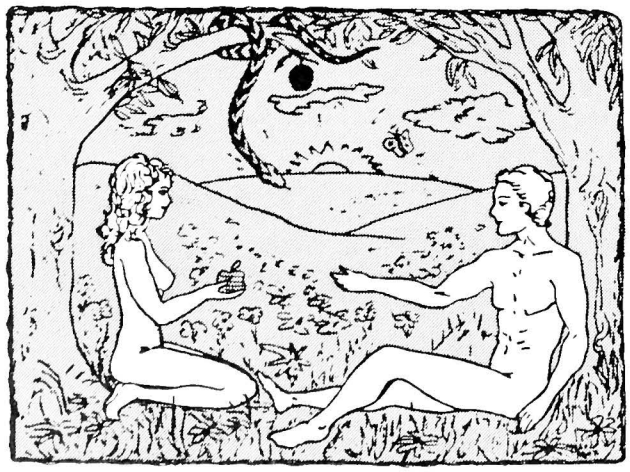
Well, that's enough hints. Do your best. Next month we'll go over this program and see if it works. After that, you're on your own. Have fun. Remember, a computer is like a car. It may be useful, but that isn't the only reason you bought it. ■

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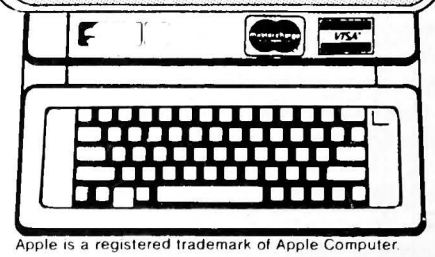
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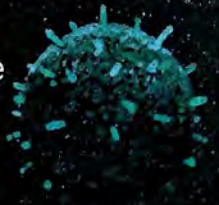


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HOT ROD III



The folks at Apple tried hard to pretend that the Apple III is not a hobby computer. Granted, they provided an excellent operating system (SOS) and many other features that are desirable for a small-business computer. They also provided Apple II Emulation, which has everything needed to warm the hobbyist's heart. If Apple had provided a switch that turned the Apple III into a perfect imitation of the Apple II, it wouldn't have been very interesting. They didn't do that. The Emulation mode is reminiscent of a poor vaudeville mimic. You can recognize the character of the Apple II, but you don't have to look very far to tell that it isn't the real thing. This poor imitation has always seemed to be the bad news about the Apple II Emulation mode. The good news is that it is mostly done in software, so it can be changed. With a little imagination, you can make the Apple III emulate some versions of the Apple II that the company never built. That's where the excitement begins.

This series of three articles will describe the important hardware differences between the two machines, the organization of information on the Emulation disk, and specific custom Emulation modes. One will allow you to play certain Apple II games that couldn't be played before on the Apple III. Another gives you the use of the full keyboard and lower-case display. In a more exotic version, you can run Applesoft with full access to the Apple III hardware. It's a project for the computer hobbyist, with disk editing, assembly and disassembly of various program segments, and hardware details of two machines. With a little effort, you'll end up with the freedom to sit down at the keyboard and design a custom Apple to your liking. You will also understand a lot more about the operation of the Apple III in all of its personalities.

Emulation Disk Organization. Let's start with a discussion of the Emulation program and the disk on which it is distributed. The Emulation disk may seem a bit of a mystery, because it has no directory. It contains a straightforward program and copies of both Applesoft and

Souped Up Emulator Challenges Apple II on Its Home Ground

by George Oetzel



Integer Basic, all of which are loaded into memory when you boot the disk. All of the useful data is on disk tracks 0 through 9, but the entire disk is formatted so that it can be copied easily. Any Apple copy utility, such as the Apple III *System Utilities* or the *CopyA* program distributed with the DOS 3.3 master disk, will suffice.

When you press control-reset, a program in ROM loads disk block 0 into addresses $A000 through $A1FF and then does a jump to $A000. On the Emulation disk, this 512-byte boot program first checks to see that it's not in an Apple II environment and then loads the rest of the Emulation program and both versions of Basic into memory. Of course, both Basics can't be loaded in their ultimate memory locations because the Apple III has no language card. All the code (ROM in the Apple II) associated with Integer Basic is loaded into addresses $2000 through $5AFF. All the code (ROM in the Apple II Plus) associated with Applesoft goes into $5B00 through $95FF. The Emulation program fills $A000 through $B670, memory that later becomes part of DOS. Table 1 shows the details of the memory organization, along with the disk block numbers that correspond to each memory segment.

Most of the Emulation program involves responses to all the setup menu choices—which version of Basic do you want, and what imitation I/O card should be connected to the RS-232 port? When you hit return, the appropriate segments are loaded into high memory, the machine control registers are set for the Emulation mode, memory above $C000 is write-protected, and control transfers to the Apple II auto-start routine.

The organization of the Emulation disk is wonderfully simple. You may have noticed that a disk track includes exactly the same amount of data as can be stored in all the addresses beginning with a given hex digit—for example, $2000 through $2FFF. The people at Apple have certainly noticed, because everything that will be located in addresses $2*xxx* is on disk track 2, $3*xxx* corresponds with disk track 3, and so



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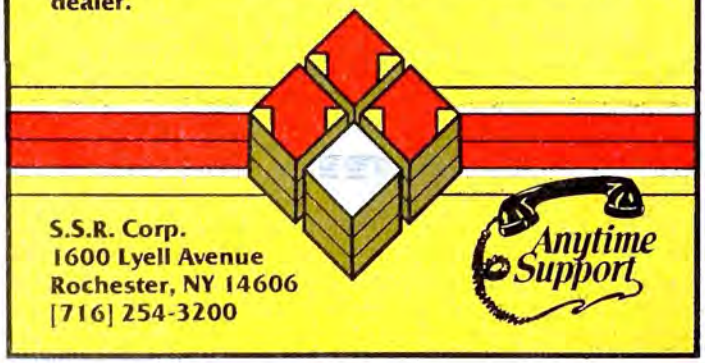
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forth. The Emulation program is on tracks 0 and 1, with addresses $A*xxx* on track 0 and $B*xxx* on track 1. Table 1 not only provides a guide to the location in memory of the Emulation ROM image, but it also tells you where to look for the data on the Emulation disk. All you need are good tools allowing you to examine and modify the contents of the disk. Table 2 gives the rules for locating the disk block numbers, or the Apple II track and sector numbers, that contain the data for specific addresses in the Basic images.

Destination Address	Boot Address	Disk Block	Description
		Integer Basic Image	
C500–C5FF	2000–20FF	10	Slot 5 (Comm card) ROM
C600–C6FF	2100–21FF	10	Slot 6 (disk) ROM
C700–C7FF	2200–22FF	11	Slot 7 (Comm card) ROM
C800–CFFF	2300–2AFF	12–15	Expansion I/O ROM (empty)
D000–D7FF	2B00–32FF	15–21	Programmers aid #1
D800–DFFF	3300–3AFF	21–23	D8 ROM (empty)
E000–F7FF	3B00–52FF	23–29	Integer Basic
F800–FFFF	5300–5AFF	29–2D	Autostart Monitor
		Applesoft Basic Image	
C500–C5FF	5B00–5BFF	2D	Slot 5 (serial card) ROM
C600–C6FF	5C00–5CFF	2E	Slot 6 (disk) ROM
C700–C7FF	5D00–5DFF	2E	Slot 7 (Comm card) ROM
C800–CFFF	5E00–65FF	2F–32	Expansion I/O ROM (empty)
D000–F7FF	6600–8DFF	33–46	Applesoft Basic
F800–FFFF	8E00–95FF	47–4A	Autostart Monitor

Table 1. Address guide to the two Basic images after booting the Emulation disk. All addresses and disk blocks are hexadecimal values.

Emulation Memory Page	Apple III Block Number	Apple II Track	DOS 3.3 Sector
N000	B0 (See note)	N	0
N100	B0	N	E
N200	B0 + 1	N	D
N300	B0 + 1	N	C
N400	B0 + 2	N	B
N500	B0 + 2	N	A
N600	B0 + 3	N	9
N700	B0 + 3	N	8
N800	B0 + 4	N	7
N900	B0 + 4	N	6
NA00	B0 + 5	N	5
NB00	B0 + 5	N	4
NC00	B0 + 6	N	3
ND00	B0 + 6	N	2
NE00	B0 + 7	N	1
NF00	B0 + 7	N	F

Note: B0 = ($10)*N/2. Computation for address $3500: Block number is ($10 * $3)/2 + $2 = $18 + $2 = $1A. Block $1A contains $3400–$35FF.

Table 2. Emulation disk Basic image location guide for Apple II and Apple III utilities.

While it is feasible to change the Emulation disk with any of numerous Apple II track/sector editors, it is easier to load patch programs and ensure that modifications look right if you edit a whole track, or two, at a time. Since editors for entire disk tracks are uncommon, a special program is in order. The *Trackmover* program in listing 1 at the end of this article is written in Integer Basic. Programming in Integer is unlikely to fill you with nostalgia for the early days of the Apple II. It's useful for modifying the Emulation and game programs, because you will probably want the miniassembler that comes with Integer Basic. You can also use the memory space from $D800 to $DFFF for utilities such as *The Inspector*, a first-rate track/sector utility from Omega Microware.

The comments included with the *Trackmover* listing explain the program logic and the peeks, pokes, and calls that make up for the small set of commands in Integer Basic. The machine language subroutines poked into memory in lines 2000 through 2080 obtain and save the IOB address and do the RWTS calls. Listing 2 shows this routine in assembly form, but as the Basic program pokes it into memory, you don't need to center listing 2. The IOB table that controls RWTS is explained in the

DOS 3.3 manual and, in more detail, in the book *Beneath Apple DOS* by Worth and Lechner. The sectors from each track are loaded in the order listed in table 2.

Start a modified Emulation disk with a copy of the original. Then use *Trackmover* to load tracks from the copy into memory. You can either make modifications immediately (using the Apple II Monitor) and rewrite the tracks on your custom Emulation disk, or you can save partially edited tracks in a DOS 3.3 binary file. The DOS file can then be reloaded and edited any time, and the *Trackmover* program will rewrite the tracks on the Emulation disk.

The next two articles will describe major modifications to the Emulation disk, but here is a useful change you can make to try out the procedure. Apple II programs often control the reset vector so that the Apple II must be turned off and rebooted to run another program. It's a double nuisance on the Apple III, because you have to reboot the Emulation disk first and then boot the next Apple II disk. You can take control of this process by changing the Monitor reset vector to the "old" Monitor entry point. Then the reset in the Apple II mode will result in the Monitor asterisk prompt. You can reboot with 6 control-P return.

There are two copies of the Monitor on the Emulation disk, and you will have to change both. Use *Trackmover* to load track 5 from the Emulation disk into a suitable Apple II location, say $5000. Go to the Monitor and dump the contents of $5AF0 through $5AFF:

```
*5AF0.5AFF
5AF0 - 83 7F 5D CC B5 FC 17 17
5AF8 - F5 03 62 FA 62 FA 40 FA
```

Now, try FFF0.FFFF. The contents of these addresses should be the same. If they aren't, you have a problem, either with your copy of *Trackmover* or with an operator malfunction. If they are the same, type

```
*5AFA:59 FF 59 FF
*5AF8.5AFF
5AF8 - F5 03 59 FF 59 FF 40 FA
```

This changes the nonmaskable interrupt and reset vectors so that they go to the Monitor cold-start entry point rather than to the auto-start routine. Return to Basic and the *Trackmover* program and rewrite the modified Monitor on track 5 of the Emulation disk. Next load track 9 into memory. Let's use $5000 again. This time the Monitor isn't in the same memory pages. Type

```
*55F8.55FF
55F8 - F5 03 62 FA 62 FA 40 FA
```

Does that look familiar? Sure enough.

```
*55FA:59 FF 59 FF
*55F8.55FF
55F8 - F5 03 59 FF 59 FF 40 FA
```

This procedure should look familiar, too. Return to Basic and use the *Trackmover* to replace the modified Monitor on track 9. Put the modified disk in the internal drive and press control-reset to reboot with your modified Emulation program. Load the Apple II program of your choice and press reset. Voila, the Monitor asterisk! Now, you have control of your computer.

Apple III Hardware. The most noticeable difference between the Emulation mode and a real Apple II is the big change in the game paddles. Many games designed for the Apple II won't run on the Apple III.

The Apple III has an eight-input, multiplexed analog-to-digital converter (A/D) to read the game paddles. Only four of its inputs are routed to the game ports on the back of the machine. The A/D measures the voltage applied to its terminals. The Apple II measures the resistance between them. Although the *Owner's Guide* presents a paddle circuit on page 130 and suggests that resistors from 1K to 700K can be used, don't

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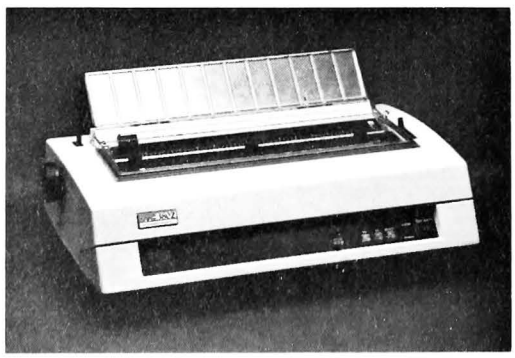


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try rewiring the 150K-ohm potentiometers from Apple II paddles into this circuit. Control becomes quite unsatisfactory with resistors much larger than about 5K ohms.

The software required to read the paddles on the two machines is very different and will be discussed in detail in part 2. Games that have internal routines to read the paddles don't work on the Apple III. Games that use the routines in the Monitor do work, because the Monitor subroutine has the same entry address and calling parameters. Many games that use joysticks use the Monitor routine. Virtually none of the single-paddle games do.

There is a widespread rumor that the Apple III won't generate color in the Emulation mode. That's partly true. If you get a high-priced RGB monitor, you won't get color displays in Emulation mode. The single-connector, composite (NTSC) color monitors don't have good enough resolution for satisfactory use with the normal eighty-column text display, but the NTSC color works both in Emulation mode and native mode. In spite of the fact that the label on the B/W video connector remains unchanged, a recent modification has routed the color video signal to that connector. On older machines, the fifteen-pin color video connector must be used for color displays. The fifteen-pin connection is a construction project of the ten-minute variety, using easy-to-get parts. The best advice for the Apple III owner who wants to use color is to get an NTSC color monitor to use only when color displays are desirable and stick to the "green screen" the rest of the time. Using both video ports, both can be connected all the time, and the cost of the two monitors is less than that of a single RGB color monitor.

The Apple III has three sound generators, only two of which can be used in Emulation mode. One is the Apple II standard that makes a click with every memory reference to addresses in the $C02*x* range. The second, activated by $C04*x* memory references, generates a short tone at about 1 kHz. It is used as the beep in most Apple III applications. The third is a six-bit D/A converter connected to the same 6522 VIA chip that controls memory bank selection (at address $FFE0). It is responsible for the audible message from the system diagnostic program: "I'm okay; system is normal." The logic that turns on the Emulation mode disables access to the 6522.

Chips for the Apple III system clock are now available in quantity. If you get one and want to read the clock in Emulation mode, you are out of luck. The assembly language instruction to read a clock byte is LDA $C070, but the only byte accessible in the Emulation mode is the milleseconds byte. The other seven bytes are switched in by changing the zero-page register ($FFD0), a function that is possible only in native mode.

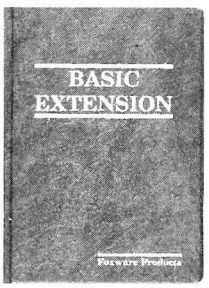
A very large number of Apple II owners have modified their computers to display lower-case characters and accept lower-case input from the keyboard. As a result, Apple II software that expects a lower-case display is rather common. It will undoubtedly become more common with the introduction of the Apple IIe. Since both of those functions are normal to the Apple III, it seems at first that it should be simple to make the changes in the Emulation mode. The display is easy to fix. The Apple II character set is a part of the Emulation program. Entry of lower-case characters is complicated by the fact that the Apple III keys are encoded in two bytes. Apple II software normally reads only the byte at $C000, which generates the key codes you see when the alpha lock key is pressed. The shift key has no effect on the alphabetic characters in this byte. To determine whether they are intended to be upper or lower case, it is necessary to read the B keyboard byte at $C008. Appendix G in the *Standard Device Drivers Manual* explains the bits in byte B. To use the lower-case characters, the Apple II Monitor must be modified to make use of the extra byte and eliminate the masks that convert all entered characters to upper case, regardless of the ASCII code that was input.

The next article is all about games. It includes modifications of the Emulation Monitor and software tools that allow easy conversion of many Apple II games so that they will read the Apple III paddles. A more complete explanation of the Emulation program and the registers that control the Emulation mode will be given in the third article. The discussion will include Emulation program and Monitor modifications that allow full use of lower case and the exotic Emulation modes possible with nonstandard states of the control registers.

```
100  GOTO 2000
120  FOR T=TS TO TE: POKE TR,T: POKE CM,C
140  FOR I=1 TO 16: POKE B1,AD: POKE SC,S(I)
160  CALL RW: REM                    Call RWTS
180  E= PEEK (RC): IF E=0 THEN 220
200  I=16:T=TE: REM                  Force end of loop on RWTS
                                     error
220  AD=AD+SZ: NEXT I: NEXT T
240  RETURN
260  H= PEEK (-16384): IF H<127 THEN 260
280  POKE -16368,0:H$=""
300  IF H=206 THEN H$="N"
320  IF H=217 THEN H$="Y"
340  H=H-176
360  IF H>9 THEN PRINT H$
380  IF H<10 THEN PRINT H;
400  RETURN
420  L= LEN(H$)
440  IF L>2 THEN 640: REM           More than 2 digits = error
460  H=0:N=-1000
480  FOR J=1 TO L
500  FOR I=1 TO 16: REM              Locate character in array of hex
                                     digits
520  IF H$(J,J)#HX$(I,I) THEN 560
540  N=I-1:I=16: REM                 Character found, fix N
560  NEXT I
580  H=16*H+N: REM                   Calculate return value
600  NEXT J
620  RETURN
640  H=-1000: RETURN
660  VTAB 23: TAB 10: POKE 50,127: PRINT "ERROR - REENTER";:
     POKE 50,255: RETURN
680  VTAB 23: TAB 10: PRINT "                    ";: RETURN
700  CALL -936: REM                  Clear screen and home cursor
720  VTAB 2: TAB 1
740  PRINT "DRIVE 1 OR 2? ";: GOSUB 260: PRINT
760  IF (H=1) OR (H=2) THEN 800
780  GOSUB 660: GOTO 720
800  GOSUB 680
```


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```
 820  POKE DR,H: REM                Put selected drive into IOB table
 840  VTAB 4: TAB 1
 860  PRINT "1 = READ"
 880  PRINT "2 = WRITE";: TAB 20: GOSUB 260: PRINT
 900  C=1:C$="READ": IF H=1 THEN 960
 920  C=2:C$="WRITE": IF H=2 THEN 960
 940  GOSUB 660: GOTO 840: REM If not 1 or 2 then error
 960  GOSUB 680
 980  VTAB 5: TAB 20: POKE 50,63: REM INVERSE
1000   PRINT C$: POKE 50,255: REM NORMAL
1020   GOTO 1100
1040   VTAB 7: TAB 1
1060   FOR I=0 TO 6: FOR J=1 TO 6: PRINT "          ";: NEXT J:
       PRINT : NEXT I
1080   GOSUB 660
1100   VTAB 7: TAB 1
1120   INPUT "START TRACK (HEX) ",H$
1140   GOSUB 420
1160   IF (H<0) OR (H>35) THEN 1040
1180   TS=H
1200   PRINT
1220   GOSUB 680
1240   VTAB 9: TAB 1
1260   INPUT " LAST TRACK (HEX)  ",H$
1280   GOSUB 420
1300   IF (H<0) OR (H>35) THEN 1040
1320   TE=H
1340   T=TE-TS
1360   IF (T<0) OR (T>6) THEN 1040
1380   GOSUB 680
1400   VTAB 11: TAB 1
1420   PRINT "START ADDRESS  $";: GOSUB 260
1440   IF H>0 AND (H+T<8) THEN 1480
1460   GOSUB 660: GOTO 1400
1480   PRINT "000"
1500   GOSUB 680
1520   AD=H*16
1540   VTAB 14: TAB 10
1560   PRINT "ALL OK? (Y/N) ";: GOSUB 260
1580   IF H$="N" THEN 700
1600   IF H$="Y" THEN 1640
1620   GOSUB 660: GOTO 1540
1640   POKE B0,0: POKE VL,0
1660   GOSUB 680
1680   GOSUB 120
1700   IF E=0 THEN 1840
1720   VTAB 17: TAB 1
1740   POKE 50,63: PRINT "ERROR";: POKE 50,255
1760   I=E/16:J=E-16*I
1780   PRINT " CODE = ";HX$(I+1);HX$(J+1)
1800   GOTO 1880
1820   GOSUB 120
1840   VTAB 17: TAB 18: POKE 50,63
1860   PRINT "DONE": POKE 50,255
1880   VTAB 20: TAB 5
1900   PRINT "MORE? (Y/N) ";: GOSUB 260
1920   IF H$="Y" THEN 700
1940   PRINT : PRINT "END"
1960   CALL -1233
1980   END
2000   RW=768:SZ=1
2020   POKE 768,32: POKE 769,227: POKE 770,3: POKE 771,32:
       POKE 772,217: POKE 773,3
2040   POKE 774,176: POKE 775,6: POKE 776,160: POKE 777,13:
       POKE 778,169
2060   POKE 779,0: POKE 780,145: POKE 781,0: POKE 782,96:
       POKE 783,32: POKE 784,227
2080   POKE 785,3: POKE 786,132: POKE 787,0: POKE 788,133:
       POKE 789,1: POKE 790,96
2100   DIM S(16),H$(4),HX$(16),C$(5)
2120   FOR I=2 TO 15:S(I)=16-I: NEXT I
2140   S(1)=0
2160   S(16)=15
2180   HX$="0123456789ABCDEF"
2200   CALL 783: REM                 Get address of IOB table from
                                     DOS
2220   AD= PEEK (0)+256*( PEEK (1)-256): REM Calculate IOB
                                     address
2240   SC=AD+5: REM                  Sector
2260   B1=AD+9: REM                  Buffer address, high byte
2280   B0=AD+8: REM                  Buffer address, low byte
2300   TR=AD+4: REM                  Track
2320   VL=AD+3: REM                  Volume
2340   CM=AD+12: REM                 RWTS command
2360   RC=AD+13: REM                 Return code,< >0 indicates
                                     error
2380   DR=AD+2: REM                  Drive
2400   TEXT : CALL -936:REM          Clear screen, home cursor
2420   VTAB 3
2440   PRINT "THIS PROGRAM READS FROM AND WRITES TO"
2460   PRINT "DISKS IN APPLE III BLOCK ORDER"
2480   PRINT
2500   PRINT "FULL DISK TRACKS ARE TRANSFERRED TO"
2520   PRINT "AND FROM MEMORY SUPERPAGES"
2540   PRINT : PRINT " EXAMPLE PAGE: $2000 - $2FFF": PRINT
2560   PRINT "PAGES $1 TO $7 ARE AVAILABLE"
2580   PRINT
2600   PRINT "ENTER ALL VALUES IN HEXADECIMAL"
2620   PRINT
2640   TAB 10: INPUT "HIT RETURN ",H$
2660   GOTO 700
```

Listing 1. *Trackmover* program to transfer disk tracks to and from memory. Integer Basic.

```
0300  20  E3  03   JSR  $03E3   ;Get IOB address
0303  20  D3  03   JSR  $03D3   ;Call RWTS
0306  B0  06       BCS  $030E   ;On error, return
0308  A0  0D       LDY  #$0D    ;IOB error-byte offset
030A  A9  00       LDA  #$00    ;Zero for no error
030C  91  00       STA  ($00),Y ;Store in IOB
030E  60           RTS

030F  20  E3  03   JSR  $03E3   ;Get IOB address
0312  84  00       STY  $00     ;Low byte in $00
0314  85  01       STA  $01     ;High byte in $01
0315  60           RTS
```

Listing 2. Assembly listing for the pokes in listing 1 lines 2000 through 2080. It is not necessary to type this in.

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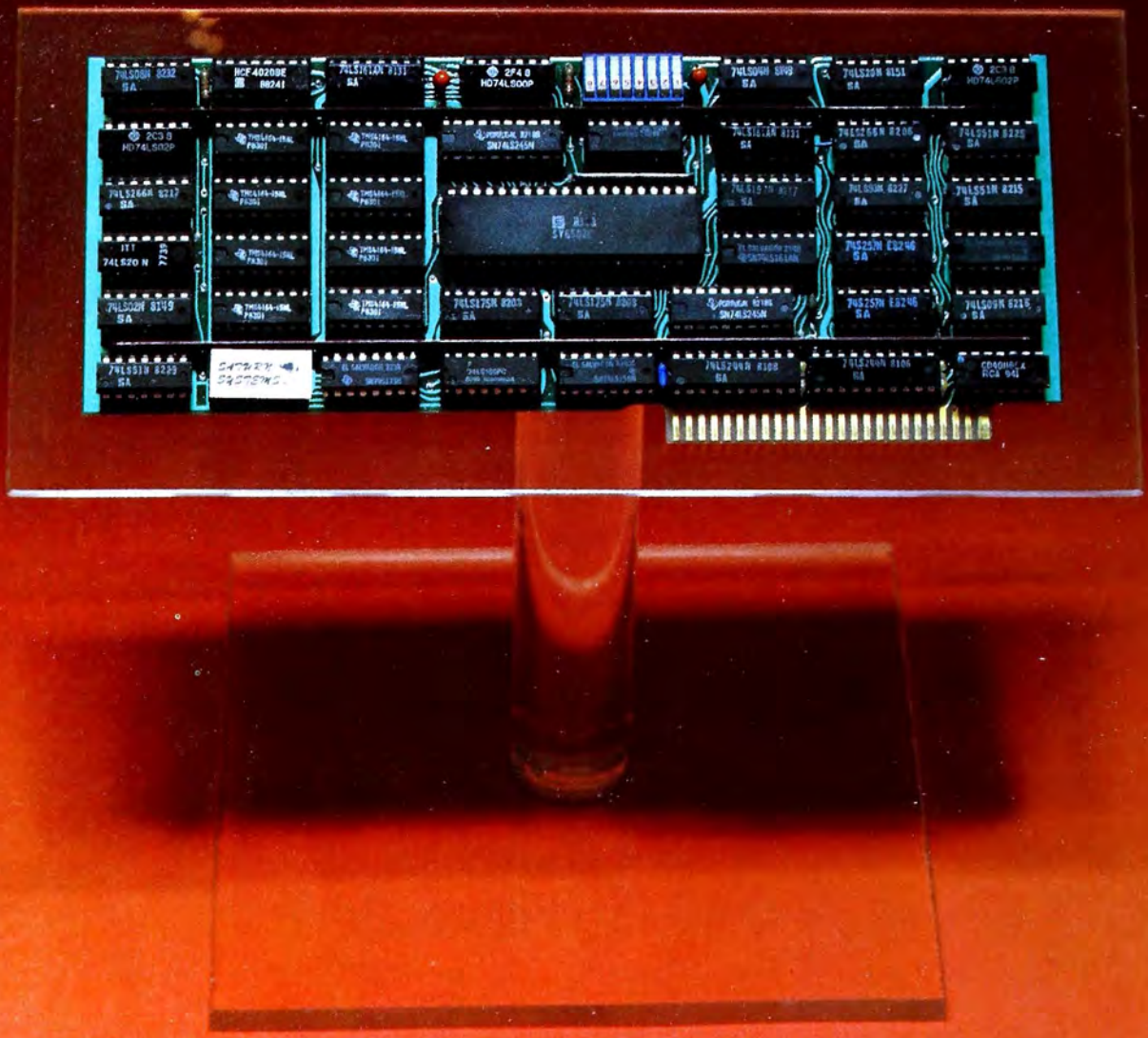
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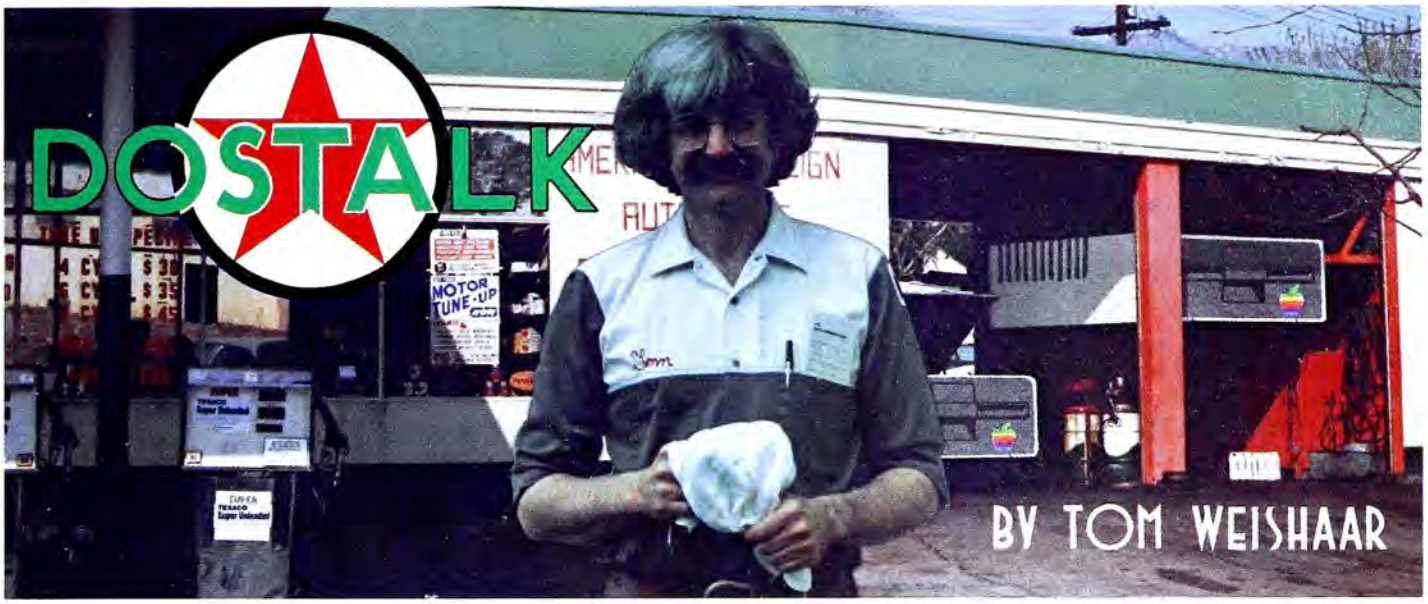
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What are you going to tell your kids when they come home and ask what a DOS buffer is? Advice on dealing with this difficult question is the main feature of this month's column. Readers will find a great deal of information, some of it useful and some of it merely edifying, about DOS buffers and the *maxfiles* command. Later in the column we'll talk about a new book called *All About DOS*, published by Call −A.P.P.L.E.

In computer talk, a *buffer* is a section of memory set aside to hold data temporarily. A good example is an area we mentioned here last month, the keyboard input buffer. This buffer lives in the memory area from byte number 512 to byte number 767 (in hex that's $200 to $2FF).

Whenever you type a DOS or Basic command on your Apple's keyboard, the characters are placed in this buffer as well as on your screen. When you press return, this is where DOS and Basic look to see what you typed. Faster than you can say "syntax error," the buffer will be cleared and ready to use again.

Welcome to the Waldorf-DOStoria. The DOS buffers are similar to the keyboard buffer. Think of each DOS buffer—there are usually three of them—as a suite of hotel rooms. The program within DOS we have been calling the Captain is the hotel's manager and reservation clerk. And the section of DOS known as the file manager is the travel agent who sends touring bits and pieces of your files to the hotel for short stays.

As hotel manager, the Captain is responsible for actually taking possession of portions of your precious memory for the DOS buffers, for building the buffers, and for keeping track of which ones are occupied and which ones are vacant.

The file manager, on the other hand, isn't much of a travel agent. He doesn't care one bit where the DOS buffers are. He doesn't even really care whether the rooms he gets are in the same suite. All the file manager wants is for someone to tell him where he can find three things: a 256-byte space he can use to temporarily store data (the data buffer); a 256-byte space he can use to temporarily store a file's track/sector list (the track/sector list buffer); and a 45-byte space he can use to keep track of a file while the file is open (the file manager work-area buffer).

In the interest of order and symmetry (but mostly to make things easy on himself), the Captain keeps the DOS buffers together in one place. He puts them in the memory area just before DOS itself. Figure 1, the familiar memory map, will help you locate them. This month the middle bar gives you an expanded view of DOS. The rightmost bar opens up a single DOS buffer for us to examine.

Inside a DOS Buffer. As you can see, each DOS buffer has everything the file manager needs and then some. In addition to the three spaces at the file manager's disposal, each buffer also contains a thirty-byte file-name field followed by an eight-byte address table.

The file-name field and the address table are used by the Captain himself to keep track of his rooms and reservations. A zero as the first character of a file name tells him that that particular DOS buffer is vacant. A valid file name tells him the buffer is occupied and by whom.

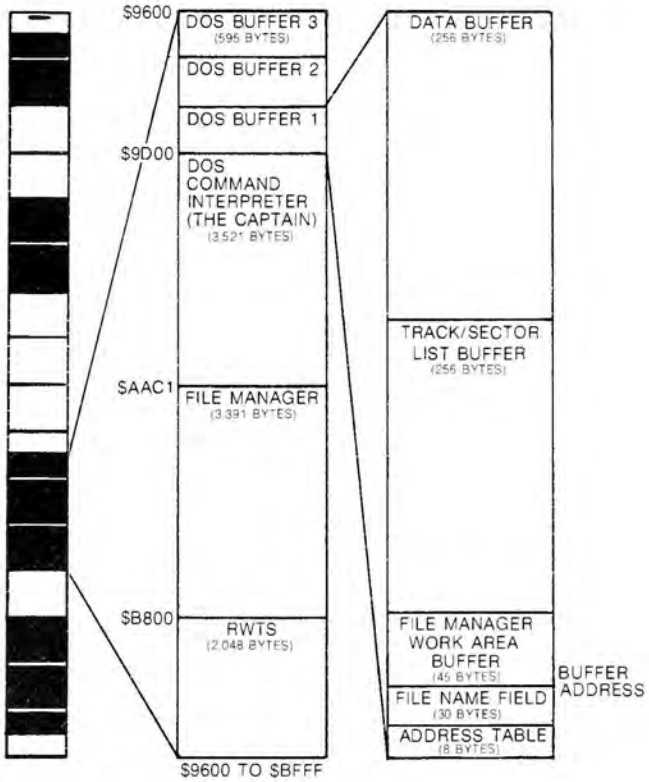


Figure 1. Apple II memory map.

The address table is mostly a handy place where the Captain keeps the addresses of the three spaces the file manager can use. It's really just a list of the room numbers in that suite.

The Captain also keeps the address of the next DOS buffer in this table. Odd as it may sound, the Captain keeps track of where in memory he built the DOS buffers by putting the address of the second one inside the first. Thus the buffers are chained or linked together. In the last buffer he uses zero for the next address to remind him there ain't no more.



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The addresses the Captain keeps in this chain actually point to each buffer's file-name field. As you can see in figure 1, the file-name field isn't at the beginning of the DOS buffer but is in the middle of it. This is sometimes confusing.

No Vacancy. If you've ever tried to execute a DOS command when all the DOS buffers are occupied, you've encountered the "no buffers available" message (onerr goto code = 12). Not very many people get to see this message, as it is fairly unusual to have all DOS buffers occupied at once.

We can divide the twenty-eight DOS commands into three groups—those that do not use DOS buffers, those that need and use a DOS buffer but leave it vacant, and those that move into a DOS buffer and stay there until you send them home with a *close* command. Figure 2 shows which commands are in each group.

Don't need a buffer	Need buffer only while executing	Occupy or require occupied buffer
pr#	init	open
in#	load	append
mon	save	exec
nomon	run	(read)
fp	bload	(write)
int	bsave	(position)
maxfiles	brun	
close	lock	
	unlock	
	delete	
	rename	
	verify	
	catalog	
	chain	

Figure 2. DOS buffer usage by command.

If it weren't for the commands in column three, DOS buffers wouldn't be worth talking about. Without those commands DOS would need only one buffer area. There would be no maxfiles command; nor would there be a "no buffers available" error.

The commands in column three all have to do with text files. When you *open* a text file it moves into a DOS buffer and stays there until you chase it out with a *close*.

If you are writing a program that runs more efficiently with several text files open at the same time, you can easily increase the number of DOS buffers. The Captain will build as many as sixteen DOS buffers at your request, though the file manager might crack if you ever actually use that many.

On the other hand, if you are writing a program that never uses the DOS commands in column three, you will never need more than one DOS buffer. In fact, even if you do use column-three commands, you still need only one buffer—that is, unless you try to open two files at once or try to execute one of the buffer-using DOS commands while your text file is open or being read by an exec command.

Each DOS buffer uses up 595 bytes of precious memory. Unless you tell the Captain otherwise, he will always build three buffers. But if you use only one of them, you are throwing away nearly 1,200 bytes of memory—a fairly significant amount of space.

Hi, Mom, How's Mem? Grabbing all this free space back from the Captain is a snap if you have just started up your Apple and are typing at the keyboard. Just enter *maxfiles 1*. Doing it from inside a program or from the keyboard when a program is in memory, however, can be tricky.

The problem is that whenever you change the number of DOS buffers you also change a value known as *himem*. This is the highest memory location available to Basic programs. Whenever the Captain builds or rebuilds the DOS buffers, he stores the new himem value at bytes 115 and 116 ($73–$74) if you are using Applesoft or bytes 76 and 77 ($4C–$4D) if you are using Integer Basic.

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6. / Single keystroke, second Catalog command.
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Applesoft stores strings from himem down. Integer Basic stores your program itself from himem down.

When you increase the number of DOS buffers while a program is loaded, you destroy the program if it's Integer or you destroy its strings if it's Applesoft. On the other hand, if you decrease the number of DOS buffers, Integer programs get lost, and Applesoft programs get high-strung.

The solution for Applesoft is fairly straightforward: Simply do your *print D$;"maxfiles 1"* as the first line of your program (or at least before you gather any strings).

The solution for Integer Basic is not that simple. The *DOS Manual* has a section on how to use *exec* to change *maxfiles* from within an Integer Basic program, but the technique simply doesn't work. *Maxfiles* turns off any active *exec* file as part of its execution. There is no easy way to change *maxfiles* from within an Integer program.

And there is yet another problem. DOS forgets about any *maxfiles* value you have given him manually and reverts to the default value after every cold start. This happens when you reboot, call the page three vector at 979 ($3D3), or execute an *fp* or *int* command. Since the *DOS Manual* neglects to say anything about this side effect of *fp* and *int* most programmers don't even know about it.

Let's Operate. You can quickly solve all these problems by changing the byte within DOS that tells the Captain how many DOS buffers to build by default. This byte is good old number 43697 ($AAB1). The procedure for this is as follows: Boot your System Master disk; enter *poke −27839,1*; and initialize a new disk.

Those of you who are puzzled by the negative number in the poke command should know that *poke −27839,1* and *poke 43697,1* do the same thing in Applesoft. But Integer Basic chokes on numbers greater than 32767 and accepts only the first version of this poke. If you want some other default *maxfiles* value, poke it in instead of one.

Whenever you boot this disk you have just initialized, the Captain will build just one DOS buffer. This will give you, as mentioned, nearly 1,200 extra bytes of free space—an increase of more than 3 percent. If you don't need the space, the procedure isn't worth the trouble. If you do need the space, it's there for the asking.

If you do make this change, it's possible that you may start running into the *"no buffers available"* error more often than you're used to. Occasionally the buffer is not released as you might expect it to be. Most often this is after an "end of data" error caused by a position command. When position hits the end of a text file, it doesn't close the file the way read does. You never noticed this before because you still had two spare buffers.

Whenever you get a "no buffers available" error, simply enter the DOS close command on your keyboard. You do not have to use a file name with close. The command is like sending the sheriff around, and whoever or whatever is squatting in your DOS buffer will move on.

It's between You and Your DOS Buffers. There is one more thing many people want to know about DOS buffers. It has become fairly common practice to trick the Captain into building the DOS buffers at lower addresses in memory than usual. After doing this, an assembly language program is inserted between DOS and the DOS buffers. This puts the assembly language program in a well-protected area where Basic can't step on it. In addition, neither *fp* nor *int* can erase the assembly language program.

If you want to do this, all you really need to know is that DOS starts at byte 40192 ($9D00) and that its first two bytes hold the address of the first DOS buffer. Remember that the address of a DOS buffer is really the address of its file-name field. The buffer ends thirty-eight bytes beyond its address.

If your assembly language program is *L* bytes long, use the following formula to find a new value, *DB1*, to poke into 40192 ($9D00):

```
DB1 = 40192 - (L+38)
```

And use this formula to determine where to load your assembly language program:

```
A = DB1 + 38
```

After making the required poke and bloading your program, you also have to get the Captain to rebuild the DOS buffers. As has already been mentioned, you can do this by calling the DOS cold-start vector at 979 ($3D3) or by using maxfiles, fp, or int.

As we said in April, you should avoid using init when you have something installed between DOS and its buffers. If you do, the image of DOS saved on the new disk will build the DOS buffers in the wrong place every time, causing mysterious problems with several commercial programs and wasting a lot of memory.

In addition, if you sell programs that install themselves between DOS and its buffers, please be kind to the rest of us and have your program check to see if the buffers have already been moved before it installs itself.

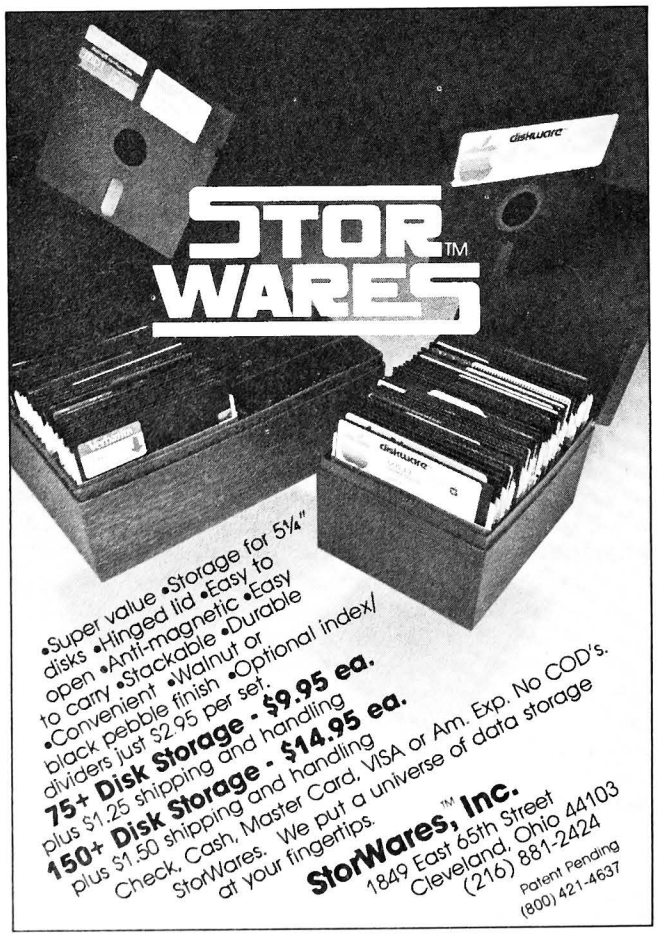
The Seven Samurbytes. Here are two final pieces of practically useless information about DOS buffers. When you have the usual three buffers, himem is set at 38400 ($9600). If your brain has a part number on it, you may spend only a few microseconds determining that there are 1,792 bytes between byte 38400 and byte 40192. However, three DOS buffers times 595 bytes each accounts for only 1,785 of them.

The Captain always leaves room for a seven-byte assembly language program between himself and the DOS buffers! You assembly language programmers who write compact code may want to do something with this.

Interesting but useless fact number two is that when DOS is assigning DOS buffers to files, he always assigns the last one first. If you want to peer into a DOS buffer to see what's there, look into number three, not number one, or you probably won't find much. Figure 3 shows you where to peer.

All about All About DOS. *All About DOS* is a new book just published by the world's largest Apple computer user group, the Apple Pugetsound Program Library Exchange in Seattle. Call −A.P.P.L.E. also publishes the popular magazine *Call −A.P.P.L.E.*

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One thing that would make the book much more valuable than a stack of old magazines is a good index. Unfortunately, it doesn't have one. But it does have a well-organized table of contents.

Anyone seriously interested in DOS should have this book or the underlying magazine issues.

Beginners, on the other hand, will probably find most of the material obscure. While there are a couple of things suitable for beginners, familiarity with assembly language is required to understand many of the articles.

Among other things, the book shows you how to move DOS to the language card; how to get DOS to recognize an Applesoft or Integer firmware card in a slot other than 0; several techniques for speeding up DOS; how to alphabetize file names in catalogs; how to use a clock card to time-stamp files; and how to use the DOS RWTS routines directly. One topic notably absent is copy protection—either how to do it or how to break it.

There's an interesting section on DOS bugs. For example, you may know that the sector length DOS shows you when you catalog is wrong for files longer than 255 sectors. There's a routine inside DOS that converts the file manager's hexadecimal notation on file length into decimal for us humans. You may have assumed that it didn't convert numbers larger than 255 correctly because there wasn't room for a complete hex-to-decimal conversion routine.

Buffer Number	Data Buffer 256 bytes	Track/Sector List Buffer 256 bytes	File Manager Work-Area Buffer 45 bytes	File-Name Field 30 bytes	Chain Pointers 8 bytes
3	38400 $9600	38656 $9700	38912 $9800	38957 $982D	38987 $984B
2	38995 $9853	39251 $9953	39507 $9A53	39552 $9A80	39582 $9A9E
1	39590 $9AA6	39846 $9BA6	40102 $9CA6	40147 $9CD3	40177 $9CF1

Figure 3. Standard DOS buffer addresses.

But *All About DOS* presents two different routines that can be squeezed into the space of the old conversion routine and that correctly convert numbers as large as 999. Since there are only 560 sectors on a disk, this is ample. The technique used is elegant and certainly worth taking a look at if you appreciate good assembly language programming.

It was mentioned in April that Apple made some changes to DOS when the IIe was introduced. One of these was to the routine at 45873 ($B331), which calculates random-access-file position. It was unclear at the time why the routine had been changed. Now there's an explanation. Last August, Art Schumer published an article in *Call −A.P.P.L.E.* explaining that the append command also uses this routine. His article, reprinted in *All About DOS*, shows how to fix the routine to kill a bug that causes append to fail on files longer than 32,767 bytes. This is the same change Apple made in DOS 3.3e.

Articles like the ones in *All About DOS* are good because they are full of new ideas. Reading an assembly language or Basic program listing may sound like a fantastic bore to most people, but if you're serious about programming, it's a superb way to increase your skills. Just as writers can learn a great deal by reading the work of others, programmers must spend time studying good programs.

On the other hand, if you are not interested in programming or in how DOS works but just want to sort your catalogs or recover deleted files, experience has shown that you are far better off spending your money on a commercial program than spending your time on retyping a program published in a user-group magazine like *Call −A.P.P.L.E.*

While these programs are great for ideas and for educational purposes, they are rarely tested and polished as well as a commercial program. (There are exceptions—the programs by Cornelis Bongers, for example, seem to be of professional quality.)

Of course, I'm biased about this, since I belong to that group of rascals who write commercial software for the Apple.

My biases and I will be back next month, bringing our tails, fp, and int behind us. See you then. ■

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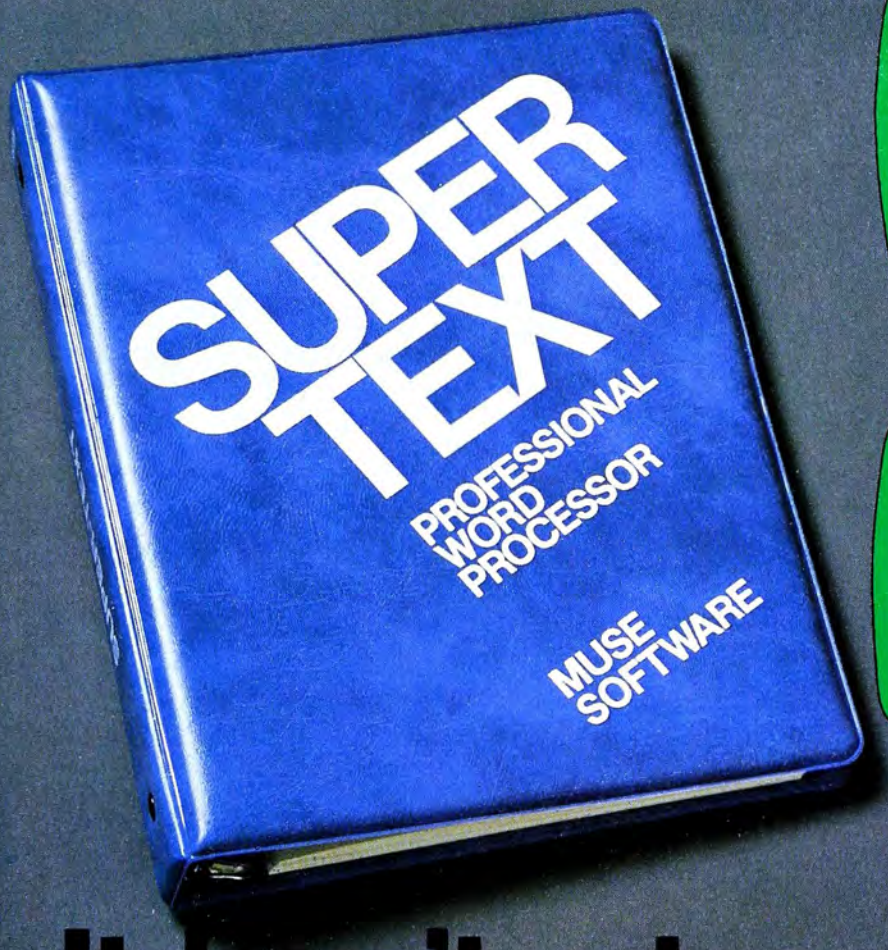
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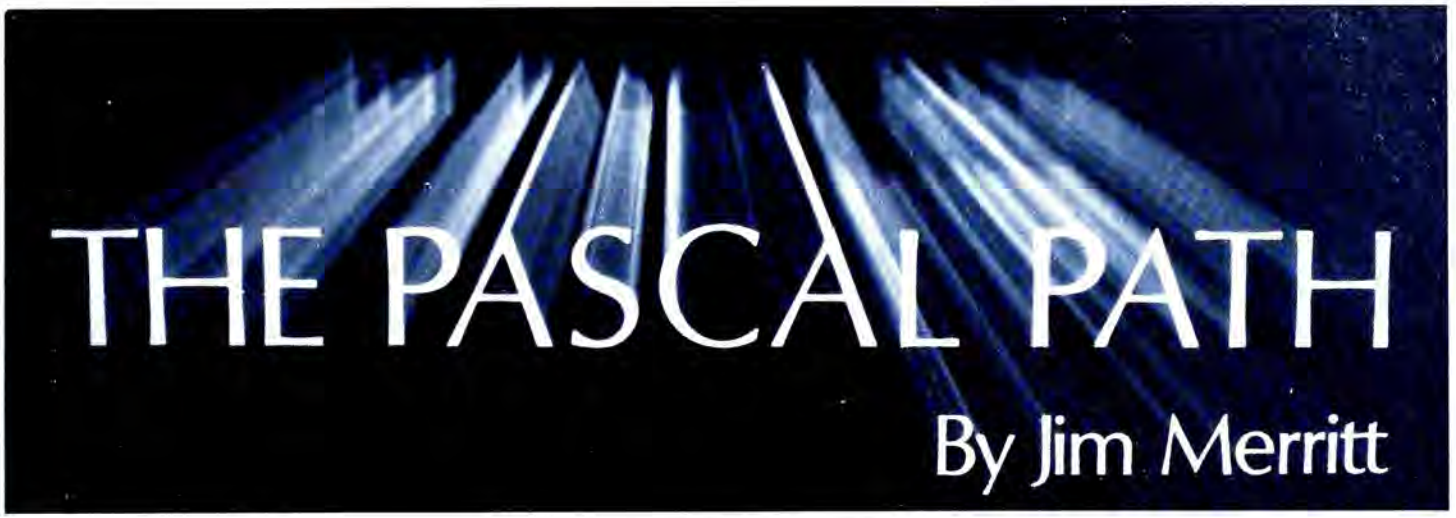
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Jungle Fever: Part 5

One night, not all that long ago, Your Pathfinder was glued to the pay-TV tube, laughing uproariously at the comedy of Robin Williams. Lately, Williams has taken to essaying a grizzled old news vendor named "Pops," who at one point during the performance described a picture of Albert Einstein by saying, "Look at those eyes . . . the lights are on, and everybody's home!"

At that instant, a light went on in the considerably dimmer brain of Your Pathfinder, as he marveled at the expressiveness of the English language. Williams's character could simply have said that Einstein was smart, bright, or even brilliant, but any of these words would have carried much less impact than the delightful analogy that Williams chose to drive his point home. Next time you get the chance, listen carefully to the people you encounter in everyday life, as Williams does before he creates a character like "Pops." You are bound to hear many incisive, almost poetic, colloquialisms. No doubt several of these will describe someone's mental ability (or lack thereof). Try it and see!

We say that English is a powerful language, not only because it lets you express so many different ideas conveniently, but also because it allows you to convey one idea in so many different ways. You are *fluent* in a language when you can recognize and consider your many options and settle quickly on the one that expresses your idea most effectively in any particular situation or context.

The goal of this column has always been to enable you to acquire fluency in Apple Pascal, one of the most expressive programming languages available for your computer. Like English (but on a more limited scale, of course), Pascal offers a multiplicity of ways for you to say what you mean. Some methods and constructs are more effective in certain situations than others. This month, we'll enlarge your Pascal vocabulary as we examine the SET data structure and use it to improve awkward code that we wrote in previous months.

SET 'Em Up! Pascal's SET was inspired by the mathematical notion of a *set*, but you don't have to be a mathematician to appreciate or make good use of it. In mathematics, a set is a (possibly empty) collection of different objects. All of the objects in a set are related to each other by virtue of a particular characteristic they have in common. Each object in a set is said to be a *member* of the set. For instance, a floppy disk, a standard sheet of paper, and an American flag are all members of the set of rectangular things. The disk and the sheet of paper are also members of the set of things on which information may be recorded. A shamrock, a dollar bill, and the sports section of the *San Francisco Chronicle* are all members of a set of green things. *All* of the items we've mentioned thus far are members of the set of arbitrary things.

In truth, you can create a set for almost every occasion. What's more, any given object (in the real world, at least) is simultaneously a member of as many sets as it has discernible characteristics! And don't forget that *any* object is also a member of a set of arbitrary things, regardless of its other attributes.

The mathematical set can include any kind of object—even sets of sets are permitted—but the Pascal SET can include only values taken from scalar data types and subranges (excluding Reals). Thus, you may speak of a "SET OF Char", a "SET OF 1 .. 100", a "SET OF (Monday, Tuesday, Wednesday, Thursday, Friday)", and so forth, but you may *not* construct or use such objects as a "SET OF FILE OF Integer", a "SET OF ARRAY [1 .. 100] OF Boolean", or a "SET OF Real". The compiler cannot make sense of the latter three definitions and thus after issuing an error message will refuse to compile them. For the "SET OF FILE ..." and the "SET OF ARRAY ...", the compiler will report "error #1" ("error in simple type"), indicating that SETs may not be based on complex, structured data types. For the "SET OF Real", you will be notified of "error #115" ("base type must be a scalar or a subrange").

Using SETs. The syntax diagram for a SET definition is given in figure 1. It consists of the two keywords "SET OF", followed by the description of the SET's *base type*, which must be a scalar (enumerated) type, a subrange of a scalar type, or an Integer subrange (such that the smallest value is not less than 0 and the largest value is not greater than 511). In particular, neither Real nor the full range of Integer may serve as the base type of a SET. Any and all values defined by a SET's base type may be members of that SET. In Pascal, members of any SET always have the base type of that SET in common.

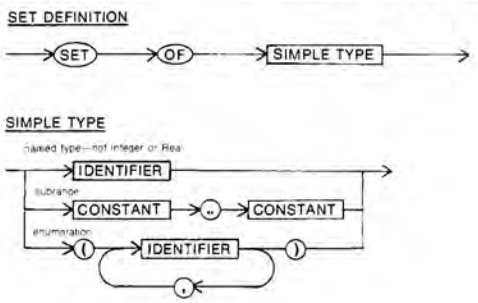


Figure 1.

Confirm that the following declaration section is valid by referring to the syntax diagram in figure 1:

```
TYPE
  PrimaryColor=
    (Red, Yellow, Blue);

  SecondaryColor=
    SET OF PrimaryColor;

VAR
  Orange,
  Green,
  Violet
  :SecondaryColor;
```

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Like any variables, Orange, Green, and Violet contain nothing but garbage until they are initialized by assignment statements. Of course, any expression that occurs on the right-hand side of an assignment to a SET variable must evaluate to a SET that is compatible with the variable in question. Just as arithmetic expressions consist of constants, variables, and operators, so SET expressions contain *SET constructors*, *SET variables*, and *SET operators*.

SET Constructors. As shown in the syntax diagram of figure 2, a SET constructor is a list of items, with the appropriate square bracket on either side of it. Each item designates one or more values, taken from the SET's base type. No values may be drawn from outside the base type. For instance, no single SET may contain Boolean, Integer, and PrimaryColor values simultaneously.

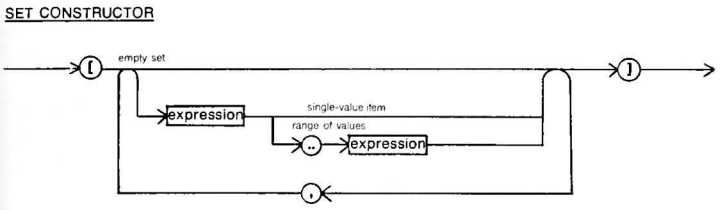


Figure 2.

Each item in a constructor list may specify either a single value or a *range* of values. The initial and terminal values in a range are separated from each other by the two-dot "Pascal ellipsis" that we have already used in specifying subrange data types. Note that the initial value of a range specification must be "less than" or "equal to" the terminal value, or the item in question will be considered as equivalent to a range that contains *no* values whatsoever. Thus, while the constructor "[False..True]" specifies a "SET OF Boolean" that contains the values False and True, the constructor "[True..False]" specifies a SET that contains no values at all, since True is "greater than" False.

Although the order of values in a range-specification item is significant, the order of individual items in a constructor list is not. Also irrelevant is the repetition of any of the items or values; Pascal effectively ignores any and all redundant items when producing a SET value from a constructor. Finally, if a constructor list contains more than one item, a single comma separates each item from its successor. Here are some constructors—based on the Char data type—that all refer to the same SET value:

```
['A,' 'B,' 'C,' 'D,' 'E']
['A', 'C', 'B', 'E', 'D']
['A', 'B', 'C', 'B', 'C', 'D', 'E', 'D', 'E']
[E', 'B' .. 'D', 'A']
['A' .. 'E']
['A' .. 'E', 'A', 'B', 'C', 'D', 'E']
```

Given the flexibility of Pascal's SET construction notation, you'll usually be able to think of several different ways to specify the same SET value. You should choose the constructor that promotes the highest degree of readability in your program. Given the previously listed sample constructors, "['A','B','C','D','E']" and "['A'..'E']" are arguably the most readable. The beginning programmer probably would choose to use the former in her programs (on account of its explicit nature), while an experienced programmer probably would choose the latter (for its brevity). Make no mistake, however; neither SET constructor is more "correct" than the other. Both of them specify and produce the same SET value, and each is evaluated by the p-machine as quickly as the other. They are simply two slightly different phrasings of the same idea. You should become comfortable with both the explicit and the abbreviated SET-constructor notations, as you will have occasion to use them both in your programs.

Here is a group of assignment statements that initialize the three "secondary color" variables defined earlier:

```
Orange := [Red, Yellow];
Green := [Yellow, Blue];
Violet := [Blue, Red];
```

After the execution of these statements, Orange contains the primary colors Red and Yellow, Green contains both Yellow and Blue, and Violet contains Blue and Red. Throughout the remaining discussion, we will assume that the SecondaryColor variables contain the SET values established here.

Constructors Are Not Constants. Although they seem to fill the niche of constants, SET constructors are not true constants in the Pascal sense. Instead, they are instructions to the Pascal compiler (and hence to the p-machine) on how to *build* a corresponding SET value at *execution time*. So far, we have used only scalar constants in our constructor lists, but expressions are also permissible. For instance, if we assume that Jack and Jill are two Integer variables containing the numbers 65 and 69 respectively, then the SET constructor "[Chr(Jack)..Chr(Jill)]" defines the same SET as "['A'..'E']". However, the use of the two variables and the Chr function in the first constructor marks it as a value that cannot possibly be determined until the program is running. In contrast, the value of any true Pascal constant is known by the compiler during the compilation process.

Because they are not really constants, SET constructors may not be equated to identifiers in CONST sections. This is a nuisance to the fastidious programmer, especially when the same SET value must be used in different parts of a program. To achieve this end, the programmer could duplicate the SET constructor at each separate point in the source code. Of course, this would tend to decrease program readability and to increase the potential for introducing typographical errors that the compiler cannot detect. As an alternative, the programmer may declare a SET variable, giving it a name that is suggestive of the nature or purpose of the constructor in question, and then use it as a "pseudoconstant." She must, however, ensure that the program executes an assignment statement, in order to initialize the variable to its proper "constant" value, prior to the execution of any other statements that might depend on the variable's contents. Programmers often forget to initialize their variables, or they accidentally position crucial initialization statements at inappropriate places in a program. As a result, SET variables used as pseudoconstants may contain garbage occasionally instead of proper data values. Any such anomaly is likely to cause program misbehavior.

The Empty SET. We noted earlier that a mathematical set may be empty. In other words, it may have no members at all. In Pascal, the *empty SET* is expressed by the SET constructor "[ ]". Like the empty String, or the Integer 0, the empty SET is often a convenient initial value for SET variables. (In fact, we'll soon use it as such.)

The Pascal compiler can determine the base type (or the lack of a consistent base type) for any nonempty SET constructor by examining the values given in the constructor list. This is not possible with the constructor for the empty SET, since the constructor list is empty. The Pascal compiler avoids confusion by treating the empty SET as a member of *all* SET types. Thus, the empty SET, when expressed explicitly as a constructor, may be assigned to any SET variable, at which point it assumes the data type of the receiving variable. Suppose that the variable CS has been declared as a "SET OF Char", while BS is a "SET OF Boolean". The statements "CS := [ ]" and "BS := [ ]" empty the two variables. However, once the assignments are complete, the empty SET contained in CS is an empty "SET OF Char", while that in BS is an empty "SET OF Boolean". In particular, Pascal would view as illegal the assignment "CS := BS", even though the *same empty SET constructor* apparently was used to initialize the two variables.

Singleton SETs. When you are working with SETs, you must remember to distinguish between a SET that contains only a single member—a *singleton* SET—and the scalar value of the member itself. For instance, "[Yellow]" is a singleton SET, the lone member of which is the scalar value Yellow. This SET constructor specifies a value that may be assigned to a SET variable, such as Green. On the other hand, Yellow itself is simply a scalar value, which may be assigned only to variables of

type PrimaryColor. Consequently, the Pascal compiler would reject the assignment "Green := Yellow", noting error condition #129 ("type conflict of operands").

SET Operators: Union (+). The *union* of two sets, A and B, is a third set that contains all the members of A and all the members of B. The union of Orange and Green is expressed as "(Orange + Green)" and equals "[Red, Yellow, Blue]". The union of any two SETs, one of which is empty, results in a value equal to that of the other SET. For instance, "(['a'..'e'] + [ ])" names precisely the same SET as "['a'..'e']".

SET Operators: Difference (−). The *difference* between two SETs, A and B, is the SET that contains all members of A that are not also members of B. The expression "((Orange − Green) = [Red])" is True, and so is "(([1..30] − [1..15]) = [16..30])". Note that if SET B is either empty or has no members in common with A, then "(A−B)" will be equal to A.

SET Operators: Intersection (*). The *intersection* of two SETs, A and B, is a SET that contains all members held in common by the two SETs. The value "(Violet * Orange)" is equal to the singleton SET "[Red]", because the scalar value Red is the only member of Violet that is also a member of Orange. The intersection of any SET with the empty SET yields the empty SET. Also, if two SETs have no members in common, their intersection is the empty SET. If all the members of A are included within B, then (A*B) is the same value as A. Thus, "((Orange * [Red, Yellow, Blue]) = [Red, Yellow])". In other words, "((Orange * [Red, Yellow, Blue]) = Orange)".

SET Operators: Comparisons and Membership (Inclusion). Most of the familiar comparison operators (=, <>, <=, >=) may be applied to SET data. Each operator requires two SET-valued expressions as its operands. One operand—call it A—sits to the left of the operator, while the other—B—sits on the right-hand side. A SET comparison operator produces a Boolean result that depends on the relationship between the operands. Equality (=) and strict inequality (<>) hold for SET expressions exactly as they do for other expressions. If A and B contain exactly the same members, they are equal; otherwise they are not equal. The "less-or-equal" operator (<=) is True when all the members of A are contained within B. The "greater-or-equal" operator (>=) returns True when A *contains* all the members of B. Thus, = and <> and <= and >= are two pairs of opposite operations, at least with respect to SET data.

Here are some Boolean expressions that involve SET comparisons. All of these expressions are True:

```
((Orange + Green) = (Green + Violet))
([0..9] = ([0..3] + [4] + [ ] + [5..9]))
((Green + Violet) = [Red, Yellow, Blue])
(['a' .. 'z'] >= ['a', 'e', 'i', 'o', 'u'])
(Orange <= (Orange + Green))
((Orange + Green) >= Violet)
```

The following SET comparison expressions are False:

```
(['a' .. 'z'] <= ['a', 'e', 'i', 'o', 'u'])
(Orange <= Green)
(Violet >= (Orange + Violet))
```

Note that neither the less-than operator (<) nor the greater-than operator (>) may be applied to SET expressions. If you try to do so, the compiler will note "error #132" ("strict inclusion not allowed") and refuse to compile your program.

The *inclusion operator* IN, returning a Boolean value, is used to determine whether a single, specific *scalar* datum is a member of a particular SET or not. The IN operator requires two operands, which we'll call A and B. A must be a scalar or subrange value, and B must be a SET expression that is based on the data type of A. The Boolean expression "(Yellow IN Violet)" is False, while "(Yellow IN Orange)" is True. Notice that "(Yellow IN (Orange + Violet))" and "(Yellow IN (Orange − Violet))" are also True. Can you see why? What about "(Yellow IN (Orange * Violet))"?

IN is probably the most commonly used of all SET-oriented operators. Even if you never use the other operators to manipulate SET variables—indeed, even if you never use SET variables at all but deal only with explicit constructors—you will almost always want to determine whether a particular scalar value is a member of a given SET.

SETs Include No Duplicate Members. By its very nature, a Pascal SET cannot contain more than one of a particular datum. For instance, after the assignment "Orange := [Red, Yellow]", it is impossible to put "more Red" into Orange with the statement "Orange := Orange + [Red]". Indeed, given the established contents of our SecondaryColor variables, the Boolean expression "((Orange + [Red]) = Orange)" is always True. On the other hand, you can "get the Red out" of Orange, using the statement "Orange := Orange − [Red]", which will leave Orange containing the singleton value "[Yellow]".

Limitations on SETs. An Apple Pascal SET variable may include up to 512 members at once. Stated another way, the base type of a SET may define up to 512 distinct values. Because it is unlikely that you will ever invent an enumerated data type that defines more than 512 values, Apple Pascal thus permits you to construct SETs for practically all enumerated types. Also, each of the built-in types, Boolean and Char, establishes less than 512 values, so you are free to construct a "SET OF Char" and a "SET OF Boolean".

Unfortunately, you may not work with a "SET OF Integer", since the Integer type includes 65,536 distinct values (−32,768 to 32,767)! The compiler will reject such a declaration, informing you that you are guilty of committing "error #115" ("base type must be a scalar or a subrange"). As we have observed, however, the compiler *does* allow you to base a SET on any *subrange* of Integer that includes no values smaller than 0 or larger than 511.

Many times during our meanderings along the Pascal Path, we have mentioned that Apple Pascal is descended from UCSD Pascal. The parent system allows a SET to include up to 4,080 members. Integer subranges used in defining UCSD Pascal SETs may include values from 0 to 4,079. In diminishing the capacity of the Apple Pascal SET structure, Apple's engineers modified the p-machine to observe the new limits but neglected to adjust the compiler accordingly. Consequently, the compiler will accept the definition of any SET that can include more than 512 but less than 4,080 members. Unfortunately, if your program tries to put members from the larger range into such a SET, a p-machine Value Range Error will occur at execution time. On the other hand, if you declare a SET that violates the original UCSD boundaries (such as "SET OF 0..5000"), the compiler will report "error #169" ("error in base set") and reject your program. This particular error condition should also be reported for any SET that oversteps the new bounds that are unique to Apple Pascal. Since this is not the case, however, you must be careful.

Practical Applications of SETs. In previous columns, we've developed and depended upon the function Capital, which translates lowercase alphabetic characters to the corresponding capital forms. Here is the original version of Capital:

```
FUNCTION
  Capital(Ch: Char)
    :Char;
(* IF Ch is lower-case letter, return capital version, ELSE return Ch.
*)
BEGIN (* Capital *)
  IF ((Ch >= 'a') AND (Ch <= 'z'))
    THEN
      Capital := Chr(Ord(Ch) - Ord('a') + Ord('A'))
    ELSE
      Capital := Ch;
END   (* Capital *);
```

As it turns out, the condition in the function's **IF** clause may easily be rewritten to employ SET operations, as follows:

```
FUNCTION
  Capital(Ch: Char)
    :Char;
(* IF Ch is lower-case letter, return capital version, ELSE return Ch. This
  implementation uses SETs for clarity and efficiency.
*)
BEGIN (* Capital *)
  IF (Ch IN ['a' .. 'z'])
    THEN
      Capital := Chr(Ord(Ch) - Ord('a') + Ord('A'))
```

```
    ELSE
      Capital := Ch;
END   (* Capital *);
```

The new version of Capital has the advantage of being less obscure than the original. Unfortunately, it tends to execute around 3 percent more slowly. The combination of two character comparisons and a Boolean AND operation executes just a bit faster than a single inclusion operation on a "SET OF Char". However, a more complicated comparison-based expression will execute more slowly than the comparable SET expression. For instance, consider the function Alphabetic, which returns True if its character argument is a capital or lower-case letter and False otherwise. Here is the comparison-based function that we might have written in previous months:

```
FUNCTION
  Alphabetic(Ch: Char)
    :Boolean;
(* Returns True if Ch is a letter *)
BEGIN (* Alphabetic *)
  Alphabetic := (((Ch >= 'A') AND (Ch <= 'Z'))
                OR ((Ch >= 'a') AND (Ch <= 'a'))
                );
END   (* Alphabetic *);
```

Rewriting Alphabetic to make use of SET operations yields the following:

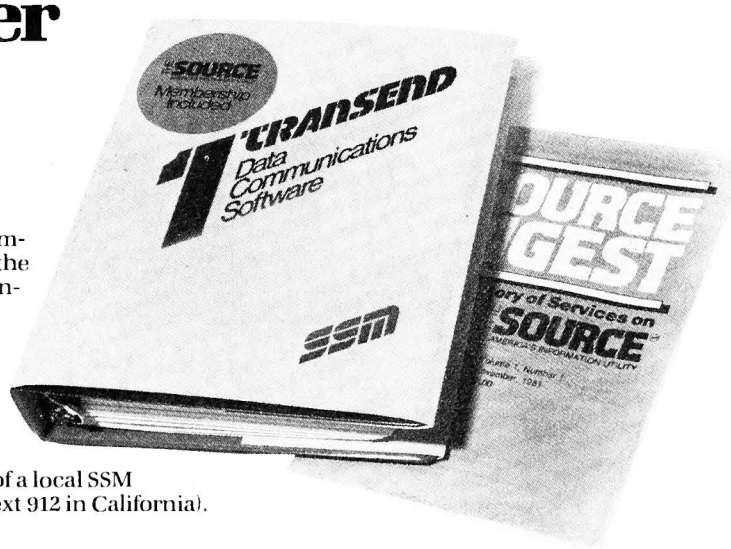
```
FUNCTION
  Alphabetic(Ch: Char)
    :Boolean;
(* Returns True if Ch is a letter.
  Uses SET operations for efficiency and clarity
*)
BEGIN (* Alphabetic *)
  Alphabetic := (Ch IN ['A' ..'Z,' 'a' ..'z']);
END   (* Alphabetic *);
```

The second version of Alphabetic runs a whopping 14 percent *faster* than the first. Clearly, the more complicated a comparison-based Boolean expression is, the more you will gain in clarity and execution efficiency by condensing it, if possible, into an expression involving only one or two SET-inclusion tests. The experience of Your Pathfinder indicates that such opportunities occur frequently, so you should remain alert to them.

As a final example of typical SET usage, here is a program that computes the prime numbers from 1 to 511:

```
 1 1 1:D   1  (************************************************)
 2 1 1:D   1  PROGRAM Primes;
 3 1 1:D   3  (* Generate a display of all prime numbers
 4 1 1:D   3     from 1 to MaxN.
 5 1 1:D   3  *)
 6 1 1:D   3
 7 1 1:D   3    CONST
 8 1 1:D   3     VersionMark=
 9 1 1:D   3      'PRIMES: Find prime numbers (17 May 1983)';
10 1 1:D   3
11 1 1:D   3     MaxN=     511;  (* This value depends upon the
12 1 1:D   3                        maximum size of a SET. In
13 1 1:D   3                        Apple Pascal, SETs may contain
14 1 1:D   3                        no more than 512 members.
15 1 1:D   3                        Integer SETS may contain only
16 1 1:D   3                        members in the range 0 .. 511.
17 1 1:D   3
18 1 1:D   3                        *)
19 1 1:D   3
20 1 1:D   3    TYPE
21 1 1:D   3     IntSet=
22 1 1:D   3      SET OF 1 .. MaxN;
23 1 1:D   3     (* Internally, same as SET OF 0 .. MaxN. *)
24 1 1:D   3
25 1 1:D   3    VAR
26 1 1:D   3     PrimeNumbers
27 1 1:D   3      :IntSet;
28 1 1:D  35
29 1 2:D   1    PROCEDURE PrimeSieve(VAR PN: IntSet; Max: Integer);
```


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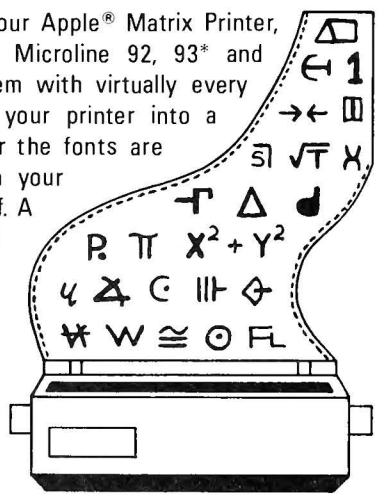
```
30 1 2:D   3   (* On exit, PN will contain no members less than or
31 1 2:D   3      equal to Max that are not prime numbers. The
32 1 2:D   3      calling program must initialize PN before invoking
33 1 2:D   3      PrimeSieve!
34 1 2:D   3   *)
35 1 2:D   3   (* This routine embodies a crude (and mathematically
36 1 2:D   3      unsophisticated) version of the "Sieve of Eratos-
37 1 2:D   3      thenes." Starting with a SET that contains all
38 1 2:D   3      Integers from 1 to Max, PrimeSieve methodically
39 1 2:D   3      removes those Integers in the interval 2 .. Max
40 1 2:D   3      that are multiples of prime numbers. At any point
41 1 2:D   3      during the Sieve process, a prime number is defined
42 1 2:D   3      as the lowest-valued, previously unexamined
43 1 2:D   3      member of PN that is less than or equal to Max.
44 1 2:D   3      The number 1 is a special case; it is accepted as
45 1 2:D   3      prime, but none of its multiples are removed from
46 1 2:D   3      PN, as this would produce a SET containing only
47 1 2:D   3      the single value 1!
48 1 2:D   3      *)
49 1 2:D   3
50 1 2:D   3     VAR
51 1 2:D   3      I, (* The number we are examining at any given
52 1 2:D   3            moment; all numbers less than I have
53 1 2:D   3            already been examined.
54 1 2:D   3      *)
55 1 2:D   3
56 1 2:D   3      J (* Always holds a multiple of I *)
57 1 2:D   3        :Integer;
58 1 2:0   0   BEGIN (* PrimeSieve *)
59 1 2:0   0    (* All are innocent until proven guilty. *)
60 1 2:1   0        PN := PN + [1 .. Max];
61 1 2:1  13
62 1 2:1  13      I := 1;
63 1 2:1  16    (* Organization of following loop causes Sieve
64 1 2:1  16       process to ignore number 1.
65 1 2:1  16    *)
66 1 2:1  16    WHILE (I < Max) DO
67 1 2:2  21      BEGIN
68 1 2:2  21        (* Examine the next candidate. *)
69 1 2:3  21          I := I + 1;
70 1 2:3  26        IF (I IN PN)
71 1 2:3  32         THEN
72 1 2:3  34          (* Assume it's prime, eliminate its
73 1 2:3  34             multiples.
74 1 2:3  34          *)
75 1 2:4  34          BEGIN
76 1 2:5  34           J := I + I;    (* I*2 *)
77 1 2:5  39           WHILE (J < = Max) DO
78 1 2:6  44            BEGIN
79 1 2:6  44             (* Knock out a multiple of I . . . *)
80 1 2:7  44                  PN := PN - [J];
81 1 2:7  56             (* . . . and determine next one. *)
82 1 2:7  56                  J := J + I;
83 1 2:6  61            END;
84 1 2:4  63          END;
85 1 2:2  63      END;
86 1 2:0  65   END  (* PrimeSieve *);
87 1 2:0  82
88 1 3:D   1   PROCEDURE ShowIntSet(VAR Dest: Interactive;
89 1 3:D   2                        IS: IntSet
90 1 3:D   2                       );
91 1 3:D  34   (* Send character representations of all the
92 1 3:D  34      members of IS to the given Dest.
93 1 3:D  34   *)
94 1 3:D  34     VAR
95 1 3:D  34       I
96 1 3:D  34      :Integer;
97 1 3:0   0   BEGIN (* ShowIntSet *)
98 1 3:1   0    FOR I := 1 TO MaxN DO
99 1 3:2  15      IF (I IN IS)
100 1 3:2 23       THEN
101 1 3:3 25         WriteLn(Dest, I:3);
102 1 3:0 50   END   (* ShowIntSet *);
103 1 3:0 64
104 1 1:0  0   BEGIN (* Primes *)
105 1 1:0  0    (* Introduce ourselves . . . *)
106 1 1:1  0       WriteLn(Output, VersionMark);
107 1 1:1 62       WriteLn(Output);
108 1 1:1 70
109 1 1:1 70    (* Start with no primes . . . *)
110 1 1:1 70       PrimeNumbers := [ ];
111 1 1:1 77    (* Determine the primes . . . *)
112 1 1:1 77       PrimeSieve(PrimeNumbers, MaxN);
113 1 1:1 84
114 1 1:1 84    (* . . . and display 'em! *)
115 1 1:1 84       WriteLn(Output,
116 1 1:1 84            'PRIME NUMBERS FROM 1 TO ',
117 1 1:1 120           MaxN,
118 1 1:1 132           ':'
119 1 1:1 135          );
120 1 1:1 150      WriteLn(Output);
121 1 1:1 158      ShowIntSet(Output, PrimeNumbers);
122 1 1:0 167   END   (* Primes *).
```


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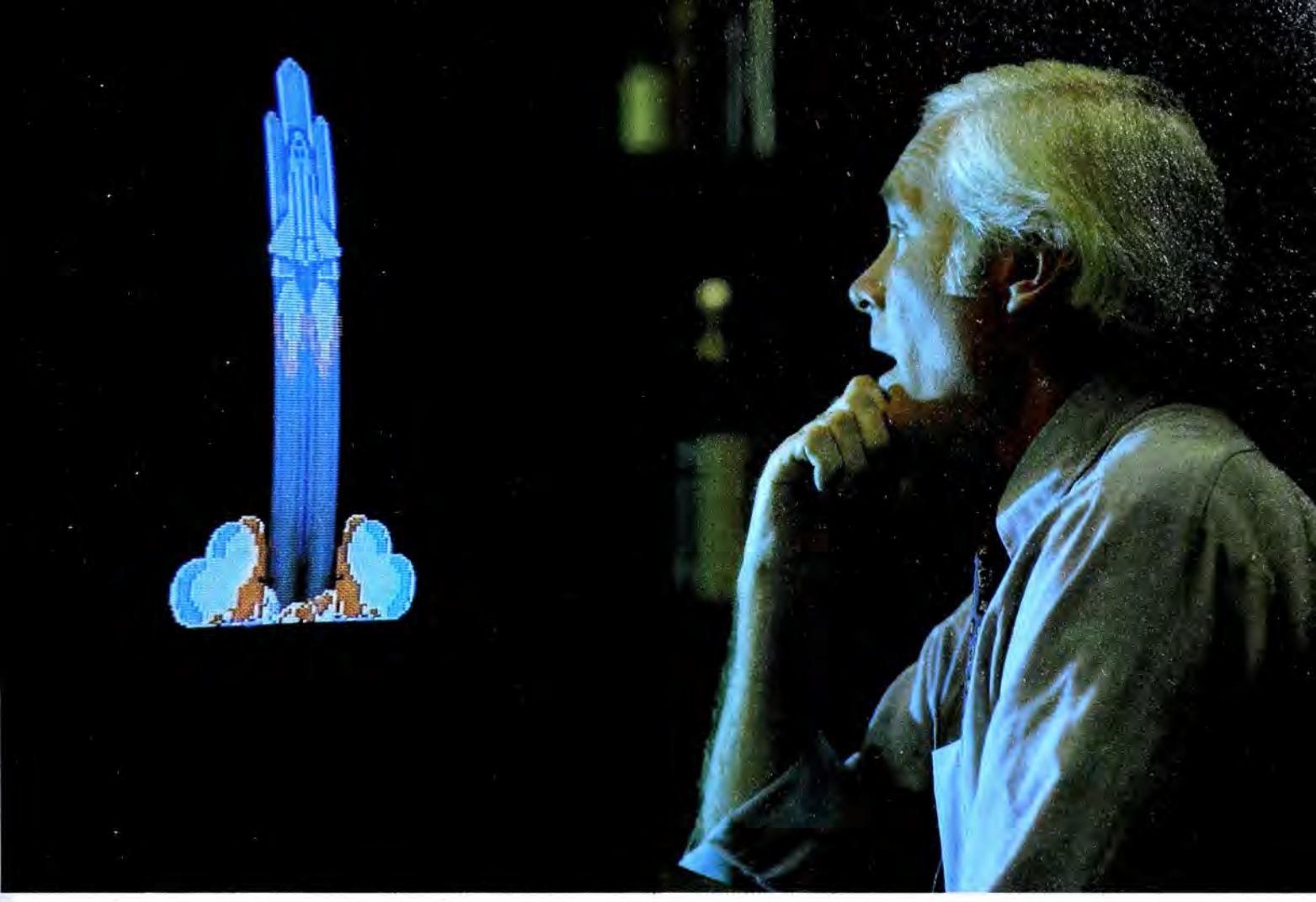
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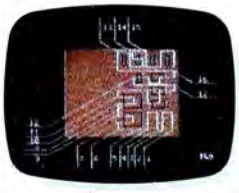
If you would like to witness the effects of the compiler bug mentioned earlier, simply recompile Primes after changing MaxN from 511 to 512, then execute the code file that the compiler produces for the altered program. The listing of Primes presented here was produced by the compiler; it thus includes S, P, and I numbers that you may match against those given by the Pascal system when the expected p-machine error condition actually occurs during execution. Should you take the challenge, you will discover that the program fails while the first statement in the routine PrimeSieve is being executed. This is the point at which PN is loaded with all values from 1 to Max (in this particular case, 1 to MaxN, or 1 to 512). Certainly, an error should occur here, since a SET based on Integer may contain no value greater than 511.

SETting the Lesson Aside. Unless your background in math (or computer science) is exceptionally strong, you may have trouble appreciating the utility of Pascal's SET data structure, given only the material presented here. Having introduced the SET, however, we are now free to use it in future programs whenever the unique properties of this structure can help us simplify or clarify our code. Experience suggests that the surest way to develop your own facility with SETs is to examine and modify actual, working programs that employ SETs to good advantage. You certainly will have an opportunity to do just that in the months to come.



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Have you ever come across an old yearbook from your high school or college days and found yourself engrossed in scanning all the once familiar faces? Forgotten memories begin to return. And the very next thing you're wondering is, what's happened to all those old friends? What are they doing today? Likewise, a look through past issues of *Softalk*, at the many stories and the faces that go with them, conjures another time—only a few years ago—when Apples were greener and Applers fewer.

A lot has happened since September 1980, when *Softalk* was a thirty-two-page magazine. What are they doing now, those people who once shared with us their excitement over Apples? It takes none other than the ominous personage of Darth Vader, whose dark presence graced *Softalk*'s first cover, to remind us of a saga that, indeed, continues. . . .

The Jedi Return—with an Apple, Of Course. The Empire struck back and captured our imaginations as well as our filmgoing bucks a few years back. This year's Jedi are trying to do the same, but not without the help of the Apple at Industrial Light and Magic's special-effects production house in Marin County, California.

David Berry is a special-effects camera operator at the Lucasfilm facility who had no experience with computers before, short of finger popping on a Hewlett-Packard calculator. He began messing around with a short program on the Apple developed by another programmer for ILM to keep track of the special-effects shots for *Empire*. That's where his story in the first issue of *Softalk* left off.

As Berry tinkered and learned, he modified his program and it grew. In fact, it became as much of a monster as anyone at ILM could devise for the screen. Starting again from scratch, Berry has since devised a program to help bring back the Jedi. This program is a lot simpler and more flexible than its progenitor, and David Berry has become a programmer through his tinkering and experience in modifying it for use on various projects, including *Raiders of the Lost Ark*, *Dragonslayer*, *Poltergeist*, and *E.T.* (It seems he's even developed a flair for hacking in his spare time.) Never before has the program been applied to as formidable a project as *Return of the Jedi*, though, and its performance is nonpareil.

Basically, the Apple has helped make the massive organization task that special-effects magicians face a lot easier. Many of the shots that impress us the most on the big screen require intricate production techniques to achieve. In a complex editing process, multiple segments of film, some with as many as sixty different layered shots, have to be synchronized. Each shot may also be composed of various elements that have to be filmed separately. One unforgettable confrontation between Luke Skywalker and the forces of evil, lasting but a few minutes on-screen, may call for almost nine hundred separate pieces of film.

The program David Berry wrote greatly facilitates the accomplishment of the herculean task by keeping track of each frame's correct synchronization, cross-referenced layer by layer, as the finished images are constructed. Data for the *Jedi* production is stored on almost thirty disks, which are consulted regularly by about ten people at ILM, all of whom share a single Apple.

Having recently acquired a IIe to use at home, Berry observes that it was less costly and a marked improvement over the machine purchased a few years ago by ILM. Now he's looking forward to exploring the educational possibilities of the Apple with his preschool kids. With the extended eighty-column card, *Prowriter* printer, *Apple Writer IIe*, and Continental's *Home Accountant Plus*, David Berry should be able to manage his personal affairs with as much alacrity as he has shown in handling those of the Jedi knighthood.





Left: Princess Leia, C-3PO, and Han Solo prepare to do battle in *The Empire Strikes Back*. Right: The duel between Luke Skywalker and Darth Vadar—a confrontation that culminates in *Return of the Jedi*.

Meet the Man Who Mastered the Apple To Conquer a Contract in Three Months



Alan Gornick photo

BY ALLAN TOMMERVIK

No architect has begun a career by designing an edifice more stunning than the Eiffel Tower. No sculptor has contrived to outdo *The Thinker* in a maiden effort. No composer has exceeded the beauty of *The Messiah* in a first draft. No engineer has surpassed the grandeur of the Grand Coulee Dam in his first project.

Likewise, no one would expect a rank amateur to create a sophisticated number-crunching program with a multitude of variables and adapt a complete microcomputer business system within six months of his first hands-on experience. Alan Gornick did, and his experience is not only illustrative of the potential of the Apple in the hands of a novice, but also of the interdependence of hardware and software vendors.

His Work's All Wet. By trade, Gornick is a cinematographer. His specialty is underwater photography, although he's equally adept with a camera on terra firma. His most recent release is *The Black Stallion*, for which he did the underwater sequences. The film caused quite a stir in Hollywood when it was not nominated for an Oscar for cinematography.

He also shot sequences for *Gray Lady Down*, *Foes*, *Stunt Rock*, and *The Towering Inferno*. Films soon to be released to which he contributed underwater sequences include *Oceanic Opera* and *Virus*, the twenty-four-million-dollar Japanese-financed epic. He's scheduled to shoot parts of *Never Cry Wolf* for Disney Studios.

Gornick has also been director of photography on segments of such television series as "Charlie's Angels," "Fantasy Island," "S.W.A.T.," and "Barnaby Jones."

The Business of Art. By its very nature, cinematography is ruled by the laws of physics, and successful cinematographers are those who clearly grasp those laws. But the general Hollywood consensus is that the director of photography is also the artist who paints on film what the writer and director have conceived and captures what the actors have wrought.

There's also a business side to cinematography, and it was this aspect of his work that led Gornick to Apple.

Late last year, he took a crew of seven on a twelve-day shoot for *Oceanic Opera* at Truk Lagoon in Micronesia. Even in Hollywood's overinflated jargon, those six thousand miles from home qualify Truk as a distant location.

So cut off were Gornick and his crew that their paperwork, including payroll, couldn't be handled until their return to the States. And so complicated are the union contracts governing the film industry that it took Gornick three days to complete his payroll computations and paperwork when he returned home.

That expenditure of time made him seek out a better way.

His search led him to microcomputers and convinced him that the languages available to him through the Apple computer were most compatible with his projected uses. Perhaps even more important to him was the modular nature of the Apple, which provides for expansion of the system as needed. In January 1980, he made his initial purchase.

Today, his system consists of an Apple II Plus with a 48K memory, an Integer card, three Apple disk drives, an Integral Data Systems 440 printer, and a D. C. Hayes micromodem.

Goliath Was a Contract. But, in January, what Gornick had was an Apple computer that he didn't know how to program and perhaps the most complex labor contract in the country that he wanted programmed. The Hollywood basic labor agreement, negotiated by the International Alliance of Theatrical and Stage Employees, covers every craft and job that goes into the behind-the-scenes production of a movie. That in itself would make the contract more detailed than most.

GOTO 22

Apples Afloat and Aloft. Hollywood certainly isn't lacking in film-industry professionals who've become attracted to programming as an avocation. Another story that appeared in *Softalk*, volume one, number one, told of cinematographer Alan Gornick, who specializes in underwater photography. As a free-lance cameraman, with all his own equipment, Gornick found that the overabundance of paperwork entailed in a film's production took much pleasure out of practicing his craft. The continual shuffling of crew and inventory lists from shoot to shoot, as well as all the paperwork involved in complying with the complex union contracts governing employees in the film industry, was tedious. Worst of all, Gornick found that these responsibilities were eating up valuable time he'd rather have spent flexing his inquiring mind in other areas. With no knowledge of programming whatsoever, Alan Gornick took the plunge with an Apple and his optimism as ballast. Though the solutions he dreamt of seemed a hundred thousand leagues distant at the time, find them he did.

When *Softalk* told his story, Gornick had recently learned to program and had been at work three months writing his *IA Day Pay* package. Still the only one of its kind running on a micro, this program facilitates making the necessary computations that determine the pay scale of various employees in the film industry, in accordance with their union (IATSE) contract agreements. Accounting work that took days to do by hand now takes only minutes. In addition, Gornick found he could easily update his equipment inventory, shipping and customs lists, personal credit resume, and mailing or crew lists using *Modifiable Database* and *Apple Post*.

He's now using Synergistic's updated package, the *Data Reporter*, along with *Magic Window* as a word processor and *Super-Text* for mailing lists; budget quotations and bidding for jobs are a snap now that he's using a spreadsheet program. He has recently eschewed using *VisiCalc* for these purposes in favor of *MagiCalc*, which allows for variable column widths.

In addition to the Integral Data Systems 440 printer and Hayes Micromodem, which he used early on for tracking weather reports in distant locations before going there on a shoot, Gornick has expanded this initial hardware array over the years. Now, he uses a Mountain expansion chassis to accommodate all the peripherals that have overrun the slots available on the motherboard, including a third disk drive, a Microsoft Visi-80 card, Grappler interface, Videx eighty-column card, Lazer Lower Case Plus, and Keyboard Plus. For letter-quality printing Gornick acquired the Zymec Hi Q 1000 printer, which is basically an Olivetti 221 typewriter augmented with a number of microprocessors.



With that labor contract under his belt and his trusty Apple by his side, Alan Gornick feels ready for more conquests—this time in the air as well as under the sea.

Nowadays a more seasoned programmer, Gornick uses the ROM Plus to have his more-often-used program utilities available, such as the *Global Program Line Editor* and *Renumber*. He's even burning his EPROMs behind him as he advances onward, using the ROM Writer. But there's no danger in his becoming a hacker—Gornick also plays the banjo and, with his three Alf music boards as accompaniment, can sketch out a tune that might just end up being the soundtrack on the next film he directs.

The fact of the matter is, Gornick's Apple arsenal is standing ready as he embarks on his next undertaking, the formation of a full-service production company—the only one in Hollywood to specialize exclusively in underwater cinematography. With the likes of the underwater sequences in the movie *Black Stallion* to his credit and all the specialized equipment he possesses, Gornick is well qualified to offer his services to productions calling for scenes shot on location in Davy Jones's locker.

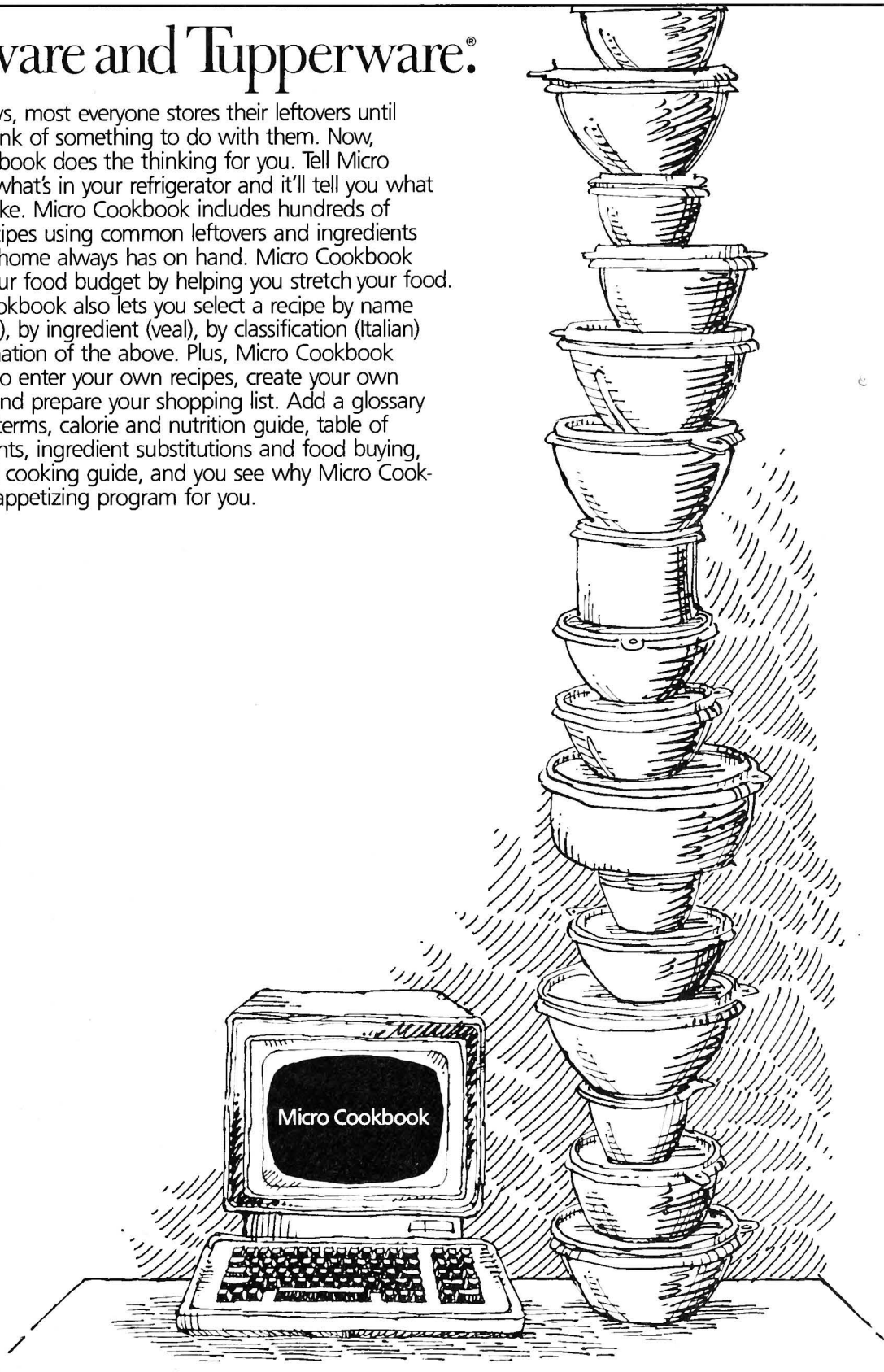
When he isn't treading water, this guy's really got his head in the clouds. By computerizing his operation, Gornick has found the time to pursue a favorite pastime. No, not daydreaming, but learning to fly his own Cessna 172 and maintain a pilot's license. He's even started working on an air navigation program that will take into account fuel requirements, current winds at various altitudes, and temperature and weather conditions to calculate the optimal route to a given destination.

Sitting in Gornick's Los Angeles home, halfway between the living room and kitchen, the Gornick Apple has become a highly valued family focus over the years. When Gornick isn't challenging himself with designing a new algorithm, his wife, Martha, may be catching up on some correspondence, or his son, Alan III, may be exercising his artistic abilities while enjoying the VersaWriter graphics tablet. And more often than you'd imagine, Gornick can be found pondering a dilemma in one of his favorite text adventures, such as *Zork* or *Cyborg*—that is, if he manages to find the time to squeeze it in between his work and his kids' *RobotWar* tourneys.

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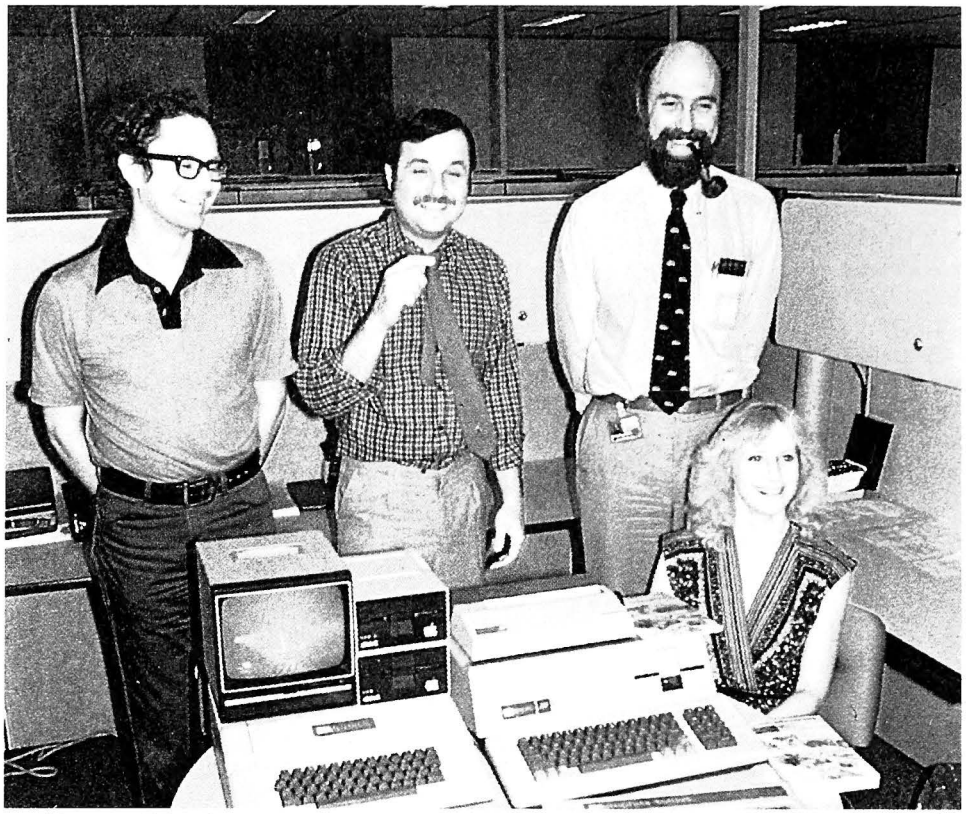
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Lisa: A Vision from the Couch at Apple. Now it's a fact of computer history, but back in 1980 it was yet a vague glimmer in the collective unconscious of a handful of software developers at Apple. Foremost among them was John Couch, then vice president of software and the subject of *Softalk*'s first Exec feature. At that time, Couch had been at Apple only six months, having been won over from a seven-year stint spent in software development at Hewlett-Packard. It was Apple's dedication to a shared point of view on the future of software that attracted him, in addition to its commitment to develop new hardware in liaison with his software lab, ensuring system compatibility and optimization.

An engaging personality whose excitement about what interests him is contagious, John Couch brought to Apple not only his expertise but also a sensitivity to people's needs and a willingness to learn from people's experiences such lessons as he could actively apply toward designing software environments, destined to set an industry standard. Couch learned one such lesson early on through his father, who at that time was managing a health spa and enlisted his son's programming ability to put the business on a micro.

Through this experience he came to recognize the limitations of traditional programming, no matter how powerful or versatile the language used. A new concept began to germinate in his mind, which he was later to term *datagramming*. The essential idea here is that the only thing the user should have to do is enter the data to be operated on, specify for the computer the operations to be performed, and then let the computer itself do the programming. Datagramming entails giving non-programmers access to conceptual tools for manipulating data that had been available previously only to programmers.

In September of 1981, one year after *Softalk*'s Exec article, John Couch came a step closer to forging his datagramming concepts into reality when he became vice president and general manager of Apple's office systems division, the position he holds today. In this capacity he took the reins of a project that brought many datagramming concepts to fruition in what we now know as the Lisa.

And boy, did it happen fast—it took less than three years to turn a dream into a marketable reality. Couch recalls that at first it didn't seem like there would ever be a light at the end of the tunnel. Then when it did appear, it turned out to be an onrushing train. Couch's management style, characterized in 1980 as "management by walking around," became, by 1983, management by running around. He half-jokingly confides that Apple has considered ordering running suits for everyone in his division. Now this doesn't imply any compromise of his person-to-person orientation. John Couch is just encountering more people than ever since Lisa became the new computer in town. He feels that the finished product turned out better than Apple had ever imagined it would.

With Lisa, Couch believes Apple has set another industry standard, providing users with a culmination of the benefits of the company's $25-million development investment and all that's been learned along the way. He believes the Lisa technology will have a stimulating effect on the market as Apple's peers respond in some way to the healthy competition, and that dealers will benefit with more business as they learn to tap a sector of buyers that is now becoming ripe. With *Toolkit* and *Clascal*, the software used to do object-based programming on the Lisa, users will expand the boundaries of what has become the norm in applications software friendliness, and John Couch's vision of datagramming, which he also calls programming by example, will come to be shared by all.

A postscript: Couch's close involvement with micros has served as an inspiration to his dad, who has closed his health spa and now reigns over Computer Kingdom, a computer dealership in Riverside, California. What else would you expect from a guy whose son is the Apple of his eye? ◨



Upper left: The Apple Software Lab's exec team is pictured, circa 1980. From left to right: Bruce Daniels, John Couch, Jack MacDonald, and Susan Wells. Above: John Couch in 1983 A.L. (anno Lisae), taking it all *cum grano siliconus*.

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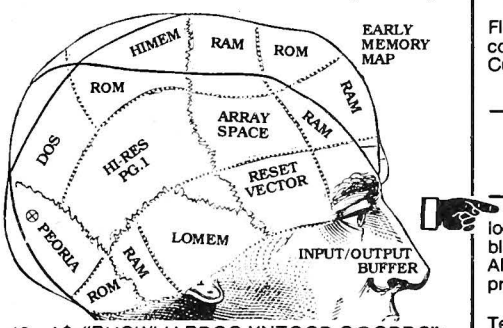
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```
10  A$="RUQWLU RBOC YNTOOB C@OBDC":
    SPEED=180: VTAB 10: PRINT A$
20  FOR X=0 TO LEN(A$)-1: S=SCRN(X,19):
    COLOR=S+(S=12)-(S=13)-(SCRN(X,18)>10):
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```

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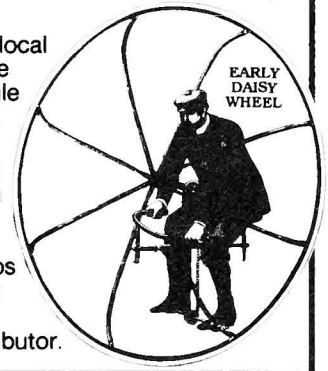
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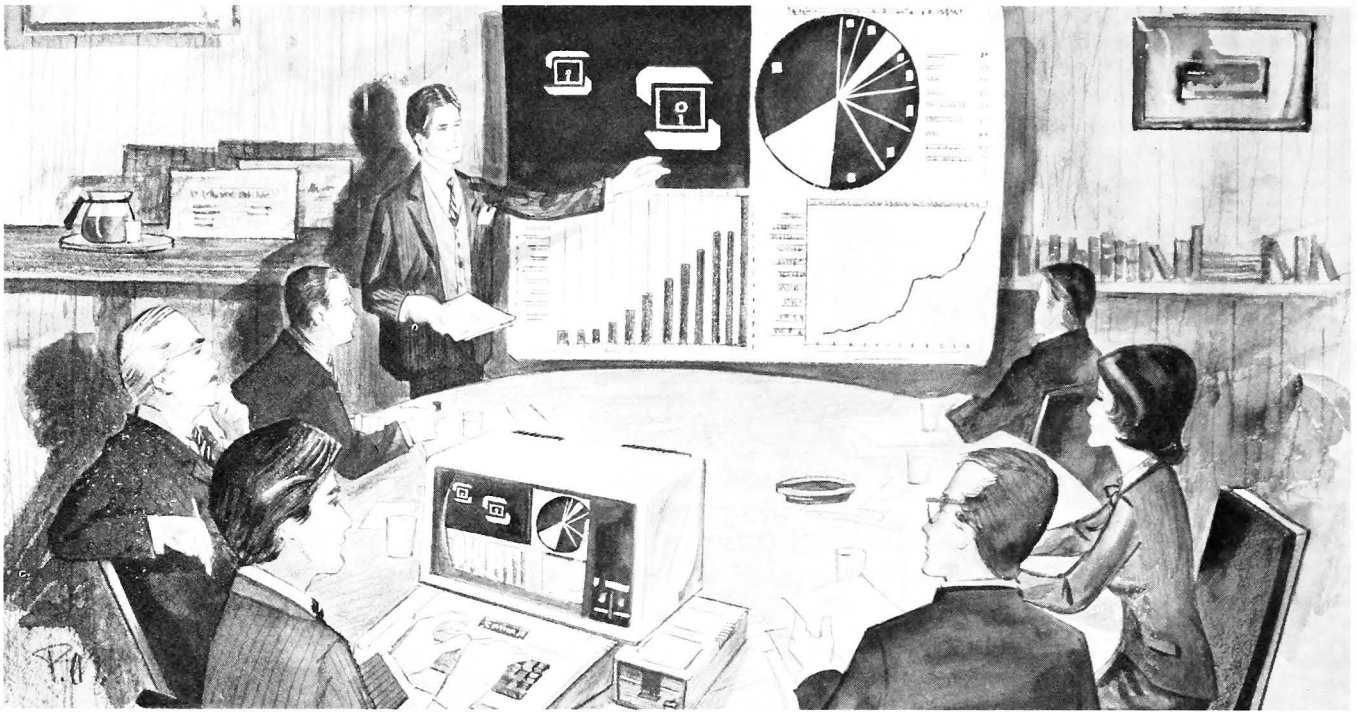
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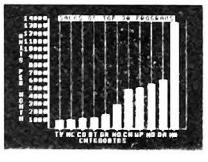
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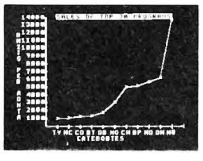


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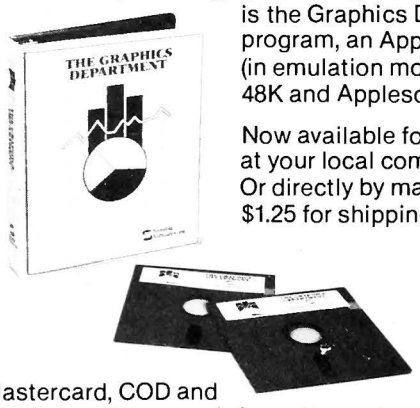
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HARDTALK

BY JEFFREY MAZUR

This month's Hardtalk is a little different. The items we'll discuss this time are not actually hardware; nonetheless, they are well worth considering here because they definitely tend to appeal to hardware enthusiasts and hardcore "hackers."

To begin, we'll review an excellent book that completely describes the Apple II hardware. Then we'll consider and compare two different Integer Basic compilers.

The Apple II Circuit Description. Winton D. Gayler's *Apple II Circuit Description* is a hefty manual that covers the operation of the Apple II in great detail. Intended for students of computer design or electrical engineering, for service technicians faced with repairing the Apple, and for serious hobbyists who just want to know every detail of how their computer works, this book is a priceless tool for understanding the operation of the Apple. The book is not for beginners, however, since some knowledge of basic electronics and TTL logic design is assumed.

More than half the book is devoted to large, pullout schematics and timing diagrams. All Apple II revision levels are covered, from the Rev. 0 motherboard to the latest RFI Rev. D (sorry, nothing on the IIe). Both the one-piece and two-piece keyboards are described, as is the power supply.

The body of the book consists of six chapters that describe every inch of the motherboard. These chapters cover the clock generator and horizontal timing, video timing, the memory system, the 6502 and system bus, on-board I/O, and the video display. Each chapter begins with an overview and a "block-diagram" look at the hardware. Following that is a detailed circuit analysis explaining the function of every component associated with that section.

The judicious use of drawings and timing diagrams helps make the text much easier to follow. In many cases, the schematics and diagrams are located on the large fold-out pages at the back of the book. The entire left side of each of these pages has been intentionally left blank. Thus, when a page is folded out, it does not get covered up by the right side of the book. This allows you to see two pages of text alongside a two or three-page fold-out drawing. These drawings do pose one slight problem, however. You have to unfold each one in order to find out which figure it is. More on this later.

In addition to the "blow-by-blow" chapter descriptions of the Apple circuitry, the book provides a brief but helpful primer on color video techniques, including a comparison between the Apple video signal and the NTSC standards. It also details most of the revisions that have been made to the Apple motherboard since its inception.

It is quite evident that a lot of work went into the preparation of this book. It's well organized and astoundingly accurate, and its author correctly analyzes some very common misconceptions about the Apple. The multitude of timing diagrams were originally deduced from the schematics and were then checked against operating Apples. These could prove invaluable to the service technician. A few actual oscilloscope photos would also have been nice, however; the first time you lay an oscilloscope probe to the Apple bus, looking for those nice clean waveforms can be quite frustrating.

As a whole, Gayler's book is topnotch. The chapter overviews explaining the basic operation of the computer should give the cursory reader a good understanding of what goes on in all of those "little black chips." And for the peripheral designer, the repair technician, and the hardcore hobbyist, there are the detailed circuit analyses. As an educational tool, this book is ideal for teaching the basics of computer design.

Credit should also be given to the publisher, Howard W. Sams, for presenting this book in a very readable format. The spiral binding allows the book to lie flat, even with the fold-out diagrams at the back. The drawings, figures, and schematics are professionally done and clearly printed.

Oh yes, about those fold-out drawings—well, there is one small problem. There are more than forty of them at the back of this book, all of which are folded inward so that what you see is the blank, back side of each figure. Therefore, as mentioned earlier, you have to unfold each figure completely to find out which one it is. The usual way to cure this problem is to reverse the second fold on each page so that the front side now shows through on the outside (think of the way fan-fold paper comes for your printer). If the figure numbers and captions had been printed on the right side of the page, this would have been ideal. A quick turnaround of each page would have left the figure numbers showing for easy identification.

Believe it or not, this matter of the figure numbering is the only negative aspect of the book (and it's an easy problem to remedy). The large schematics are great, the text is impeccable, and the information provided is unlikely to be found anywhere else. Anyone with a strong desire

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to understand the Apple II will enjoy *The Apple II Circuit Description.* And, in fact, most readers will find it an indispensable reference.

Two Integer Basic Compilers. More so perhaps than the typical Apple owner, readers of this column probably have some respect for the Integer Basic language that was native to the early-generation Apples. While this language is still available today, most programmers have opted to use the much more powerful Applesoft language. Some die-hards still poke around with Integer Basic, however, and for some good reasons. The most obvious of these is speed—for simple calculations, graphics displays, or repetitive data manipulations, Integer Basic can be several times faster than Applesoft. Of course, there are Applesoft compilers to speed up that language, but there are also Integer Basic compilers to speed things up even more. Lest you still think that Integer Basic is not too useful, consider that many programs, such as text editors, compilers, operating systems, utilities, and most games, use integer (sixteen-bit or less) computations.

Let's look now at two compilers for Integer Basic—the *Integer Basic Compiler (IBC)* from Galfo Systems and the *Flash!* compiler from Laumer Research. Both of these products take Integer Basic programs (the *source code*) and convert them to an optimized intermediate stage (*object code*); in order to run them, you still need an interpreter program, called a *run-time package.*

These Integer Basic compilers, like their Applesoft counterparts, do not generate a straight-through, concise, machine language program. Coupled with the run-time package, however, the compiled programs they create can be brun or called from other programs. Except for the obvious commands that have no meaning for a compiler (list and run, for example), the entire Integer Basic language is supported by both compilers. In fact, each compiler adds a number of additional commands to make the language more powerful. Furthermore, after compilation, the programs generated are saved as binary files. This means that they no longer require Integer Basic in memory in order to run. Thus an Integer Basic program compiled by either of these compilers can be run on an Apple II Plus without a RAM or ROM card to hold Integer Basic.

Galfo Systems IBC. The Galfo Systems compiler, *IBC*, can generate two forms of object code: pure GSL (Galfo Stack Language) code or a mixture of 6502 machine code and GSL code. GSL is a computer code specifically designed for the 6502 and Integer Basic.

According to *IBC*'s author, GSL gets its speed through "data exchange and manipulation on the 6502 stack, its direct linking technique, the use of special op-codes to handle common Basic statement sequences, and numerous programming innovations that improve character string manipulation and sixteen-bit arithmetic."

Compiling to pure GSL is a way of getting extremely compact code—code that typically uses 20 to 50 percent less memory than the original source code. Mixed code optimizes for speed at the expense of memory. Figure 1 shows each mode's performance for *BM7*, a standard benchmark program, and various other more familiar programs.

The only restriction on the source code program is that arrays must be explicitly dimensioned. Whereas Integer Basic allows a variable or expression to be used for an array dimension, the *IBC* requires that the array be changed to some constant size before a program is compiled. This should not pose any serious problem for most programs. Evaluated gotos (goto 1000+100*X, for example) are allowed, but of course statements that employ them cannot be optimized by a compiler (see the sidebar, "How Compilers Work"). When the *IBC* encounters such a statement, it issues a warning: "Can't optimize goto, gosub." The compiler must then generate a line-number reference table, which can add considerably to the length of the compiled code (four bytes for each line number in the program).

Another important limitation to be aware of is the *IBC*'s lack of error-checking for array limits and for overflow/underflow conditions such as division by zero. A compiled program will continue to run after such an error (probably with incorrect results), and no indication will be given that an error occurred. Thus the source code program should include whatever error-trapping may be necessary.

On the plus side, several limitations on Apple's Integer Basic are also remedied. Strings, for example, can be of almost any length (up to 32,000

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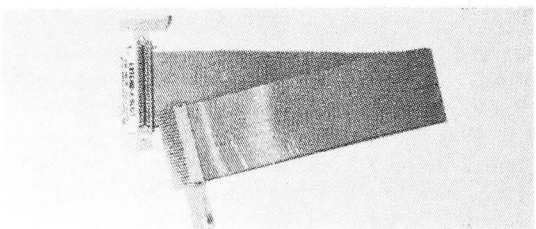


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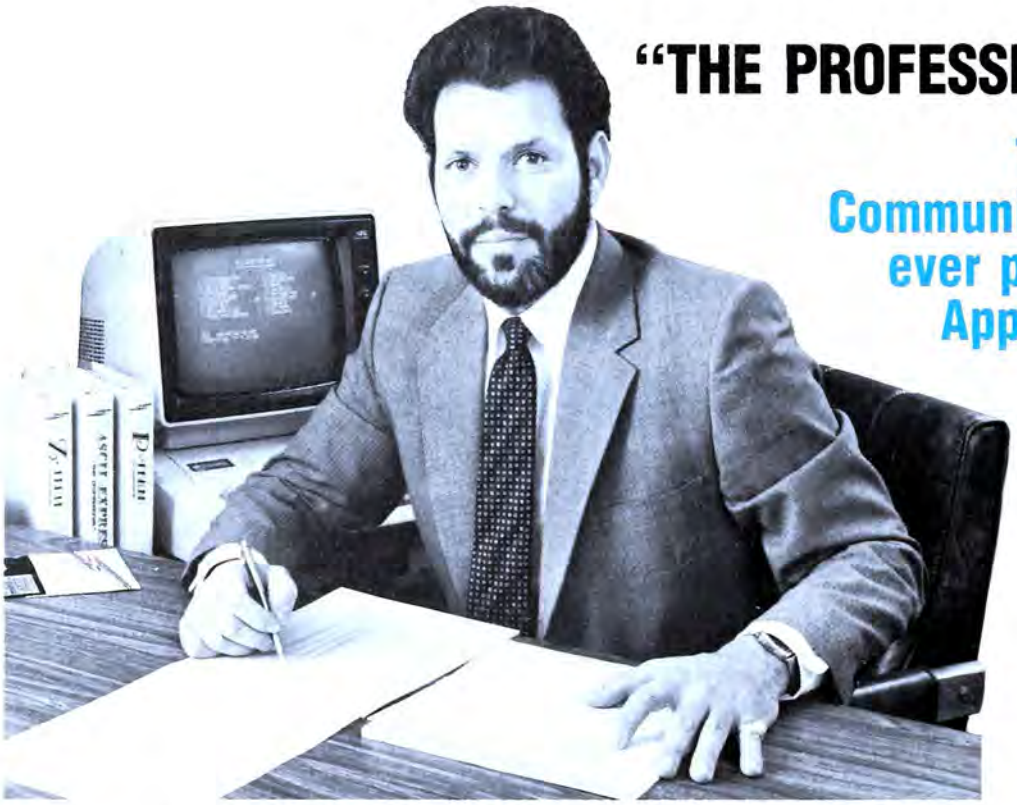
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```
300  PRINT "START"
400  K=0
430  DIM M(5)
500  K=K+1
510  A=K/2*3+4-5
520  GOSUB 820
530  FOR L=1 TO 5
535  M(L)=A
540  NEXT L
600  IF K<1000 THEN 500
700  PRINT "END"
800  END
820  RETURN
```

Figure 1A. Benchmark program *BM7*, used to test compiler performance.

	Test	Integer Basic	Galfo *IBC* Optimized for Speed	Galfo *IBC* Optimized for Space	*Flash!*	
	Compile Time		5.9	5.9	17.1	(6.7)
BM7	Execution Time	28	2.5	2.9	5.6	
	Space Used		17C	115	112	
	Compile Time		13.0	11.3	137	(59)
Biorhythm	Execution Time	18.2	3.3	3.4	4.4	
	Space Used		1AFF	E30	EC8	
	Compile Time		6.3	6.3	30	(13.3)
Sieve	Execution Time	238	16.9	19.9	19.7	
	Space Used		336	225	2EF	

Notes: All times in seconds.
All memory space in hexadecimal.
Flash! compile time in parentheses when RAM card used.

Figure 1B. Performance comparison chart for Integer Basic language, Galfo *IBC* compiler, and *Flash!* compiler.

characters as opposed to 255) and can contain any of the possible character codes. Also, the maximum number of gosubs that can be nested is increased to twenty-four.

To alleviate some of Integer Basic's shortcomings and, in general, to make the language more powerful, the *IBC* adds thirteen new commands and three new functions. The functions are CHR$(0,expr), get(0), and key(0).

CHR$(0,expr) converts an expression in the range 0..255 into the ASCII character represented by the code *expr*. (This is similar to the CHR$ function in Applesoft.)

Get(0) enters a single character from the keyboard or some other input device and returns the ASCII value of that character. (This is similar to the Applesoft get command, except that it causes a numeric value to be retrieved instead of the character string.)

Key(0) allows a program to access the Apple keyboard directly. This function will return a 0 if no key has been pressed; otherwise, it returns the ASCII code of the last key pressed and then resets the keyboard strobe. This is a more elegant replacement for the peek (−16384) statements commonly found in Integer Basic programs.

The thirteen new statements are entered into the Basic program using a special syntax that begins with the keyword DSP. This allows the interpreter to accept the line because it thinks a display command is being entered. The *IBC* does not support the usual DSP command, using it instead as a prefix to the new commands we'll look at next.

Home clears the screen and moves the cursor to the upper-left corner of the text window. This command is identical to the Applesoft home command and to a call −936.

Clear clears the screen from the current cursor position to the end of the line. This command is identical to a call −868.

Invert causes further printing to the Apple screen to be in inverse video. This command is identical to the Applesoft inverse command and to poke 50,63.

Flash is the same as invert, except that it causes flashing characters to be printed. It is identical to the Applesoft flash and to poke 50,127.

Normal restores characters to be printed in normal video. This command is identical to Applesoft normal and to poke 50,255.

Mixed sets the graphics mode (either lo-res or hi-res) to the mixed-text mode. This command leaves four lines of text at the bottom of the graphics display and is equivalent to a poke −16301,0.

Full sets the graphics mode to full screen display. It is equivalent to poke −16302,0.

Lo sets video mode to display lo-res graphics, page one.

H1 sets display to hi-res graphics, page one.

H2 sets display to hi-res graphics, page two.

Point, *line*, and *shape* allow simple hi-res graphics to be created. These commands work in conjunction with a hi-res driver routine (supplied) or can be configured to utilize the Programmer's Aid #1 ROM if it's available.

All of the commands just listed are embedded within the source program using the DSP prefix; for example:

```
100 DSP HOME
```

is an alternative to

```
100 CALL -936.
```

Using the *IBC* is quite straightforward. First the source program is entered from the keyboard or loaded from disk. Normally, the *IBC* is co-resident with the source program. This means that the source program, the compiler, and the object program can all be in memory at the same time. Thus, you can run the interpreted program, compile it, and then run the program in its newly compiled version. Then if you like you can go back to the source program, list it, make some changes, recompile it, run the newly compiled version of the program, and so on. This is possible except with very large programs. If the compiler runs out of memory during its translation, however, it will begin overwriting the source program in memory. Therefore, it's a good idea to save off to disk (before compiling) any modifications to the program.

The next step is to insert the *IBC* system disk into the drive and brun the file *IBC*. This starts the compilation process. The first prompt asks you whether or not you want to optimize for speed. After a yes or no has been given, the actual compiling begins. For this, another disk, labeled



the *Compiler*, must be used. Single-drive users are required to swap disks; those with two drives simply place the *Compiler* disk into drive 2. At this point, the compiler begins displaying a table of all variables. Each entry includes the variable name, type, absolute memory location, and length (see figure 2).

Almost immediately after this table has been generated, the compilation is finished and the starting address and length of the object code are displayed. A final prompt is given that allows you to ask that the object code be executed if you like. Otherwise, you can bsave the object code to disk using the parameters given.

The object code generated by the *IBC* is completely relocatable to any page boundary (that is, the last two hex digits of the address are 00). Likewise, the run-time routine is also relocatable (it takes up 3.5K of memory) and can therefore be easily combined with the object code to form a single brunable file.

The Galfo *IBC* can best be described in one word—fast. It compiles programs at lightning speed (50 to 200 Basic lines per second!) and executes them seven to fifty times faster than the Integer Basic interpreter. All this, plus some useful extensions to the language, make the *IBC* quite an impressive package.

Laumer Research Flash! Compiler. The *Flash!* compiler sacrifices some execution speed for complete error-checking. It adds thirty-one new statements to the Basic language. Both the trace and DSP functions of Integer Basic are supported, as are variable dim statements. Compilation speed is rather slow, but many useful options are available.

The best way to get a picture of how this compiler works is to look at the sample run in figure 3. The first thing the compiler asks for is the name of the source file. If the source program is already in memory, then no name needs to be given; otherwise a valid file name must be supplied and *Flash!* will load the file into memory.

The next prompt asks for the name of an object file. Normally, the compiler stores the translated code directly back onto disk. This allows it

```
*** INTEGER BASIC COMPILER - VS 2.0 ***

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IBC: PLEASE LOAD COMPILER DISK!
IBC: OPTIMIZE FOR SPEED (Y/N) ? Y

VARIABLE NAME      TYPE        <$LOC>  <$LEN>

K ..............   INTEGER     <0800>  <0002>
M ..............   INT ARRAY   <0802>  <000E>
A ..............   INTEGER     <0810>  <0002>
L ..............   INTEGER     <0812>  <0002>

IBC: OBJ. CODE LENGTH: $017C
IBC: OBJ. CODE STARTING ADDRESS?
IBC: OBJECT CODE LOCATED: $0A00.0B7C
IBC: EXECUTE (Y/N) ?
```

Figure 2. Sample output from Galfo *IBC*.

```
FLASH!              VERSION 1.0              BY MIKE LAUMER
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        SOURCE FILE :
        OBJECT FILE :
      ASSEMBLY FILE :
   CAN RAM CARD BE USED ?
   RUNTIME IN OBJECT FILE ?
    LANGUAGE EXTENSIONS ?
       SYMBOL TABLE LIST ?
  LINE NUMBER TABLE LIST ?
 ASSEMBLY LANGUAGE LIST ?
         PROGRAM ORIGIN :
 START ADRS FREE MEMORY :
   END ADRS FREE MEMORY :
  READY TO BEGIN COMPILE ?

COUNT     PHASE      #SYMS   #LINES   CUR LINE
    0   CODE GEN         4       13        820
```

Figure 3. Sample output from *Flash!*

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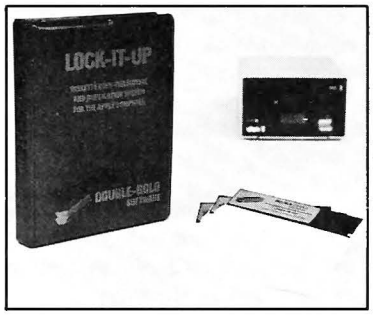
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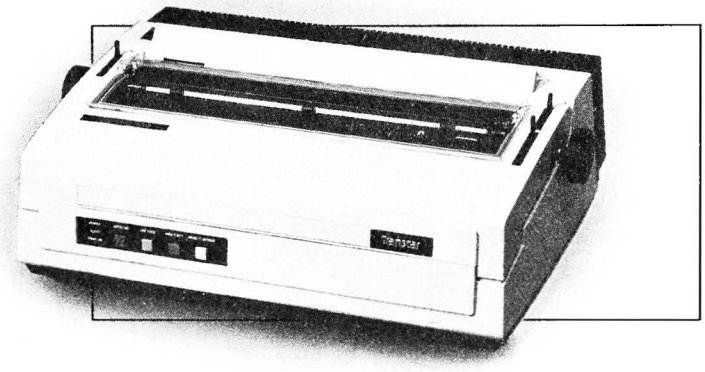
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How Compilers Work

Most people are familiar with the Basic language as it is executed by a combination interpreter/operating system. Both Integer Basic and Applesoft fall into this category.

When you enter a program that uses an interpreted Basic, the data you type in at the keyboard is immediately examined by the interpreter/operating system. First, the input line is fed into the routine called a *parser*. This routine examines the line, character by character, attempting to determine what action is being requested. If the line is a command, such as list or run, the interpreter jumps to the appropriate routine to execute that command. If the line begins with a valid line number, then the interpreter assumes that this line is part of a program. Some syntax checking may be performed (Integer Basic does a complete check), and then the line is converted into a standard format (that is, a format standard to that particular interpreter) and stored in memory.

When the program is run, the interpreter finds the beginning of the program text in memory and then starts to execute it. Each line of the Basic program is then reexamined by the interpreter and translated into calls to standard subroutines within the interpreter. For example, the interpreter may have special subroutines that correspond to such Basic commands as for, next, and goto. When a branch instruction (goto or gosub) is encountered, the interpreter starts searching from the beginning of the program, line by line, until it finds the correct one, and then resumes execution. If the desired line is near the end of a long program, or if this branch is repeatedly executed, quite a lot of time is wasted searching through the program for line numbers.

A compiler, on the other hand, takes the source program and begins to translate it into machine language. Common functions may still be handled by a set of standard routines (the *run-time* package), but each program line is assigned an absolute location in memory. Branch instructions now become immediate jumps to the code for that specified line number. No searching is required; so it makes no difference whether the line is near the beginning of the program or at the end of it.

Many other techniques are used by the compiler to generate faster and more efficient code than that used by the interpreter. Of course, the advantages of the interpreter are that program changes can be made quickly and easily, the program can be listed, and immediate execution is provided by the run command.

It is possible, however, to have the best of both worlds. A program can be written and debugged using the interpreted Basic (this affords preliminary syntax checking, immediate error flagging, and quick checks that the program is working as desired). Then, when the entire program has been completed and checked out, it can be compiled for fast execution. Operation of the compiled program should be identical to that of the original interpreted version.

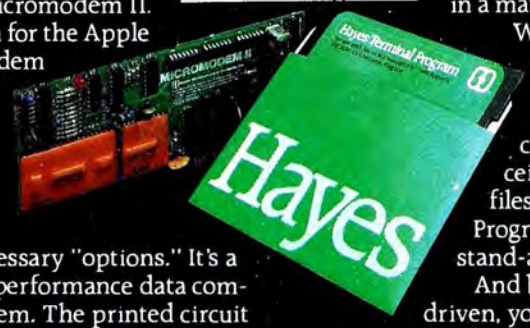
to compile very large programs that might otherwise not fit in the Apple's memory (remember, that's the source code *plus* the compiler, *plus* its working RAM, tables, and so on, *plus* the object code). When you're working with a small program, you can cause the object code to be compiled directly into memory by saying no to the object file prompt.

You'll discover various areas where a more efficient routine to replace the compiler's code can be written directly in assembly language. You can use the *S-C Macro Assembler* (from S-C Software) to generate such a program. Those areas of the program that are executed often, or are very time-critical, can thus be recoded using assembler.

The next prompt requests an assembly language file. If you've generated such a file, it will contain an assembly language text file (source code) for the compiled program. This text file (actually it shows up in the catalog as an I file) can be used by the *S-C Macro Assembler II* to further speed up program execution. This is done by rewriting some of the routines generated by the *Flash!* compiler.



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Assembly listing, symbol table, and line number table created by *Flash!* Compare the assembly code to the Basic listing in figure 1A.

```
FLASH! VERSION 1.0 COMPILED BASIC LISTING          PAGE 0001

0A00-                          .OR   $0A00
0A00- 4C 51 5D                 JMP   L.START
                               .IN   R.EQUATES
                               .IN   R.DATA
                               .IN   R.MATH
                               .IN   R.LOGIC
                               .IN   R.FUNCTIONS
                               .IN   R.ERRORS
                               .IN   R.GOTO/GOSUB/LOOPS
                               .IN   R.STRINGS AND ARRAYS
                               .IN   R.I/O ROUTINES
                               .IN   R.LORES
                               .IN   R.HIRES1
                               .IN   R.HIRES2
                               .IN   R.HIRES3
                               .IN   R.DSP ASSIGNMENTS
5D51-                          .OR   $5D51
5D51- 20 6B 0C L.START         JSR   R.INIT
5D54- 00 00                    .DA   LINE.TBL
5D56- 00 00                    .DA   LINE.TBLN
5D58- 00 00                    .DA   DATA.TBL
5D5A- 00 00                    .DA   DATA.TBLN
5D5C- 44 5E                    .DA   DSP.VAR.TBL
5D5E- 4F 5E                    .DA   END.VARS
5D60- 4F 5E                    .DA   FREE.P
5D62- B1 37                    .DA   FREE.S
5D64- 00                       .HS   00
5D65- 20 89 10 L.300           JSR   R.STR.CON
5D68- 05                       .HS   05
5D69- D3 D4 C1                 .AS   -"START"
5D6C- D2 D4
5D6E- 20 88 14                 JSR   R.PRTS
5D71- 20 8E FD                 JSR   MON.CROUT
5D74- A9 00    L.400           LDA   #0
5D76- A0 00                    LDY   /0
5D78- 8D 45 5E                 STA   K
5D7B- 8C 46 5E                 STY   K+1
5D7E- A9 05    L.430           LDA   #5
5D80- A0 00                    LDY   /5
5D82- 20 41 0B                 JSR   R.PSH
5D85- A9 47                    LDA   #M.A
5D87- A0 5E                    LDY   /M.A
5D89- 20 1D 10                 JSR   R.DIMA
5D8C- AD 45 5E L.500           LDA   K
5D8F- AC 46 5E                 LDY   K+1
5D92- 20 41 0B                 JSR   R.PSH
5D95- A9 01                    LDA   #1
5D97- A0 00                    LDY   /1
5D99- 20 50 0B                 JSR   R.ADD1
5D9C- 20 47 0B                 JSR   R.PUL
5D9F- 8D 45 5E                 STA   K
5DA2- 8C 46 5E                 STY   K+1
5DA5- AD 45 5E L.510           LDA   K
5DA8- AC 46 5E                 LDY   K+1
5DAB- 20 41 0B                 JSR   R.PSH
5DAE- A9 02                    LDA   #2
5DB0- A0 00                    LDY   /2
```

```
FLASH! VERSION 1.0 COMPILED BASIC LISTING          PAGE 0002

5DB2- 20 D5 0B                 JSR   R.DIV1
5DB5- A9 03                    LDA   #3
5DB7- A0 00                    LDY   /3
5DB9- 20 A3 0B                 JSR   R.MUL1
5DBC- A9 04                    LDA   #4
5DBE- A0 00                    LDY   /4
5DC0- 20 50 0B                 JSR   R.ADD1
5DC3- A9 05                    LDA   #5
5DC5- A0 00                    LDY   /5
5DC7- 20 62 0B                 JSR   R.SUB1
5DCA- 20 47 0B                 JSR   R.PUL
5DCD- 8D 4B 5E                 STA   A
5DD0- 8C 4C 5E                 STY   A+1
5DD3- A9 3E    L.520           LDA   #L.820
5DD5- A0 5E                    LDY   /L.820
5DD7- 20 4A 12                 JSR   R.GOSUB0
5DDA- A9 01    L.530           LDA   #1
5DDC- A0 00                    LDY   /1
5DDE- 20 41 0B                 JSR   R.PSH
5DE1- A9 4D                    LDA   #L
5DE3- A0 5E                    LDY   /L
5DE5- 20 41 0B                 JSR   R.PSH
5DE8- A9 05                    LDA   #5
5DEA- A0 00                    LDY   /5
5DEC- 20 41 0B                 JSR   R.PSH
5DEF- 20 57 13                 JSR   R.FOR.1
5DF2- AD 4D 5E L.535           LDA   L
5DF5- AC 4E 5E                 LDY   L+1
5DF8- 20 41 0B                 JSR   R.PSH
5DFB- A9 47                    LDA   #M.A
5DFD- A0 5E                    LDY   /M.A
5DFF- 20 41 0B                 JSR   R.PSH
5E02- AD 4B 5E                 LDA   A
5E05- AC 4C 5E                 LDY   A+1
5E08- 20 41 0B                 JSR   R.PSH
5E0B- 20 4A 11                 JSR   R.ASG.ARY
5E0E- A9 4D    L.540           LDA   #L
5E10- A0 5E                    LDY   /L
5E12- 20 D7 12                 JSR   R.NEXT
5E15- AD 45 5E L.600           LDA   K
5E18- AC 46 5E                 LDY   K+1
5E1B- 20 41 0B                 JSR   R.PSH
5E1E- A9 E8                    LDA   #1000
5E20- A0 03                    LDY   /1000
5E22- 20 89 0D                 JSR   R.LT1
5E25- 20 D8 0D                 JSR   R.JF1
5E28- 4C 2E 5E                 JMP   F.0
5E2B- 4C 8C 5D                 JMP   L.500
5E2E-                  F.0
5E2E- 20 89 10 L.700           JSR   R.STR.CON
5E31- 03                       .HS   03
5E32- C5 CE C4                 .AS   -"END"
5E35- 20 88 14                 JSR   R.PRTS
5E38- 20 8E FD                 JSR   MON.CROUT
5E3B- 4C B5 0F L.800           JMP   R.END
5E3E- 20 65 12 L.820           JSR   R.RETURN
5E41- 4C B5 0F                 JMP   R.END
```

```
FLASH! VERSION 1.0 COMPILED BASIC LISTING          PAGE 0003

                               LINE.TBL .EO 0
                               LINE.TBLN .EO 0
                               DATA.TBL .EO 0
                               DATA.TBLN .EO 0
5E44- 00                       DSP.VAR.TBL .HS 00
5E45-                          K          .BS   2
5E47-                          M.A        .BS   4
5E4B-                          A          .BS   2
5E4D-                          L          .BS   2
5E4F-                          END.VARS
5E4F-                          FREE.P
                               FREE.S     .EO   $9600-FREE.P
5E4F-                                     .EN
```

```
FLASH! VERSION 1.0  VARIABLE ALLOCATION            PAGE 0004

 I      5E45  K
*A      5E47  M.A
 I      5E4B  A
 I      5E4D  L
```

```
FLASH! VERSION 1.0 LINE NUMBER ALLOCATION          PAGE 0005

LINE#  ADRS    LINE#  ADRS    LINE#  ADRS    LINE#  ADRS
  300  5D65      400  5D74      430  5D7E      500  5D8C
  510  5DA5      520  5DD3      820  5E3E      530  5DDA
  535  5DF2      540  5E0E      600  5E15      700  5E2E
  800  5E3B
```

The next question asked depends upon whether or not you have a RAM card in slot 0. If you do, *Flash!* wants to know if it can be used to hold a temporary file created during compilation. If you have Integer Basic loaded into the card and do not want it wiped out, then *Flash!* will create a temporary file on the disk. Allowing the RAM card to be used, however, can drastically reduce the compile time needed.

The next choice made available to you concerns whether or not to include the run-time package in the object file.

The next question you're presented with concerns the inclusion of language extensions.

The thirty-one new statements and three new functions that can be added to the standard language are called *language extensions*. These new functions are week(expr), CHR$(expr), and hex$(expr).

Week(expr) peeks at two bytes at once (one word), returning a sixteen-bit value.

CHR$(expr) gives the string character for the code *expr*.

Hex$(expr) gives a four-character hex value for *expr*.

The new commands are made available through the use of extended remark statements. Any statement with a period immediately following the rem keyword is considered to be a Basic extension. These extensions include home, flash, inverse, normal, hgr, hgr2, hcolor=, hplot to, shape= (which is the same as it is in Applesoft), scale=, rot=, draw at, xdraw at, get, read, data, and restore.

The following is a list of the remaining Basic extensions, with explanations of their functions:

Mixed—sets mixed text and graphics; full—sets full screen to graphics; page1—selects screen display to primary page; page2—selects secondary screen page; hires—sets hi-res-graphics display; lores—sets lores display; CLREOL—clears screen from cursor to end of line; CLREOP—clears screen to end of page; woke—sixteen-bit poke (pokes two bytes at one time); wait—causes the program to halt for a specified number of milleseconds; hback—fills the current hi-res screen with the current color; hfind—used after draw or xdraw to locate the endpoint of the hi-res shape; tone—generates a tone from the Apple speaker (both pitch and duration parameters can be selected); note—similar to tone, but the pitch values now relate to a chromatic scale (that is, every twelfth value represents a different octave).

A sample program line using one of these extensions would look something like this:

```
10 REM .HOME
```

At this point in the process, you can request a symbol table list. This list will show the memory locations of all program variables. In addition, a type code will also be indicated, including codes for variables whose value was never assigned by the program or for variables assigned a value but never used by the program. This can be helpful when you're debugging and cleaning up a program.

The next prompt gives you the option of printing a line-number table showing the memory location for each line of the Basic program that was compiled. The assembly language listing goes even further, showing not only the memory location but also the actual code generated by each line. The listing on the facing page shows what goes into the optional assembly language file. Even if you don't request the disk file you can obtain a listing to the screen or printer by answering yes to this prompt.

The next prompt is self-explanatory. If the object code is to be sent to disk, three questions will appear that allow you to specify where in memory the program is meant to reside and the upper and lower limits of free memory. Presumably, this permits you to reserve memory space for machine language routines, data storage, and so on.

During compilation, *Flash!* goes through three passes of the source program: the *parser*, *allocate*, and *code gen* phases. A status line at the bottom of the screen constantly shows the current phase, the line number being processed, the number of bytes remaining to be scanned, and various other information. The compilation process is fun to watch; to get an idea of how much time it takes to compile some simple programs, refer back to the chart in figure 1.

Flash! corrects two bugs, one in Integer Basic and the other in the Programmer's Aid. Apparently, there is a tiny bug in the section of Basic that handles the for-next commands. Two bytes have to be changed to correct the problem but normally Basic is running from ROM and thus cannot be fixed (Integer Basic loaded into a RAM card can be patched to correct this bug). Likewise, the Programmer's Aid also has one single-byte error (aren't ROMs fun!) that prevents the xdraw subroutine from working. Because of this error, the xdraw function is not even mentioned in the Programmer's Aid manual. With the correct patch, however, on a RAM card, for example, this routine can be restored. Both of these bugs have also been corrected in the *Flash!* run-time package.

The *Flash!* compiler comes with a concise, sixty-page manual. Details on the operation of the compiler, as well as on the creation of the optional assembly language file, are included. Another disk with the full assembly language source code for the run-time package is also available.

In Comparison. Comparing the *Flash!* compiler to the Galfo *IBC* is rather difficult to do. The results in the chart in figure 1 show the *IBC* as being much faster for compiling and also faster during execution; this cannot be denied. However, the *Flash!* compiler has more error-checking, more source-language compatibility, and many more language extensions. Comparing the two products is much like comparing a Porsche and a Cadillac, or a 6502 and a Z-80: One boasts sheer speed, while the other offers more frills.

One other note should be made about compilers in general. There are several traps that can cause a perfectly functioning program to bomb out when compiled. One such problem can occur when the program uses specific peeks or pokes to locations connected with the interpreter. Illegal commands such as himem: and lomem:, for example, which have commonly been added to Integer Basic programs, are also a no-no. For these reasons, some source programs may require modification before they can be compiled. ◨

Galfo Systems, 6252 Camino Verde, San Jose, CA 95119; (408) 226-2377. Howard W. Sams & Company, 4300 West Sixty-second Street, Indianapolis, IN 46268; (317) 298-5400. Laumer Research, 1832 School Road, Carrollton, TX 75006; (214) 245-3927. S-C Software, Box 280300, Dallas, TX 75228; (214) 324-2050.



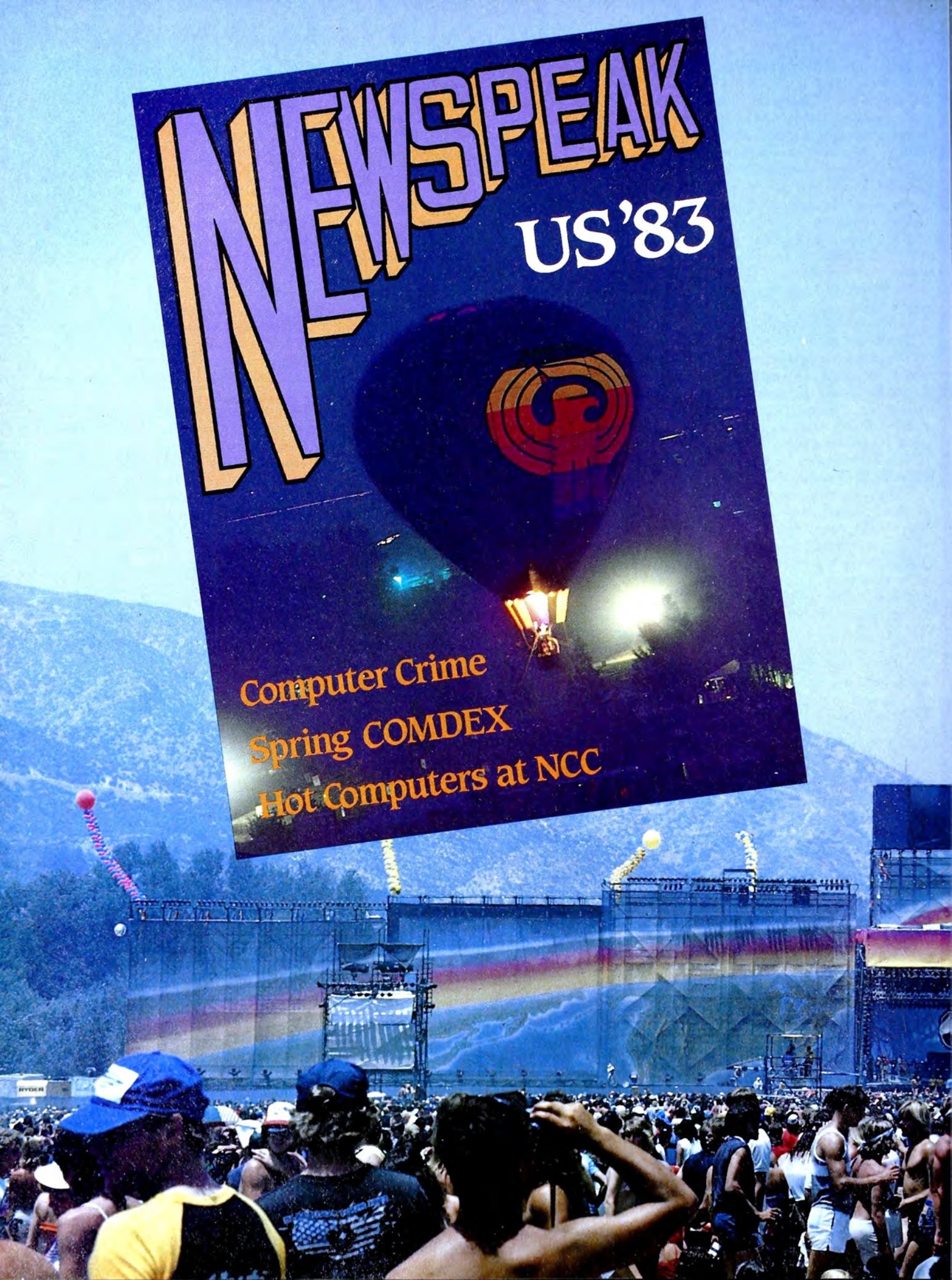
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NEWSPEAK
US '83
Computer Crime
Spring COMDEX
Hot Computers at NCC

The Return of the US Festival

Before noon on Monday, May 30, Steve Wozniak spoke to a tentful of US '83 attendees and the usual media. Toward the end of Woz's question-and-answer session, one young fellow turned to his companion and asked rhetorically, "Doesn't look like a millionaire, does he?"

Let no one accuse Wozniak of cowardice. All four days of the 1983 US Festival, he put himself on the line—fighting hard to remain optimistic while parrying a thousand thrusts from the media. Wozniak did all he could to make this year's festival work; he believed in it, he bankrolled it, he put his heart and soul into it.

Was it worth it? That depends on whom you ask. More than likely, the average concertgoer would say yes—despite the heat, the cold, the huge amounts of walking, the dust, and the so-so food. Ask Wozniak and Unuson and the answer would again be yes—despite the lower-than-expected attendance figures, the violence, the arrests, the hundreds of illegal fires, the trash, and the frequently belligerent media.

US '83 got off to a good start, Saturday morning, May 28, with a Soviet-U.S. tele-

GOTO page 264, column 1







Above, the Stray Cats were one of the US Festival's most popular groups; above right, festivalgoers cooled off during the day at the numerous water fountains; right, people traveled from all over the world to attend this year's US Festival, even from south of the Mason-Dixon line.

US Festival photos by Dave Hunter and Neil Britt



AMPERGRAPH

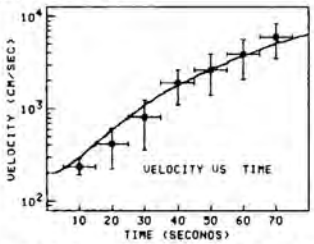
AMPERGRAPH is a powerful, easy-to-use relocatable graphics utility for the Apple II +/e. AMPERGRAPH adds twenty-two Applesoft commands that allow effortless generation of professional-looking plots of scientific or financial data. All of the necessary scaling and screen formatting is accomplished with just a few, simple Applesoft lines.

Unlike most other plotting systems for the Apple II which are stand-alone systems, the AMPERGRAPH utility provides extended BASIC graphics language macros that you can use directly in your own Applesoft programs. The additional commands are &SCALE, &LIMIT, &AXES, &GRID, &FRAME, &LOG X, &LOG Y, &LABEL AXES, &LABEL, &VLABEL, &CENTER LABEL, &CENTER VLABEL, &DRAW, &PENUP, &CROSS, &OPEN SQUARE, &CLOSED SQUARE, &OPEN CIRCLE, &CLOSED CIRCLE, &ERROR BARS, &DUMP (to dump the graph on a Silentype printer) and &*DUMP (to link with AMERDUMP, see below).

$45.00

SAMPLE AMPERGRAPH PROGRAM LISTING:

```
10 &SCALE, 0, 80, 80, 13000
15 LX$ = "TIME (SECONDS)":LY$ = "VELOCITY
   (CM/SEC)"
20 &LOG Y: &LABEL AXES, 10, 10
25 LABEL$ = "VELOCITY VS. TIME":&LABEL, 30,
   200
30 FOR T = 0 TO 80:&DRAW, T, 150 + T12:NEXT T
35 FOR T = 10 TO 70 STEP 10
40 &CLOSED SQUARE, T,
   (150 + T12)*(.8 + .4*RND(3) )
45 &ERROR BARS, 5, T12/2
50 NEXT T:&DUMP
```



AMPERDUMP

AMPERDUMP is a high-resolution graphics dump utility which can be used either in menu-driven mode, or directly from your Applesoft program, with, or without AMPERGRAPH. The following printers will work with AMPERDUMP: Epson MX-80, FX-80, MX-100; Apple DMP, NEC PC-8023A-C, C. ITOH 1550, 8510A/B, 8600. AMPERDUMP offers many features which are not available in other graphics dump routines:

- Horizontal magnifications: 3 with Epson printers (2.33 to 6.99 inches); 12 with all others (1.75 to 7.78 inches)
- Vertical magnifications: 9 with Epson printers (0.88 to 7.96 inches); 6 with all others (1.33 to 8.00 inches)
- Horizontal and vertical magnifications can be specified independently.
- Normal / Inverse dumps
- Fast
- Adjustable horizontal tab
- Easy to use
- Compatible with AMPERGRAPH
- Relocatable

$40.00

The AMPERGRAPH and AMPERDUMP graphics utilities require an Apple II +/e (or Apple II with language card). The AMPERDUMP utility requires one of the following interface cards: Epson, Apple, Grappler, Interactive Structures, Mountain Computer, Epson Type2, Tymac, or Microbuffer II.

AMPERGRAPH and AMPERDUMP are available from your dealer or order direct. Include $2.00 for shipping and handling; Wisconsin residents add 5% sales tax.

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COMPUTER INDUSTRY STRUTS ITS STUFF AT ANAHEIM NCC

Who would have thought it could happen? The pride of the world computer industry rolled into Anaheim for the annual NCC (National Computer Conference) and many exhibitors left downright angry or, at the very least, disappointed with the management of the show.

Now you've heard the bad news, the reasons for which we'll get to in a bit. The good news at the 1983 NCC, held May 16–19 at the Anaheim Convention Center and the Disneyland Hotel Convention Center, was that its size and scope indicated a generally healthy American computer industry, despite impressive showings by Japanese, Australian, French, and other overseas companies.



IBM, Xerox, Intel, Apple, Vector Graphic, VisiCorp, Sperry, Perkin-Elmer, Motorola, Fortune Systems, Bell & Howell, and hundreds of other American computer firms brought out their snazziest booths and their prettiest and handsomest sales personnel. The circus had arrived and the god-fearing residents of Anaheim (their baseball team is the Angels, nicknamed the Halos) poured into the halls, ready to be seduced, amazed, and positively flabbergasted by all the wonderful space-age gadgetry.

What they found was a whole lot of networking and telecommunication products and services. They also found what you'd expect—business, business, business. At least IBM broke up the monotony with its 7565 manufacturing robot, housed in a rectangular metal frame. And at least business meant splash and finesse, showgirls and magicians, giveaways and more giveaways, movies, and demos, demos, demos.

As was noted by several exhibitors, a large number of the attendees at this year's NCC were average citizens of the state with little or no experience using computers. One can only wonder what they made of this four-day computer orgy and its openly acknowledged confusion. NCC is the ultimate end-user show and has many things in common with the annual West Coast Computer Faire, such as tossing competing companies willy-nilly around the floor until they are eventually concentrated all together.

"Hey, Reggie fans. Wanna find the right micro for you? Go to NCC and see over a hundred different kinds."

Does anybody know how long it takes to evaluate a hundred different microcomputers satisfactorily, particularly if you've never seen one in the flesh before? The answer: Don't go to NCC to choose a computer; go to the computer store. On the other hand, how many computer stores stock over one hundred kinds of microcomputers?

It's probably a good thing that only around eighty thousand people a year attend a show like NCC. If there were twelve NCCs a year in twelve different cities, there would be twelve times as many confused consumers who, after experiencing the organized chaos of a show like this one, would probably give up trying to make an informed decision and settle on the micro with the slickest television commercial.

Some companies make no bones about it and ignore the potential end-user steadfastly. NCC is a place to do business with other businesses, a place to make contacts and make tentative deals (and check out the competition). Who needs all those unwashed novices poking into things they don't understand and can't afford?

Okay. But to some exhibitors the steady stream of attendees is the main reason for coming to NCC. Many of the smaller companies—the ones with unroofed booths and two

GOTO page 262, column 1



Atari Creates Ultimate Computer Game Sequence for *Superman III*

The folks at Atari are doing more than just designing home and arcade video games. The Special Programs Division, helmed by Steve Wright, recently worked fourteen weeks creating a sequence for one of the summer's special-effects blockbusters—*Superman III*. Wright calls what they did "computer visualizations" (a fancy name for stop-frame computer animation).

The sequence involves the portion of the action film where the Man of Steel does battle with the Ultimate Computer, described in the film by computer-whiz Gus Gorman (Richard Pryor) as "the world's first stonekiller-diller get-down, get-it-on and twice-on-Sunday supercomputer." The footage Atari provided, which shows up on a computer monitor in the film, has images of Superman flying through a canyon as rockets explode all around him. Everything on the monitor, including the caped wonder himself, was generated entirely on a sophisticated computer system created by Atari.

"Warner Bros. [a division of Warner Communications, as is Atari] wanted the sequence to convey the spirit of a supermega-video game of the future," explains Wright. "They asked us to provide graphics that would resemble closely how a coin-op arcade game might look several years from now."

The Disney films *Tron* and *Something Wicked This Way Comes* used three-dimensional computer animation images—images that had volume and shadow characteristics—in an attempt to simulate real life. Atari's *Superman III* computer footage intentionally carries the look of low-resolution graphics, called 2 1/2-D in the computer animation vernacular. Flat images combined with a few visual tricks to make them look as though they retained a sense of depth were preferred.

"The extra depth is where the 1/2 comes in," says software manager Pat Cole. "We had a different set of challenges than the work on *Star Trek II* presented. If it looked too real we'd have failed. Our effort was to firmly establish a look of video games, but not any game you'd see on Earth today."

The concept of 2 1/2-D is similar to the multiplane animation pioneered by Disney Studios in the late thirties. An artist would paint a scene on several sheets of glass. On the rearmost sheet would be mountains; on the second, trees; on the third, a car; and on the glass closest to the observer there might be a human or animal character. The objective is to create a feeling of depth whereby the car can pass behind the person, and objects further away are slightly out of focus as they would be in real life.

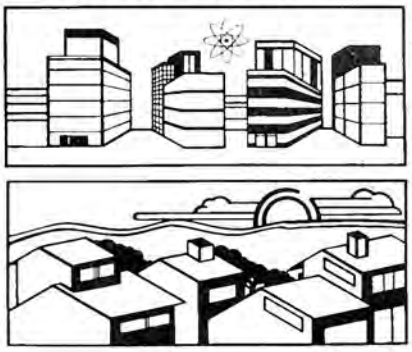
The added "computer visualizations" in *Superman III* cost Warner Bros. roughly ninety-five thousand dollars in equipment and nearly four months of production time. It took ten weeks to prepare the program and four weeks to shoot the mere twenty-six seconds that end up on film. But wow, what a sequence! (Atari actually provided Warner Bros. with sixty seconds of final footage. But true to a big-budgeted picture's form, more than half of it was left out.)

Atari's Special Programs used an Ikonas Frame Buffer computer to create the sequence, using much lower resolution than the system is capable of. The first step was to build a software program allowing Atari's designers to visualize how their animation would look. This came in two parts: a paint and animation program to create the visual images, and a script and sequence controller that enabled the designers to write a script outlining what the objects were to do.

For example, a shot was scripted and then recorded with an elaborate stop-frame video unit called a Lyon-Lamb Animation Controller. This hardware device allowed them to record the sequence accurately one frame at a time onto a Sony 3/4-inch broadcast-quality tape deck. It took the Ikonas an hour or two to calculate and process all the low-resolution graphics in the scene onto videotape so

GOTO page 263, column 1

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Anaheim NCC

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or three weary executive-types in three-piece suits looking either ecstatic or deeply depressed—are trying to create a public image at an affair like NCC. They prepare like maniacs for a show that is probably too expensive anyway and then wait for the crowds to come bopping in (crossing their hearts and hoping to die).

Well, some of the companies that could least afford it got burned badly for most of NCC's four days amidst circumstances that no one involved with the planning of the show had foreseen. Basically, one bad thing led to another.

The show was too big for the Anaheim Convention Center, so six interlocked, giant, hot-dog-shaped tents were set up in the parking lot. In the tents were more than three hundred exhibit spaces, most of which were small—one-tenth the size of Apple's plywood temple. Two hundred or so additional exhibits were located in the Disneyland Hotel's convention center.

The second day of the show, the temperature outside peaked around a hundred degrees and the air conditioning in the tents did not work well. Jim Spillars, vice president of retail operations at Microsoft, was in charge of a booth out in the tents.



Master of marketing IBM displayed one of the widest ranges of products—from personal computers to robot manufacturing systems.

"Our big-screen projection system failed at 102 degrees. The computer flickered at 105 degrees and we turned it off. A couple of people fainted in the booth. It was a freak thing. Better planning would have solved some of it. Everything possible that could go wrong went wrong."

You may have heard the story of the salesman who made shorts out of his suit pants by cutting off the legs. Tuesday, May 17, was just that kind of day. Weary attendees poked their heads in the tents after trekking through the hot sun and turned right around. There were some very angry exhibitors.

On Wednesday, May 18, a meeting between exhibitors and show management, the American Federation of Information Processing Societies (AFIPS), was held and no alternative plan was adopted. AFIPS apologized and promised to make some kind of amends. That wasn't enough in many exhibitors' minds and more than a hundred companies got nasty and threatened to file a class-action suit.

"It wasn't really AFIPS's problem," says Bill Kehoe, trade show manager for Orange Micro. "The cooling system didn't work. AFIPS acted in good faith; they just didn't move quickly enough. I noticed the traffic was down a little in the tents. The trouble was people were moving very fast and didn't want to hang around."

Jim Spillars, who says he was constantly missing appointments at Microsoft's booth because of the heat, was "obviously disappointed" but still plans to be at the next NCC (in Las Vegas next July) as does Go Sugiura, president of Amdek. Sugiura feels that this year he missed out on many of the business opportunities that usually result from NCC. Amdek, like Orange Micro and Microsoft, is waiting to see what amends AFIPS will make, though attending next year's NCC is a foregone conclusion.

In addition to the problems in the tents, attendance at the Disneyland Hotel's convention center was noticeably light because of the distance separating it from the rest of the show. Also, security was reported to be bad, both before the show opened and right after it closed.

AFIPS is a class organization and it has put on enough NCCs to know better. Anaheim was not big enough to hold the show and bad luck in the form of sizzling temperatures only made things worse. Three-quarters of the exhibits ran smoothly in air-conditioned comfort and there were no problems. But that still left a lot of angry exhibitors.

The same problem should not occur next year, even though Las Vegas in July rivals the dizzying temperatures of the Kalahari. The Las Vegas Convention Center is well equipped and big enough to handle the show. DH

Tandy showed off its new portable "lap" computer—the Model 100—and it drew a crowd.



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Superman III

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they could view the choreography.

Once the look of the sequence was agreed upon, a medium-resolution "take" was photographed onto 35mm film using a Dunn Procolor Camera, or Dunn box. The box contained a high-resolution black-and-white monitor with a custom-modified 35mm Mitchell camera precision-mounted for recording the images onto film. Custom-making the box to Atari's specifications cost $35,000. And it took the computer three to four hours to process a scene.

Under automated computer control, each frame was displayed on the Dunn monitor in black-and-white separations, analogous to the method used for the rear projection compositing of matte paintings, or to storing negatives to prevent their color from fading. Each black-and-white separation was photographed by the Mitchell through the appropriate red-green-blue Kodak gelatin filter (in this case, a 25, 58, and 47b filter) to combine the elements of the full-color image.

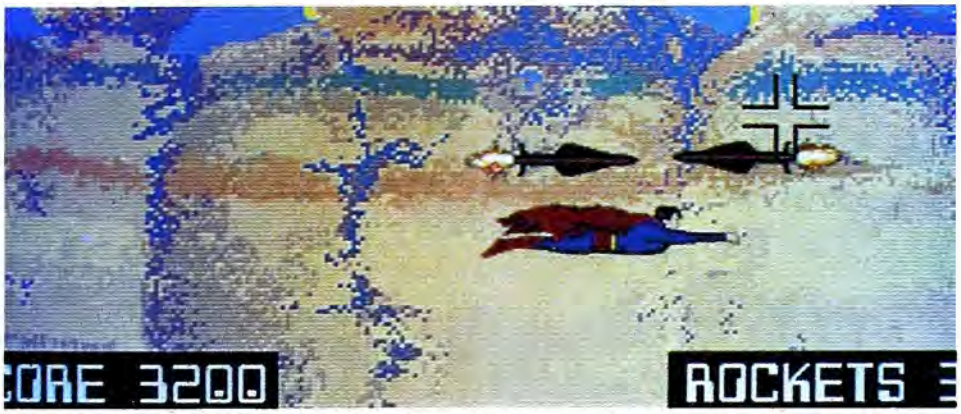
The computer sent the image to the hi-res black-and-white monitor and the camera photographed the single picture in three passes. First the Dunn box sent the image of red information to the monitor's screen and then the camera photographed it with a red filter over its lens. The film did not advance and the filter automatically rotated to green as the green channel was imaged on the monitor. Then a second picture was taken.

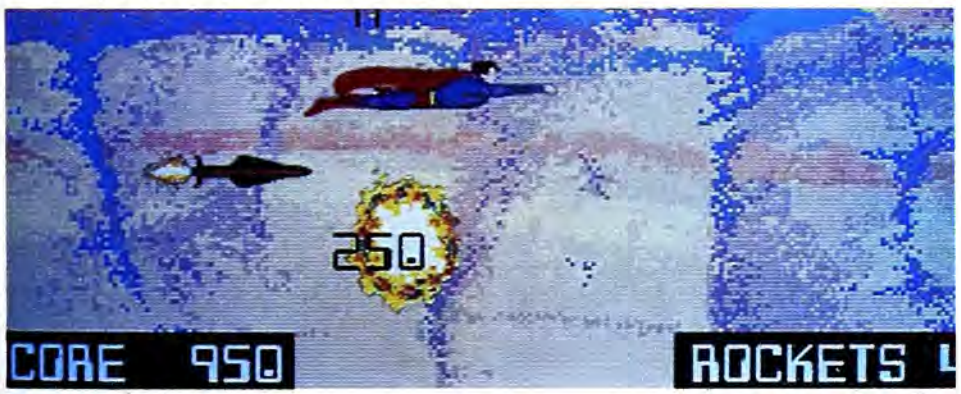
After photographing the blue channel in like manner, the camera advanced the next frame and the entire process was repeated automatically. By keeping the frame of film stationary for the three takes, perfect film registration was achieved. Also, the result was first-generation color (just like the process used in *Tron* achieved) since no color desaturation or contrast build-up could take place in the duping of a black-and-white image.

When everything checked out on the medium-resolution test film, a final run of the scene was made with high resolution (that is, as high as the scene's "unrealistic" requirements dictated). This process took an additional twelve to fifteen hours per scene.

A few interesting side effects came out of this rigorous process. Since the film was shot in Panavision format, the proper 2.35-to-1 aspect ratio was achieved via software programming rather than through anamorphic lenses on the picture-taking camera. In other words, Atari "squeezed" the image to Panavision through an anamorphic software package, without worrying about any distortion characteristic from having to film through an extra piece of glass. This development could lead to game manufacturers actually marketing games in Cinemascope for future projection television sets modified for anamorphic widescreen images.

As of this writing, Atari has no merchandising plans through its consumer-electronics division for a game cartridge based on its work in *Superman III*. There are, however, plans for a 400/800/1200 version of the game for owners of Atari home computers. The *Superman III* game, of course, cannot possibly look anywhere near as good as what appears in the movie. LR





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US Festival

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vision link-up. With the help of a two-way satellite transmission and human translators, the famous and unfamous of both nations were allowed to exchange views and pose questions to each other. Eventually children of both countries posed questions to their counterparts. The event was refreshingly innocent—free of the usual political jockeying associated with previous U.S.-Soviet face-to-face meetings. One Soviet official, when asked what kind of music Russians like best, said, "Rock and roll."

That night, the US Festival crowd was treated to twenty minutes of jazzy rock music by the Soviet group Arsenal. Then the Soviets got to see and hear a hefty chunk of Men at Work's energetic set. Seeing the hopping and bopping Soviet rock-music fans on the big Diamond Vision and Eidaphor screens, as well as hearing their music, was a once-in-a-lifetime experience that most US Festival concertgoers appreciated, even though some had booed the initial public-address announcement of the link-up.

Though thousands of festivalgoers crowded into the one main exhibit tent, the technology fair was a major disappointment. Only a handful of computer-industry companies showed. The majority of exhibits concerned music—everything from cars with stereos to synthesizers and drum machines. The musical din inside the tent, caused by all the attention grabbing booth demonstrations, was considerable.

When speaking Monday morning, Wozniak said that the technology fair was rushed and that potential exhibitors weren't given enough advance warning. Even Apple stayed away from this year's festival, though it was present at last year's. The mammoth annual National Computer Conference was held just the week before and may also have been a factor in the poor showing by large computer firms.

The crowd Saturday, May 28, was peaceful and orderly. The best acts were Oingo Boingo, The English Beat, Stray Cats, and Men at Work. The headlining act that night, The Clash, was a big headache for Unuson and Wozniak. Everything about The Clash's appearance at the festival rang false. The Clash is not a good mass-crowd act. Its gritty, working-class, Marxist-tinged music comes off best in a small auditorium.





Opposite page: top, the long, cold wait for David Bowie; below right, science-fiction writer Ray Bradbury talked about how he develops ideas for his stories; below left, the crowd for the rock-music weekend was predominantly white, middle-class teenagers—but there were a few exceptions. This page: upper left, once again the US Festival boasted the largest sound system ever assembled for an outdoor rock concert; upper right, the technology exhibit was a disappointment—lots of synthesizers and stereos but few computers; below, Woz under fire at a press conference the afternoon before The Clash played.

Added to this basic miscalculation on Unuson's part was a series of well-publicized incidents between The Clash and festival officials, wherein the band members played the spoilers—claiming that the festival was too commercial, that they were a more suitable band for the U.S.-Soviet link-up, and that they did not have a contract with Unuson and just might not play.

Before The Clash finally played, there was a "really big show." Combining lasers, dozens of floodlights, a wonderfully effective make-believe alien spacecraft, film, computer graphics, and the massive four-hundred-thousand-watt sound system, Unuson took everybody



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on a little trip—to the Univus Festival in the rings of Saturn. Amusing, interesting, silly, spectacular, mind-blowing, ridiculous, and ideological all describe this Spielberg-like, de Mille-like extravaganza that also preceded Van Halen's performance the following night.

In a nutshell, a fictional alien having trouble finding his way home after the Univus Festival (where all the peoples of the universe get together and party) stops by our pathetic little US Festival and injects the crowd with a heavy dose of one-world, one-people, no-nations ideology. Eventually the show got bizarrely mystical, though few people seemed to mind.

Sunday, May 29, heavy-metal-music day, was alternately a disaster and a success. Both concertgoers and festival officials were tense because of the increased crowds (over two hundred thousand, though estimates vary wildly) and reports of sporadic violence. The positive atmosphere of the previous day became leaden, heavy with apprehension.

The heavy-metal day was about as crass a commercial move as Unuson could have made. None of the hedonistic bands that played Sunday cared much about the US Festival philosophies of peace, working together, and uniting the peoples of the world. All they cared about was money—and who could blame them when Unuson paid such outrageous fees to sign them?

The final day of the Memorial Day-weekend rock fest brought back some of the optimistic feeling of the first day, but it had its problems too. The show got off to a slow start and kept falling farther behind schedule as the day wore on.

By the time Stevie Nicks ended her set around 9:00 p.m., there were hundreds of small fires burning in the three-quarters-packed amphitheater. To keep warm, concertgoers (many of whom had been there for ten hours or more in bathing suits) burned garbage by the armload. The local fire department was present and not pleased but did not interfere except in the most extreme cases. Overall, it was a wonderfully communal scene.

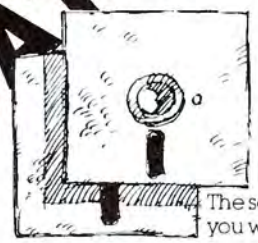
When David Bowie finally finished his set, it was close to 1:00 a.m. Tuesday. This was not good planning. In fact, many aspects of the 1983 US Festival seemed to be grossly miscalculated by Unuson. The organization initially projected an attendance of 1.2 million for the entire four days. They could barely handle the four hundred thousand that did show.

Unuson's marathon concert philosophy (six or more groups on one day) tired even the hardiest of festivalgoers. Even the Saturday, June 4, country music day didn't finish till after 1:00 a.m. Had the weather been warmer, the late nights wouldn't have seemed so bad.

But Wozniak took a chance with the weather, with the bands (most of which he

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US Festival

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was not familiar with), and with the crowds. Unless the painstakingly acquired video rights to the festival pay off, Wozniak stands to lose another few million (he lost several million on last year's festival).

Was it worth it? Woz says yes and that he's thinking about doing another festival in 1984, if he can get other backers besides himself. How they'll make it commercially successful remains to be seen, but Unuson learned some hard lessons this time around.

Was it worth it? Yes. The US Festival was a different world, a magical oasis in the desert. Once you've experienced it—lived and camped for three days with thousands of total strangers—you'll never be quite the same. Coming back to the real world is reassuring, but ultimately a letdown. People nowadays tend to stay locked in their dwellings, isolated, scared to confront their fellow beings.

Woz did what he could to show us there is an alternative. Thanks, Woz.

And thanks to the hundreds of festival security and staff members—even those who made a practice of knowing little and revealing nothing. Special kudos is due to the wandering concessionaires, who brought cool drinks to the parched crowds. It was a long four days and nights, but it worked. DH

Has Sixteen-Bit Software Taken the Lead?

COMDEX Marches through Atlanta To the Beat of the Dealer's Drum

Microsoft, VisiCorp, and Digital Research were nowhere to be found at the Spring '83 COMDEX, held in Atlanta last April, yet most trade-show visitors this year weren't disappointed.

COMDEX is a trade show for any and all microcomputers. Where Apple and S-100 machines dominated in the past, the trend seems very strong toward more powerful sixteen-bit machines, particularly the IBM pc and its unrelated cousins.

Far more new products were introduced for the IBM pc than for the Apple or any other computer. In the past, software for the IBM pc consisted of worked-over eight-bit programs, hastily converted to run on the pc. That trend is changing, with new sixteen-bit products appearing; some haven't a chance of running on a stock Apple, but that will change if some manufacturer introduces a board to convert an Apple II into an IBM pc. Don't laugh; Quadram's already done the reverse.

Quadram's Quadlink turns an IBM pc into a 48K Apple using the disk drives, display, printers, and so on indigenous to the pc. The display and disk drives are attached directly to Quadlink, with cables running from there to the pc, allowing Quadram to control these devices for complete Apple compatibility.

Quarterdeck introduced *DesQ* which, like Lisa's environment and *VisiOn*, builds overlapping windows on the screen and allows information to be transferred between different programs by cut-and-paste operations, but with a twist—*DesQ* works with almost any commercial software that runs on an IBM pc. But, this next-generation software still requires at least 256K of RAM and a hard disk.

Portable computers are becoming very popular and were much in evidence at COMDEX. Unfortunately, most so-called portable computers are too heavy to be truly portable. More accurately, they're transportable.

Both Tandy and Gavilan Computer Corporation introduced "lap" computers at NCC. The Gavilan is the more impressive of the two (and the more expensive), being a full-power computer, complete with sixty-six-character-by-eight-line liquid crystal display, three-inch microfloppy, and an AC adapter—the whole package weighs in at just nine pounds. You can soon expect larger screens and Apple and IBM pc compatibility in a lap computer.

The voice-input fad seems to have hit hardware and software companies the way the Hula-Hoop hit teenagers more than a decade ago. Witness Tecmar's voice-recognition card (for the IBM pc), which SuperSoft demonstrated with its *VoiceDrive* software and *ScratchPad*, its spreadsheet program.

What's next? The personal publishing house, that's what. Diser, Inc., demonstrated Lilith, the Modula computer. This computer was developed by Professor Niklaus Wirth, father of Pascal and the highly touted next-generation language Modula-2. At about thirty thousand dollars, with a laser printer, the Modula computer is not exactly a small-business machine. It's a small publishing house. The editor is a true what-you-see-is-what-you-get editor, complete with varied type styles and sizes, while the output from the laser printer is almost equal in quality to that of professionally printed books.

The language Modula-2 will also have an impact on software development as Modula-2 compilers become available for most popular computers. JS



Programmer Pleads Guilty to $17,000 In Computer Thefts

While working as a programmer/analyst with the state of Washington's Division of Vocational Rehabilitation, Stanley V. Slyngstad of Olympia, Washington, was arrested on the job March 11, 1983. For ten months prior to his arrest, Slyngstad had diverted funds set aside to train the handicapped for new careers, mostly into his own pocket. Between April 1982 and last February, Slyngstad used a special program to issue twenty-five unauthorized checks.

The discovery of Slyngstad's crimes occurred by accident. An accountant routinely examining one of the DVR's "remittance advices," which provide a record of all the agency's check authorizations, noticed that the address on the document was the same as Slyngstad's.

The twenty-five checks amounted to $16,923. Twenty-two of them were made out directly to Slyngstad and mailed to his home address. He gave one of the three remaining checks to a drinking buddy, who used the money to make a down payment on a pickup truck. A number of publications picked up the story as a "Robin Hood and his Merry Computer"-type situation. But Leslie F. James, director of the Division of Vocational Rehabilitation, sees it differently.

It's James's opinion that Slyngstad spent most of the money on himself. Slyngstad spent a good deal of his spare time at a local tavern, Charlie's, where he sometimes left $100 tips. There, in James's mind at least, lies the source of the problem. He insists, "I don't think any of this would have happened if Stan hadn't started drinking."

The question now is not so much why it happened as how and, more important, how to prevent it from happening again. James is trying to keep an open mind, saying that it's important not to become suspicious of computer programmers as a whole because of this one case. But he remains skeptical. "I don't think it is combatable. Anyone who knows your system well enough to make it work for you knows it well enough to steal from you."

Slyngstad, who had worked at the Division of Vocational Rehabilitation since 1978 and who was highly regarded there, has been ordered to keep away from state computer terminals pending sentencing. As a result of the seventeen-thousand-dollar theft (he pleaded guilty to first-degree theft last April in Thurston County Superior Court), Slyngstad has lost his $30,000-a-year job and faces up to ten years in prison. MS

Computers Help East Coast Firm Bridge The Language Gap

There is often a tendency in our country to expect everyone and everything foreign—from imported products to visiting journalists and tourists—to cater to our linguistic limitations.

The United States, however, often fails to extend the same courtesy, says Hani Khouri, president of Language Management Corporation of Monmouth Beach, New Jersey.

Khouri, the son of a United Nations translator, decided to do something to meet the need for a better means of translating English text into other languages. Then the question became which languages would take priority and what would be the process. Khouri—who speaks English, Arabic, Spanish, French, and Portuguese—decided, "Let's stick with one language and do it perfectly before we move on to another."

So when LMC opened its doors almost two years ago the company focused on English-to-Arabic computer-aided translation, coining the term *Arabization.*

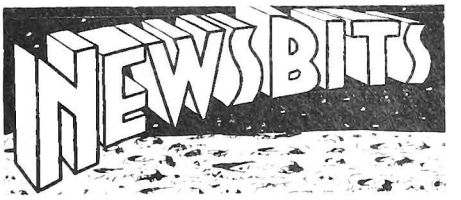
Khouri says Arabic was the logical language choice. Even though there are one hundred thirty million Arabic-speaking people in the world, it is a market often overlooked, he says. Also, many large American corporations already transact a lot of business in Arabic-speaking countries—these interactions demand speedy translation of significant amounts of paperwork.

As of January 1, Arabic became an official language at the U.N., which means that everything in the archives must now be translated into Arabic. Currently, a crack U.N. translator can cover a little more than two thousand words a day manually. LMC's Arabization, done on a Digital Equipment Corporation minicomputer, is capable of translating about eight thousand words in a twenty-hour period.

At LMC, English text is entered into the computer via magnetic tape or optical scanner, or it's keyed in from written documents. Once text has been entered into the system, a vocabulary search begins. If a word or idiom is not included in the four hundred thousand-word Arabic dictionary/database, its equivalent is looked for manually in published sources.

Next an Arabic linguist and the appropriate editor, depending on the subject matter, decide on the correct Arabic meaning before the word or phrase is added to the system's dictionary.

The program is so well designed, says Khouri, that it can choose words based on a concept. Dialect, degree of formality, cultural appropriateness, and educational level are also taken into account. LMC relies on a team of subject matter consultants (who specialize in English) and language researchers fluent in both English and Arabic. MS



☐ **Motor City Graphics.** SIGGRAPH '83—this year's version of the computer industry's annual graphics rodeo—will be held in Detroit July 25–29. Sponsored by the Association for Computing Machinery's Special Interest Group on Computer Graphics in cooperation with the Engineering Society of Detroit, the IEEE Technical Committee on Computer Graphics, and Eurographics, SIGGRAPH traditionally attracts artists and graphic designers from all over the world. In recent years, the number of artists doing innovative work on microcomputers has made microcomputer artwork an important part of the show. SIGGRAPH is also a good place to see what the state-of-the-art mainframe graphics companies are up to. For information, contact the SIGGRAPH '83 conference office in Chicago, Illinois.

☐ **Is Software's Number Up?** The American National Bureau of Standards has appointed a subcommittee to design a standard numbering system for computer software. The ANBS, which is currently responsible for the assignment of the International Standard Book Numbers (ISBN) found on almost every publication, wants to extend the advantages of the ISBN method to computer software. The development of a standard numbering system for software presents some challenging problems. For example, unlike a book, a software product may have more than one publisher. The ANBS subcommittee is charged with designing a standard numbering system that can uniquely identify each variable in a program's profile, including make and model of hardware that the software will run on, minimum hardware configuration, and publishing history.

☐ **An ID Card with Teeth.** The U.S. Army has begun testing an identification card with a mind of its own. The Smart Card, which resembles a credit card, has an embedded microprocessor that stores information and can interact with a central computer system. If deemed successful by Army testers, Smart Cards will replace the traditional laminated paper identification cards now used by all armed-forces personnel. The new cards carry a photo in the upper right-hand corner and a special ID number that includes the bearer's Social Security number. Information such as name, rank, branch of service, blood type, privileges, and medical data is also embossed on the cards, as well as being stored in the microprocessor. Plans call for installing special "readers" in many locations, tied into a central database. According to Navy Captain John Butterfield, initial reaction from servicemen and dependents involved in the testing has been positive. Butterfield adds that there has been interest in encoding more in-

formation on the cards, such as equipment-issue status, additional medical data, and financial information. The Smart Cards, developed to work in conjunction with France's ambitious Electronic Directory videotex project, are being supplied by France-based Phillips Data Systems.

☐ **Atari Makes a Move.** Atari has made the big move into software for personal computers other than its own. The wholly owned subsidiary of Warner Communications recently announced its intentions to market computer games and educational programs for Apple, Commodore, Tandy, IBM, and Texas Instruments computers. Fred Simon, former vice president of Walt Disney Productions, has been appointed vice president of marketing for the new division handling the project.

☐ **The Radio Strikes Back.** Nobody was more skeptical than radio-talk-show host A. J. Austin of WAVI radio in Dayton, Ohio, when the station started an experimental half-hour talk feature on computers. Even though he had owned an Apple himself for over a year, Austin wasn't sure that people would take to a radio show on the subject. Since then his eyes have been opened. On June 4, *Computer Talk*, which has expanded from a half hour to two hours every Saturday morning, celebrated its first birthday. Members of local user groups were featured on the show that day, and prizes and software were given out by Austin. Each week, *Computer Talk* features a computer news report, in-studio and telephone interviews with important industry figures, a new products segment, user-group meetings report, software and hardware reviews, and an open phone forum. Even though *Computer Talk* covers a number of different brands of computers (Apple, TRS-80, Atari, TI, Commodore, and Timex/Sinclair) it has earned a loyal listening audience. This is partly a result of the exchanging of information and the relating of experiences between owners of diverse kinds of machines on the air. Austin, who is just getting into *Wizardry*, would like to spend more time on *Computer Talk*, but his regular hosting chores prevent it. For the moment, *Computer Talk* will remain a two-hour program Saturday mornings.

☐ **Not a Real Conference, but an Incredible Simulation.** The 1983 Summer Computer Simulation Conference (SCSC) will be held July 11–13 at the Hyatt Regency in Vancouver, B.C., Canada. Sponsored by the Society for Computer Simulation, SCSC will feature over forty sessions, with original papers covering the field of computer simulation. Five special presentations—including Robotics and Simulation, Discrete Simulation, and Design of Direct Execution Language for Interactive Simulation—and several state-of-the-art presentations by experts on subjects such as supercomputers and simulation languages are the main courses offered at this three-day simulation feast. The Society for Computer Simulation is a La Jolla, California-based technical group dedicated to the advancement of simulation and allied computer arts in science, engineering, mathematics, education, government, and medicine.

☐ **Chips in Heat.** Physicists at the National Aeronautics and Space Administration's Lewis Research Center in Cleveland, Ohio, have come one step closer to realizing the dream of "hot chips." The reason electronic chips have hitherto been impossible to implant in high-temperature environments like jet engines is that the fragile integrated circuits are dependent on microscopic electronic webs that are destroyed by temperatures above 600 degrees Fahrenheit. Most chips found in computers are silicon, doped with traces of other elements like boron. Back in the fifties, researchers decided that a silicon-carbide-based chip would be able to endure temperatures as high as 1,600 degrees Fahrenheit. Because of the different crystal structures of silicon and silicon carbide, the task of building a crystalline silicon-carbide layer on a silicon base has dragged on for more than two decades. Two years ago, physicists at Lewis proposed to lay down a thin layer of irregular silicon carbide crystals to act as a bridge between the two different crystal structures. Now the same researchers have used silicon carbide produced in this fashion to build diodes and other electronic devices. NASA wants to use hot chips inside experimental turbine engines for monitoring and controlling. Other applications would surely follow.

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☐ **Universal Games.** MCA Video Games, the video game licensing arm of MCA Inc., has joined forces with Atari to form Studio Games. Last year, MCA Video Games worked with Atari on the home video game of the film *E.T.* and the new joint venture should facilitate further projects of this nature. Under the terms of the agreement, Studio Games will create coin-operated video games, home video games, and software based upon motion pictures, television, and other properties developed and proposed by MCA. Studio Games will have headquarters in Sunnyvale and will operate an office in Universal City, California. Executives from Atari and MCA Video Games will manage the joint venture.

☐ **Looking for Future Rookie Sensations.** The fortunes of the San Francisco Giants ought to be a little brighter this year. No, they didn't make any big trades or pay megabucks for some aging superstar. The Giants are expecting big things from their new microcomputer-based scouting system. Using a Fortune 32:16, 68000-based, Unix-equipped, general-purpose business computer and a scouting program designed by United Data Corporation, the team's management can now retrieve every scouting report and analysis ever made on a given player from the system's sophisticated database. Each entry on a player includes vital statistics in addition to the subjective evaluation of playing abilities supplied by scouts. Information is fed into the system continually from several different terminals and, at present, the system can maintain five thousand entries, a capacity that eventually will be tripled.

☐ **A Penney for Your Videotex Thoughts.** J.C. Penney may be getting into the videotex business. You may never have to go stumbling through the shoe department again. The surprise announcement that J.C. Penney plans to acquire First Bank System's videotex system, FirstHand, coincided with the temporary shutting down of FirstHand, which was being used on an experimental basis by more than two hundred fifty farmers in North Dakota. First Bank System, based in Minneapolis, commissioned the development of FirstHand. French Teletel videotex technology (France is a world leader in advancing videotex technology) was brought in for the project. When FirstHand comes back on-line it will depend heavily on banking and will be tied into banking institutions. So far, it seems, emphasizing practical applications is the only route to ensuring a commercially successful videotex system. ■

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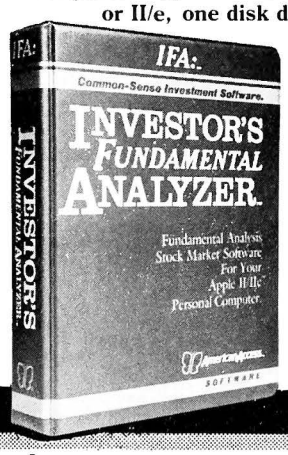
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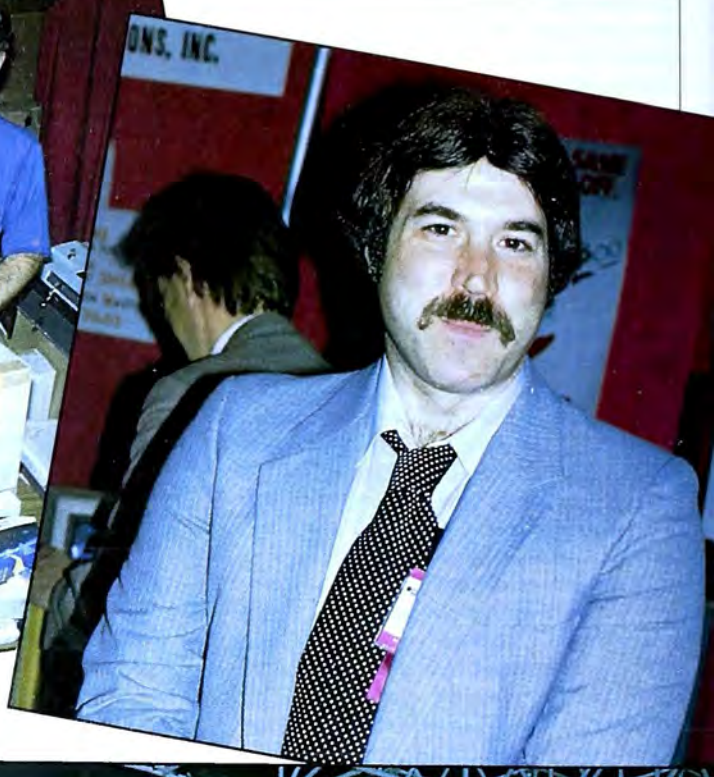
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The Boston Applefest, held May 13–15, took place at a new site this year. Other than a new location—the new Bayside Exposition Center to the south of downtown Boston—there was little that made this year's Boston Applefest different from the last two.

Significant, though, was the absence of most of the big West Coast Apple software houses—Broderbund, Sirius, Sierra On-Line, Datamost, VisiCorp. The diversification by these companies into other kinds of personal computers puts a show like the Boston Applefest low on their list of priorities.

The size of the show—about the same as last year's—depended on a whole new crop of small companies that took up the slack left by the missing West Coast heavyweights.

Generally, Boston Applefest attendees are a pretty sharp crowd; more veteran users made the rounds this year.

Tutorials, advanced user workshops, product spotlights, applications workshops, and open forums were featured, most of them well attended.

Not much in the way of new software from major publishers appeared at the show. There were a few new hardware products. The only robot company to exhibit was Colne Robotics, with its Armdroid I tabletop robot arm, though at least one other robot—RB Robot's R2-D2-like RB5X—graced a local distributor's booth.

This year the Boston Applefest was a good regional show, but its stature as a national show may be slipping. With the industry still heavily concentrated on the West Coast, this fall's San Francisco Applefest is being anticipated as much as the Boston affairs have been in the past. ■



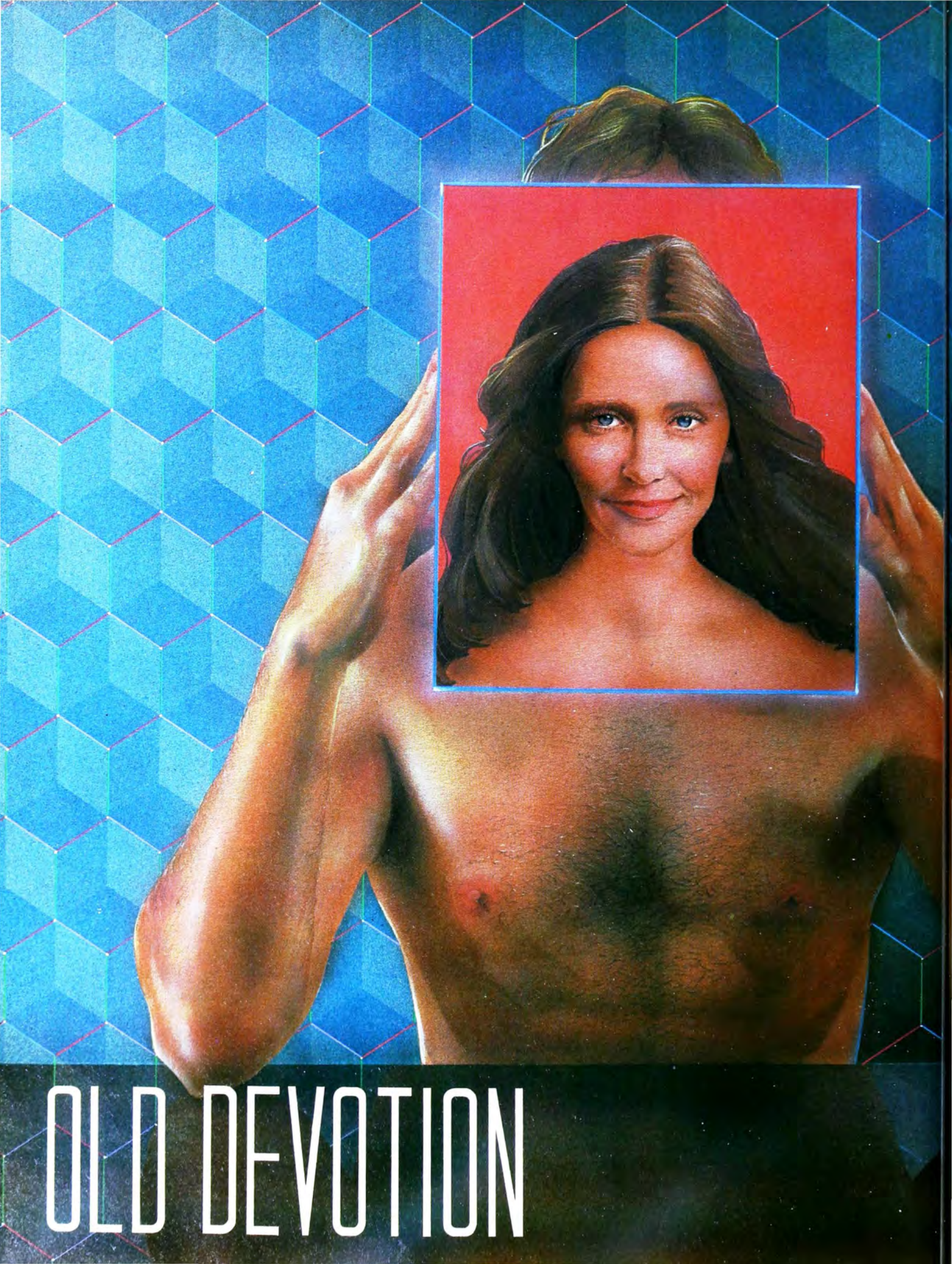




THE BOSTON APPLEFEST

The Third Time Around

Opposite page, top row. Left, discount stores, such as the one pictured, drew large crowds to their booths at the Boston Applefest. Right, Gary Haffer, president of Software Technology for Computers—one of the few West Coasters who made it to the show. Bottom row: Left, Jane Hartley, cofounder of Hartley Courseware (formerly Hartley Software), demonstrated her company's educational software. Right, Apple demonstrated Lisa to the milling crowds. This page, top row. Left, science-fiction author and text adventure programmer Michael "Suspended" Berlyn of Infocom. Right, Apple cofounder Steve Wozniak held a special seminar where he spoke candidly about the history of Apple Computer and the "hacker mentality." Above, Trish Glenn of Penguin Software typified the relaxed atmosphere of this Boston Applefest—she didn't even complain of sore feet.


OLD DEVOTION

S·T·O·R·Y·T·A·L·K F·I·C·T·I·O·N

MICHAEL BERLYN

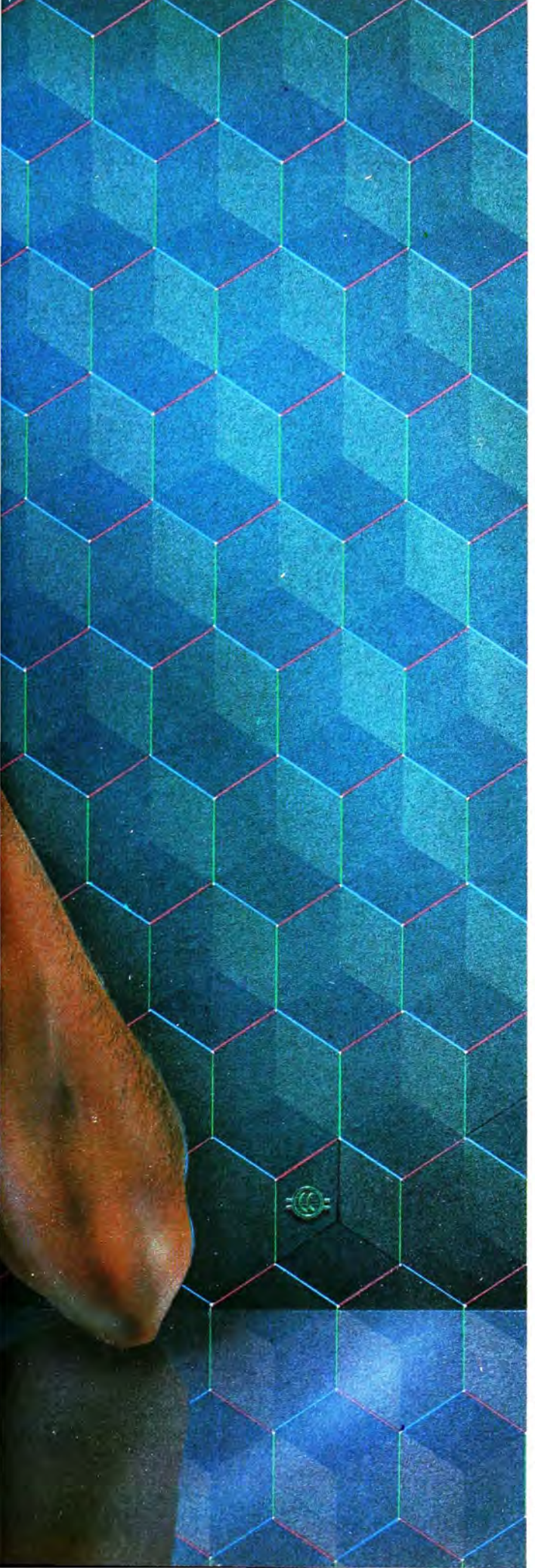


Illustration by Craig Calsbeek

"I'll watch for sharks, old man," Rapp said from over his shoulder, then laughed cruelly.

The gentle waves fizzed and bubbled as they licked the old man's feet, flowing over the metal footrests of the wheelchair. With each wave the sandy base gave way a little more, sinking the rubber-rimmed wheels another sixteenth of an inch. As the waves receded they deposited grains of sand and bits of seaweed between his toes, trapping them in the cracks, making him scowl.

The old man knew that Rapp couldn't leave him at the water's edge much longer. Rapp was responsible for him and wouldn't just abandon him to the ocean. That would be murder.

He sat and watched, licking his dry lips and tasting the brine, waiting, always waiting, staring out over the quiescent ocean.

A distant rumble, an echoing explosion far off on the horizon, caused the old man to sit up straight in the leather-slung seat. A smile crept over his cracking lips, lit his yellowing eyes with hope. He recognized the sound, had heard it many times through his childhood, a sound he would never forget. A shuttle was bursting through the atmosphere, on its way back from the station in orbit. He could tell it was Janice who piloted the ship by the way the sound rolled and rolled through the air, by the way it lingered in his ears, by the way his heart leaped to life in his fragile chest.

His gnarled hands gripped the padded armrests of the wheelchair, fingernails making deep impressions in the vinyl as he mustered his strength. He tried to stand. Janice would want that, would expect that when she landed the shuttle nearby. It wouldn't do for her to see him sitting there like a feeble old man. He knew he would need help getting aboard the shuttle, but he would manage, aided by the crew, unhindered by Rapp.

"Going somewhere?" Rapp asked.

"Yes," the old man said. His voice was a pitiful mockery of human speech, aided by a small metal box surgically implanted in his throat. "The ship—it's coming. I just heard it."

Rapp laughed long and hard. "Be serious, old man. That was thunder."

Thunder? It couldn't have been thunder. He turned his head, fighting the stiff pain that spasmed down his back, and caught sight of Rapp's evil, grinning expression. Rapp looked hard and cynical, an impression intensified by his round, boyish face.

"Stop it," the old man croaked, his breath scraping against his windpipe. "I don't pay you to laugh at me."

"Pay me?" roared Rapp. He laughed again, harder, wiping his eyes with balled-up fists. "You don't pay me." He slowly regained control of himself. "Take another look out there."

The old man was still fighting for breath as he turned back to the smooth ocean. Dark clouds, rolling thunderheads, lined the horizon, flashes of lightning leaping from one to another, lighting them from the inside. Peals of thunder reached his ears. The old man swallowed with difficulty, felt his hope and heart sink lower than the wheels of the chair. The clouds hadn't been there a moment before, hadn't been there before he'd turned away to talk to Rapp.

"No," the old man said. "I don't believe it."

"Believe it, old man. No one is coming for you. Do you understand that? No one. No one cares."

The old man lowered his gaze and watched the constant ebb and flow of the water, his fingernails still digging into the armrests. He knew Rapp was lying to him. Someone did care. She would be coming to take him away with her, back to space, to where he belonged. She always did, and she always would.

Janice, he thought. If only I could remember more than just your name.

The first thing he saw when he opened his eyes was the ceiling. It was

cracked and water-stained; little chips of paint peeled and flaked off, exposing spots of concrete. He blinked a few times, thinking for a moment, trying to remember, to place the ceiling in his memory, and failed. He sat up, then looked around in amazement as though he had an audience who could appreciate the fact that he'd accomplished that simple feat.

His bones no longer creaked, his muscles no longer cried out in tortured agony. When he tried to move his legs he found they cooperated, and his eyebrows rose as a joyous smile started to form.

My God, he thought. My body works.

I'm whole again.

He wanted to leap up from the bed and dance around the room, wave his arms around and spin a few times, try running and jumping and bending down to touch his toes. He wanted to find his clothes, run down the corridors and find Janice, embrace her and swing her around and around, and get them out of there.

He swung his legs over the edge of the bed and turned, facing a mirror mounted on a mint-green wall. He saw a face reflected there, a face easily twenty years younger than it should have been, and did not recognize it. He looked into the reflected eyes, stared into them, tried to learn something from their intensity, tried to make those eyes be his eyes; but they belonged to someone else. The face was that of a stranger. His own. He was still staring, trying to make the features in the glass coalesce into a whole, trying to make them trigger some buried memory, when the door opened.

He heard the latch click and spun around, expecting to see Janice standing there, smiling, motioning for him to come along. But all he saw was Rapp's grinning face.

Rapp walked directly to the bed with a firm, confident stride. He was powerfully compact, with broad shoulders and solid muscles barely hidden beneath his white clothes. As the old man watched Rapp's approach, he weighed the odds of overpowering the little man, of making a bolt for freedom, of finding Janice and getting out of there. The old man felt good, stronger than he'd felt yesterday, when he'd been on the beach waiting for the ship—the ship?—but he realized he was far from strong.

The ship?

The word hung in his mind, a word without image, a memory without emotion or a link to his past. It floated without anchors, a circuit with a broken connection, a half-thought.

"How are you feeling, Van Pelt?" Rapp asked.

Van Pelt. That was something—he now knew his name. Maybe Rapp didn't know what shape his memory was in, and, if he didn't, there was a chance of finding out what was going on. If he could manipulate Rapp, control the conversation, he might hear something that would trigger a memory.

"Better. Better than yesterday," Van Pelt said. He tried to show no surprise at the sound of his own voice, no longer mechanically assisted, clear and crisp like the waves at the beach.

"Yesterday?" Rapp paused for a moment, his face blank, then smiled as recognition and understanding showed in his eyes. "Ah, yes. Yesterday. Are you strong enough to walk?"

What was that supposed to mean, yesterday? Hadn't it been yesterday?

"Van Pelt?"

"What?"

"Are you strong enough to walk?"

"Yes, yes. I suppose so."

"Good." Rapp crossed the room to a door Van Pelt hadn't noticed and swung it open. It was a small closet. Two hangers were dangling on the crossbar: one was empty; the other held a robe. Van Pelt frowned as he tried to remember what other piece of clothing was supposed to be hanging there. He was sure that something should have been hanging in the closet beside the robe, but no images, no memories came.

Van Pelt stood on the tiled floor and slipped his arms through the robe's sleeves, held by Rapp. Rapp studied each movement with great interest, and, when Van Pelt had tied the sash, he seemed to sigh in relief.

"Ready?" Rapp asked.

Van Pelt nodded. "Where to?"

"You'll see."

Rapp grabbed his arm in a firm, unshakable grip and led him to the door. While standing there, waiting for the door's locking mechanism to open, Van Pelt glanced to his left, to a milky window lined with prison bars. The window was translucent and seemed to be lit from within its own interior. Van Pelt frowned, expecting to have seen the beach.

The door slid open and Rapp led him out into the hallway.

"That window," Van Pelt said. "I couldn't see through it."

Rapp nodded.

"Why? What's on the other side?"

"Nothing."

"What do you mean, nothing? Isn't it a window?"

"It's what you want it to be," Rapp said.

Van Pelt bit his lower lip, trying to control the anger he felt building within. Rapp was being so damned elusive, and there wasn't any cause for that. He decided to take a stand, as firm as his strength would allow. "I'm not moving until I get some answers."

"Fine. We can stand here if you like," Rapp said.

Van Pelt felt himself biting harder on his lip as his stomach tightened. "What about the beach, Rapp? Is that where you're taking me again? Back there?"

"The beach?" Rapp asked as if trying to recognize a word he'd never heard before. "No, I don't think so. Not today."

"Why not?"

Rapp sighed and glared into Van Pelt's eyes. "Look, you can walk, or you can talk "

"We could do both."

"No. Walk or talk. Walking is productive; your body could use the exercise. But talking at this stage would be counterproductive; it would exercise your mind."

Van Pelt felt a glimmer of understanding. He was being misled, deliberately confused. And with that realization came the conclusion that talking with Rapp would most likely confuse him more—nothing would be made clearer.

"We'll walk."

He figured there was a chance he might see something that would trigger a memory, or he might even find Janice. Perhaps they were being kept prisoner. If that were the case, scouting the area would prove beneficial if he tried an escape later. Unless, of course, she found him first.

The hallway curved upward in both directions, giving Van Pelt the feeling that he was in the middle of a hamster's wheel. Nothing around him looked familiar.

"Just one question before we walk, Rapp?"

"What?" Rapp asked, his impatience clear in his voice.

"Yesterday, when we were at the beach, why did you laugh at me? You're my nurse, aren't you? Don't I pay you?"

"It wasn't yesterday, you don't pay me, and there is no beach. The beach is a memory from your childhood, the place where you grew up. Now, let's move."

Van Pelt felt the sudden surge of adrenalin course through his body, the chill run up his spine, the tiny beads of cold sweat break out on his face. He licked his dry lips with a drier tongue. He swallowed with difficulty as his heart pounded against his ribs. Nothing made sense. Nothing was getting clearer. Rapp had to be misleading him. He was certain that was the case, now more than ever. There had to be a beach—he'd been there, with Rapp, waiting for Janice.

She would have the answers he craved. She always had them. She would be waiting at the end of the hallway, waiting to take him out of this insane place and back into space, back to where he belonged. She wouldn't let him down.

They started walking, Van Pelt with short, cautious strides, unsure his legs would continue to support him. Rapp didn't seem to mind and kept his own pace deliberately slow. After a few minutes, he felt himself grow tired and needed to lean against a wall for support. He stood there, catching his breath, waiting for the strength to return to his legs, looking up and down the curved hallway. Now, more than ever, he felt as if he were trapped in some huge wheel, walking but getting nowhere. The hallway either rotated as they walked, or they were defying gravity. And either alternative meant he had to be in space, and that couldn't be right. It simply couldn't. There were no beaches in space, and that was all there

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was to it.

As he turned to Rapp, face set and determined to find out just what was going on, Rapp held up his hand to stop the question.

"In there." Rapp motioned toward an open doorway.

Van Pelt thought for a moment, trying to decide what course to take, what the best possible solution to his confusion might be.

"In," Rapp said forcefully.

He walked through the doorway. As soon as he was inside the room, the door slid shut behind him. He immediately tried the door handle, but the door was locked.

All right, he told himself, stay calm. Don't panic. So there's no way out. So he tricked you into something. Sure, but what did he trick you into? Where the hell are you? What's going on?

Blind panic spread through him in a wave and he had to fight for control of his body. He wanted to smash his fists against the door, yell for Rapp, demand the answers he deserved, but he stood there, fists clenched at his sides, eyes leveled at the center of the door, until he felt he was back in control.

He turned away from the door as if that action might erase its presence. He glanced around the room quickly. It was identical to the one he'd just left except for two things: There was no window, and the walls were pale blue. The closet door was there, just as it had been in the other room, and he decided to check it out for a possible exit. He slid open the door and stood there motionless, transfixed by what he saw. There, on one of the hangers, was a one-piece jumpsuit. He recognized it and knew instantly that it belonged to him. And then another memory quickly followed, a more disturbing memory—he belonged to that jumpsuit. He stood there staring, waiting for the other memories to come flooding back, but nothing came. Perhaps if I see my reflection again, he thought.

He walked across to the small mirror and looked into his eyes, fascinated and yet horrified by the alien image reflected there. He leaned closer as if touching the glass might merge his reflection and himself into a whole person, a person with memories. He leaned closer yet, nose touching the glass, his breath fogging it, staring into those friendly but unknown eyes.

Nothing.

The door clicked open and he spun around, self-conscious and embarrassed by what he'd been doing. The half-formed image of a woman flashed in his mind. For a long moment Van Pelt thought it might be Janice, standing in the doorway, come to take him away.

He should have known better. Rapp entered the room carrying a tray. "Your food," Rapp said.

"I'm not hungry," Van Pelt lied. "Just leave the tray."

"I didn't ask if you wanted it, Van Pelt. You should listen more closely. I didn't offer it to you. You will eat this food, and eat it now."

From the way Rapp spoke, Van Pelt realized that he had to eat the food, or there would be dire consequences.

"What if I don't want to?" Van Pelt asked, challenging.

Van Pelt saw Rapp's grin and, in an instant, imagined rushing forward, knocking the little man over, stepping on his head, crushing his skull, making his way down the hall, opening all the doors he'd passed to try to find Janice.

Van Pelt moved a step closer, and Rapp's grin changed into a lurking smile.

"Sit down," Rapp said. "If you insist on giving me trouble, I'll sedate you and feed you intravenously."

Van Pelt took a ragged deep breath and felt the tension in his body. He sat on the edge of the bed. Rapp handed him the tray and stood there like a high priest waiting for a sacrifice to finish his last meal.

Van Pelt ate, shoveling the soy paste into his mouth, barely chewing, tasting nothing.

"Lie down."

"I'm not tired," Van Pelt said.

"Lie down."

Van Pelt felt like spitting in Rapp's face, but he didn't. He lay back in disgust.

"Close your eyes."

He closed his eyes and felt a pinprick on his arm.

And saw row after row of buttons and flashing lights. He was at the command center, the bridge of the *Paladin*, his hands flying over switches and dials, eyes glancing at the constantly changing computer graphics. He was wearing a one-piece jumpsuit, strapped into an acceleration couch.

He glanced to his right and saw the form of a woman, vague and hazy, as if they were separated by a thin mist. He couldn't make out what she looked like, but he knew immediately it was the woman he'd been waiting for. He was about to talk to her, ask her where she'd been, why she hadn't come to help him earlier, at the beach, when a warning light flared and pulsed, bathing the cabin in a burst of intense red light. A high-pitched wail came from a speaker somewhere behind his head.

The graphics showed the ship's course. After the jump out of Tau-space, they'd reentered real space too close to their target star, Tau Ceti, and were about to be captured in the star's gravitational field. He knew all this in a moment, but he didn't punch the button that would rectify the error. His hands poised above the button, shaking, sweat dripping down his forehead, stinging his eyes—

"Jeff!"

—face muscles slack, concentration slipping—

"Jeff!" this time accompanied by a stinging slap across his face, and then another, to no effect.

Van Pelt stared into nothing, his reflection in the glass meters and dials, the glowing, flashing panel of instruments beyond. He heard her shout bitter words of disappointment at him and he knew, then, that he'd had enough.

Enough!

She reached in front of him for the button and he smashed her face with the back of his hand, throwing his weight into the blow. She grabbed her head and groaned, and he saw her eyes for the first time, glowing with love, with hate, with fear, and he still could not remember more than her name. He unstrapped himself from the couch and leapt to his feet in one fluid motion, then beat her repeatedly until they were both on the deck, her face as bloody as his hands.

Enough!

His hands trembled uncontrollably and bile rose in his throat. He turned to the controls, grinning maniacally, watching the lights before him coalesce into a grand scheme, a magnificent pattern that mirrored the entropy of the universe. He stared for long, silent, unblinking moments, finding order in their random flashing.

At last he bent over and lifted the woman, cradled her in his arms. He knew he had done wrong, and realized that everything would be fine once he found someplace where they could hide. He would find a place that was warm, safe, and secure.

He left the control room—

—and saw Rapp.

"Good morning, Mr. Van Pelt," Rapp said.

He was back in the blue room, in bed. In his agony, his frustration and pain, he turned away from the little man. Rapp's continued cruelty was more than he could bear. He looked straight ahead. Into the mirror. The image made him gasp.

His hands rushed to his hair—thick blond hair with only a spot of gray at the temples. He sat up quickly and stared into the face of a man in his forties. His cheeks were fleshy, his eyes had pouches beneath them, his forehead was lined, but he was younger!

Younger?

"My God," Van Pelt said.

"You'll get used to yourself this way."

"But just a few minutes ago—"

"It wasn't a few minutes ago."

He took that news hard, his body freezing for a split second—heart stopped, breathing stopped, thoughts stopped as if he'd been dipped in liquid nitrogen. He moved and the shock dissolved, leaving him strong, powerful, and very impatient. He wouldn't let Rapp elude him this time. He would find out what he needed to know. He would have answers, or Rapp would be sorry. He'd tear out his lungs and ram them down his throat.

"When was it, then?" Van Pelt demanded.

Rapp remained silent.

"Answer me!"

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Rapp took a step back and Van Pelt saw his opportunity. He leaped to his feet, surging with newfound strength, raw animal power. Rapp was backpedaling, still smiling. Van Pelt never got close; as he took his first, hate-filled step toward Rapp, his strength disappeared. An empty shell, no longer capable of supporting itself, Van Pelt's body collapsed to the floor.

"Aggression, Mr. Van Pelt! Excellent! I'm glad to see you make such progress."

Rapp helped him into bed.

Row after row of flashing lights, dials, and meters sprang to life around him. He was at the command center of the *Paladin*, his hands slapping buttons, hitting switches, turning dials, eyes constantly glancing at the changing computer graphics. He was wearing a one-piece jumpsuit, strapped into an acceleration couch.

He glanced to his right and saw Rapp.

Rapp?

What was he doing here? Van Pelt was about to demand an explanation when a warning light flared, pulsing in time to the wailing siren by his ears.

They were in a dangerous position, about to be pulled too close to Tau Ceti, trapped in the star's gravitational field without enough fuel to power their way up. Van Pelt knew that and yet hesitated, hand poised over the button that would set everything right.

"A stupid mistake, Jeff," Rapp said, taunting him. "But there's time to fix it. You do want to fix it, don't you? Just press that button like a good boy."

"Press it yourself!"

"You dolt. You imbecile. What kind of captain are you? There's a crew on-board. This is an important mission! This ship alone is worth billions! Why don't you hit that button, son?"

Van Pelt would have rather hit Rapp's face, smashed his skull, and been done with it. He'd had enough of the little man's taunts and jeers, his telling him how to run his own ship. He was the captain.

The captain!

"What's the matter, little Jeffrey? Can't hit the button, little Jeffrey?"

The red light stayed on continually and the siren's wail knifed through his head.

"The button, son! Hit the button!" Rapp screamed.

But Van Pelt's hand, poised over the button, clenched into a fist. He ignored the threat of death the instruments told him was moments away, the lives of his crew, his responsibility to NASA 2. He rose from the acceleration couch and, with tears blurring his vision, swung wildly at Rapp—

—and found himself old, feeble, sitting in a wheelchair at the beach. He was totally drained, his mind numb, and he could do nothing more than stare at the ocean and pray it was really there. He noticed a firm, comforting hand on his shoulder and turned toward his right.

"Please, Rapp. I can't take much more. What's going on? Tell me?"

"We've locked onto the problem this time through," Rapp said.

"What?"

"The problem keeps sending you back here, to the beach where you grew up. You're seeking security instead of facing the problems we've presented."

He was suddenly in a different room—its sterile whiteness and gleaming stainless steel triggered a recognition, a memory of having been there before. He was naked, sitting in a large aquarium tank filled with gel. It slid down his chest in clinging sheets, stung his nostrils, tasted alkaline in his mouth and throat. He shifted his position and the thick oozing liquid gave off a medicinal smell.

Memories came back slowly at first, like water trickling through a crack in a dam, then burst in a rush of awareness as the dam gave way to the pressure.

He saw his reflection on the shimmering gel. His face and head were dotted with silvery disks. Even though the image was fragmented as it skipped and slid over the liquid surface, he recognized it at last. He was back in touch with himself, his personality, his past, and a present that might not be as pleasant as what he'd just experienced.

Perhaps I passed the tests, he thought. Maybe everything is okay.

He looked around the room expectantly.

At least he was alive. Alive and sane. After those tests, he felt he should be grateful for that. NASA 2 was not about to hand over the captaincy of its first faster-than-light starship to just anyone. The security checks he'd undergone just to get into its complex beneath the lunar surface had proven that to him.

Alive, he thought. Alive and sane. The fourth one to sit in this geltank, and the only one still to be in one piece at the end. He remembered the two who'd come out vegetables, and the one who hadn't come out breathing. He knew that NASA 2 had eleven years invested in building the *Paladin*, had more money invested than was conceivable, and wanted its choice for captain to be the right one.

He'd heard the psychologists warn him that the test had "teeth," that it was important that he fight for his life and his mind. They stressed the fact that they could not intervene once the scenarios had started. He was on his own.

He had been inside the geltank for days. The disks on his head linked him to the computer and provided the psychologists with the means to monitor his physical and mental states. He had slid beneath the surface, swallowing and breathing the gel that had sustained him through the tests.

They released chemicals into the gel molecule by molecule until his mind became blank. A few carefully modified hallucinogens to alter the serotonin level enabled them to create a new reality, a reality he believed in totally. The psychologists' computers chalked in the paths he would have to walk, the decisions he would have to make. Even with constant monitoring they couldn't stop the tests in time to save him; they were limited to creating situations and observing reactions. Intervention had to be after the fact.

"It's over," Van Pelt said, relieved to be breathing and thinking.

"So far," Rapp said. "We can stop here if you want."

Van Pelt turned his head to the right and saw the little man standing behind his shoulder. The chief psychologist smiled in sympathy.

"I take it, then, I didn't pass?"

Rapp shook his head. "I'm afraid not. Not this time through. But we managed to uncover the problem that was blocking you."

Van Pelt's eyebrows arched as he swallowed with difficulty. "Well?"

"Well, we really didn't spend much time aboard the *Paladin*. Your problem kept asserting itself, wedging its way into all the critical situations."

"The problem, Rapp?"

"It won't really help you to know what it is. If you want to try again, we'll make adjustments in the test programs to see what a direct confrontation will do. Sort of a conflict of interests, with you and NASA 2 winning. At least we hope so."

"The problem!"

"Your relationship with Janice."

My mother? Van Pelt thought. What the hell does she have to do with this? Give her half a chance and she'd insist on going with me—to make sure nothing happened to her precious son. Christ!

"Do you want to try again?" Rapp asked. "We're ready with the program changes."

Van Pelt knew he'd been lucky this past time through, that he might not be so lucky a second time. He could die moments after the test began, lungs filled with gel, number four on the list of candidates.

He tasted fear—real fear, alive and crawling up his throat, lacing his body with adrenalin.

"Don't worry, Jeff. You're doing better than the other three," Rapp said.

"Yeah, sure."

"Are you ready?"

"I'm ready," Van Pelt said instantly, without thought. He wished he'd meant it, believed it.

He silently slid beneath the surface of the gel; the computer link-up forced him to swallow and breathe, swallow and breathe. He waited for the chemical alterations to the gel, for his memories to disappear, for the situations to unfold.

Mother, he thought. How could you do this to me?



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Softalk Presents The Bestsellers

When Bert Kersey took the disk drive out of his ear and announced the end of his DOStalk column, it was a sad day for his avid readers. But it's becoming clearer by the month that Kersey needed the extra time to execute the new set of treats he had in store for all Apple owners. And those treats have been so successful that the hirsute representatives from Beagle Bros will soon be able to afford a shave.

Kersey's company has released approximately one new product a month recently, and each has taken off on its own as well as fueling sales of its antecedents. The mixture of light-hearted humor in his Tip Books and easy to understand and use programs on his disks appears to be a solid recipe.

In May, Beagle Bros placed five programs on the Top Thirty and captured places one through five in the Hobby 10. That's the strongest showing by any one company since Sierra On-Line was in its heyday, dominating the Adventure 5 and scoring with *Screen Writer II* and arcade games as well.

While Kersey certainly deserves the lion's share of the credit—after all, he's doing the lion's share of the work—Beagle Bros's current success can be marked to a number of authors who have found Kersey's approach of humor and simplicity copacetic to their own predilections.

First and foremost, at present, is Mark Simonsen, whose *Double-Take* has taken off. *Double-Take* is the highest ranking newcomer to the Top Thirty, scoring twelfth in its maiden appearance.

Not far behind is *DOS Boss*, that artful piece of whimsy and practicality that Kersey coauthored with Jack Cassidy. *DOS Boss* has been a bellwether of the company and was one of the first utility programs to tackle the shibboleth that useful programs had to be boring.

Trailing by only a couple of steps are *Pronto DOS* and *Apple Mechanic*. The former is written by Tom Weishaar, while Kersey soloed on the latter. Another Kersey solo effort, *Utility City*, was farther down the list. Kersey almost scored again with *Beagle Bag*, a set of entertainment programs that narrowly missed acing out *Zaxxon* for last place on the Arcade 10.

Zaxxon was the hottest thing in the market in the first part of June, bidding fair to overtake all comers in entertainment software. Datasoft's translation of the arcade favorite had been so eagerly anticipated that enough people plunked down their bread in advance to give *Zaxxon* status in the May poll, even though few, if any, units were actually available.

Zaxxon looks like it'll be *Miner 2049er*'s next serious contender. *Miner* finally put significant distance between itself and *Choplifter* to reign at present as the arcade king. Bill Budge's *Pinball Construction Set* moved to third in that relatively static list.

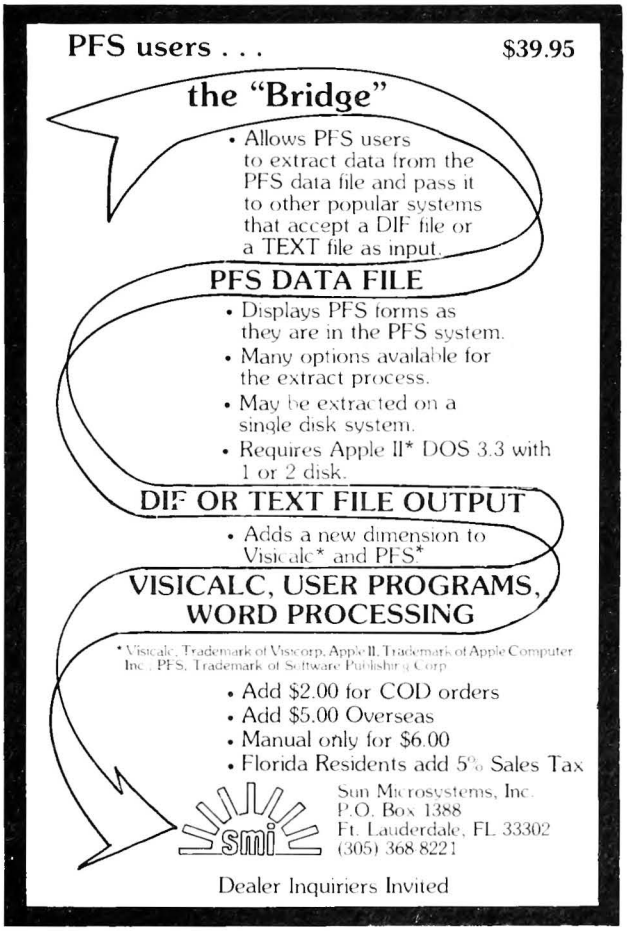
The most significant news applying to entertainment software was that May was the first month in the thirty-three months of the Top Thirty poll in which there was no game program in the top five. *Wizardry*'s sixth-place showing was the best among the games, with *Miner* ranking eighth.

Apple III

This Month	Last Month	
1.	1.	**VisiCalc: Advanced Version,** Software Arts/Dan Bricklin and Robert Frankston, VisiCorp
2.	2.	**Apple Writer III,** Paul Lutus, Apple Computer
3.	4.	**Quick File III,** Rupert Lissner, Apple Computer
4.	6.	**Word Juggler,** Tim Gill, Quark Engineering
5.	—	**VersaForm,** Joseph Landau, Applied Software Technology
6.	7.	**VisiCalc III,** Software Arts/Dan Bricklin and Robert Frankston, VisiCorp
7.	10.	**General Ledger,** George Shackelford, State of the Art
8.	8.	**Apple III Business Graphics,** Apple Computer
9.	3.	**PFS: File,** John Page and D. D. Roberts, Software Publishing Corporation
10.	—	**Mail List Manager,** Apple Computer
	9.	**The Catalyst,** Tim Gill, Quark Engineering

Arcade 10

This Month	Last Month	
1.	2.	**Miner 2049er,** Mike Livesay and Bill Hogue, Micro Fun
2.	1.	**Choplifter,** Dan Gorlin, Broderbund Software
3.	5.	**Pinball Construction Set,** Bill Budge, BudgeCo
4.	4.	**Aztec,** Paul Stephenson, Datamost
5.	3.	**Frogger,** Olaf Lubeck, Sierra On-Line
6.	6.	**The Arcade Machine,** Chris Jochumson and Doug Carlston, Broderbund Software
	9.	**A.E.,** Broderbund Software
8.	8.	**Super Taxman II,** Brian Fitzgerald, H.A.L. Labs
9.	7.	**Seafox,** Ed Hobbs, Broderbund Software
10.	—	**Zaxxon,** John Garcia and Jim Ratcliff, Datasoft



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Brøderbund Software

Discover the Difference

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Apparently the flood of new owners coming into the Apple market are less entertainment oriented than their predecessors.

Apple Writer IIe continues as the hottest software of them all. The upset was at second place, where *Home Accountant* unseated *VisiCalc*. *VisiCalc* has never been lower than fourth in the Top Thirty, and *Home Accountant* hasn't been out of the top ten since its introduction. But never before had Continental's finance program outsold the veteran spreadsheet program.

Another relative surprise was the showing of fourth-place *MasterType*. Bruce Zweig's typing instructor has been faring well for months, but May's strength is all out of proportion to previous results. It's one indication that a sizable number of newly bought Apples are being put to educational uses.

Other educational programs are doing exceptionally well also. *Typing Tutor* from Microsoft is sixteenth, and *Snooper Troops I* from Spinnaker is seventeenth. The bottom third of the list is almost solidly education, with *Facemaker* from Spinnaker, *Mix & Match* and *Ernie's Quiz* from Children's Television Workshop via Apple, *Early Games for Young Children* from Counterpoint Software, and *Apple Logo* from Logo Computer Systems via Apple.

The educational bent of the marketplace is also indicated by *Bank Street Writer*'s seventh-place showing. The word processor was designed

Word Processors 10

This Month	Last Month	
1.	1.	**Apple Writer IIe,** Paul Lutus, Apple Computer
2.	2.	**Bank Street Writer,** Gene Kuzmiak and the Bank Street College of Education, Broderbund Software
3.	3.	**Screen Writer II,** David Kidwell, Sierra On-Line
4.	5.	**Magic Window II,** Bill Depew, Artsci
5.	7.	**Word Handler,** Leonard Elekman, Silicon Valley Systems
6.	5.	**WordStar,** MicroPro
7.	9.	**PIE Writer,** Softwest, Hayden
8.	4.	**Super-Text Pro,** Ed Zaron, Muse
9.	8.	**Format-II,** Kensington Microware
—		**Apple Writer II Pre-Boot Disk,** Kevin Armstrong and Mark Borgerson, Videx

Home Education 10

This Month	Last Month	
1.	1.	**MasterType,** Bruce Zweig, Lightning Software
2.	2.	**Typing Tutor,** Image Producers, Microsoft
3.	6.	**Snooper Troops I,** Tom Snyder, Spinnaker Software
4.	—	**Facemaker,** DesignWare, Spinnaker Software
5.	5.	**Mix & Match,** Children's Television Workshop, Apple Computer
6.	7.	**Ernie's Quiz,** Children's Television Workshop, Apple Computer
7.	3.	**Early Games for Young Children,** John Paulson, Counterpoint Software
8.	4.	**Apple Logo,** Logo Computer Systems, Apple Computer
9.	—	**The Game Show,** Geoff Zawolkow, Pete Rowe, and Ted Perry, Computer Advanced Ideas
10.	—	**Delta Drawing,** Computer Access Corporation, Spinnaker Software



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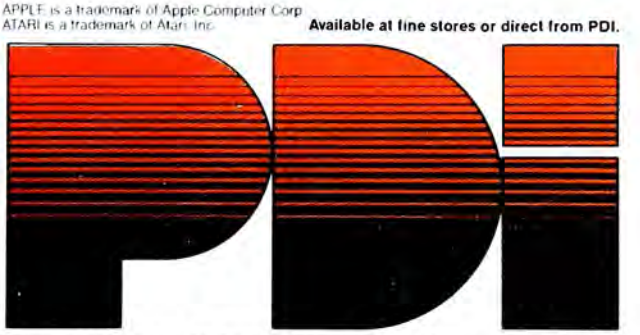
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for use by children at the Bank Street College of Education. In a market niche filled with viable and contentious competitors, *Bank Street Writer* is presently the clear second choice behind *Apple Writer IIe*. *Screen Writer* held a position on the Top Thirty and remained the third most popular word processor.

In a relatively flat sales month, the word processors began to find their sea legs after having been blitzed by *Apple Writer IIe*. Most showed sales jumps, with *WordStar* and *PIE Writer* making the most significant improvements.

Multiplan continues its strong challenge to *VisiCalc* among business programs, but yielded third place in the Business 10 to *Quick File IIe*, which is mounting its own strong bid to unseat *PFS: File*.

As the personal filing systems grow in strength, the database programs are taking it on the chin. *DB Master*'s sales are lower than any time since its introduction and it's being seriously challenged by *VisiFile*, which isn't near its peak strength either. Confusing the issue some is *The Incredible Jack*, which combines database and word processing functions in an integrated package.

The Home 10 underwent few changes. *Home Accountant* is still top dog by a wide margin. New to the list were *Z-Term* from Southwestern Data Systems, *Know Your Apple* from Muse, and *Family Roots*, a genealogy package from Quinsept.

Adventure 5

This Month	Last Month	
1.	2.	**Suspended,** Michael Berlyn, Infocom
2.	5.	**The Serpent's Star,** Michael Ormsby, Larry Franks, Chris Anson, Kristin Pearson-Franks, and Alan Clark, Ultrasoft
3.	4.	**Deadline,** Infocom
4.	3.	**Zork I,** Infocom
	1.	**The Mask of the Sun,** Chris Anson, Alan Clark, Larry Franks, and Margaret Anson, Ultrasoft

Strategy 5

This Month	Last Month	
1.	2.	**Castle Wolfenstein,** Silas Warner, Muse
2.	1.	**Flight Simulator,** Bruce Artwick, SubLogic
3.	—	**Rendezvous,** Wes Huntress, Edu-Ware Services
4.	—	**Cosmic Balance,** Paul Murray, Strategic Simulations
	3.	**Sargon II,** Dan and Kathe Spracklen, Hayden

Fantasy 5

This Month	Last Month	
1.	1.	**Wizardry,** Andrew Greenberg and Robert Woodhead, Sir-tech
2.	2.	**Ultima II,** Lord British, Sierra On-Line
3.	3.	**Knight of Diamonds,** Andrew Greenberg and Robert Woodhead, Sir-tech
4.	5.	**Ultima,** Lord British, California Pacific
5.	—	**The Missing Ring,** Terry Romine, Datamost

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Wizardry continues atop the Fantasy 5, but a new contender entered the list in fifth place: *The Missing Ring* from Datamost.

Castle Wolfenstein regained first place among strategy programs from *Flight Simulator*, but the surprise here was the strength of *Cosmic*

Business 10

This Month	Last Month	
1.	1.	**VisiCalc,** Software Arts/Dan Bricklin and Robert Frankston, VisiCorp
2.	2.	**PFS: File,** John Page and D. D. Roberts, Software Publishing Corporation
3.	4.	**Quick File IIe,** Rupert Lissner, Apple Computer
4.	3.	**Multiplan,** Microsoft
5.	5.	**PFS: Report,** John Page, Software Publishing Corporation
6.	8.	**PFS: Graph,** Bessie Chin and Stephen Hill, Software Publishing Corporation
7.	6.	**BPI General Ledger,** John Moss and Ken Debower, Apple Computer
8.	7.	**DB Master,** DB Master Associates, Stoneware
9.	—	**VisiFile,** Creative Computer Applications/Colin Jameson and Ben Herman, VisiCorp
10.	—	**The Incredible Jack,** Business Solutions

Hobby 10

This Month	Last Month	
1.	4.	**Double-Take,** Mark Simonsen, Beagle Bros
2.	9.	**DOS Boss,** Bert Kersey and Jack Cassidy, Beagle Bros
3.	5.	**Apple Mechanic,** Bert Kersey, Beagle Bros
	8.	**Pronto DOS,** Tom Weishaar, Beagle Bros
5.	2.	**Utility City,** Bert Kersey, Beagle Bros
6.	6.	**Bag of Tricks,** Don Worth and Pieter Lechner, Quality Software
7.	7.	**Apple Pascal,** Apple Computer
8.	3.	**Zoom Grafix,** Dav Holle, Phoenix Software
9.	9.	**The Complete Graphics System,** Mark Pelczarski, Penguin Software
10.	1.	**Graphics Magician,** Chris Jochumson, David Lubar, and Mark Pelczarski, Penguin Software

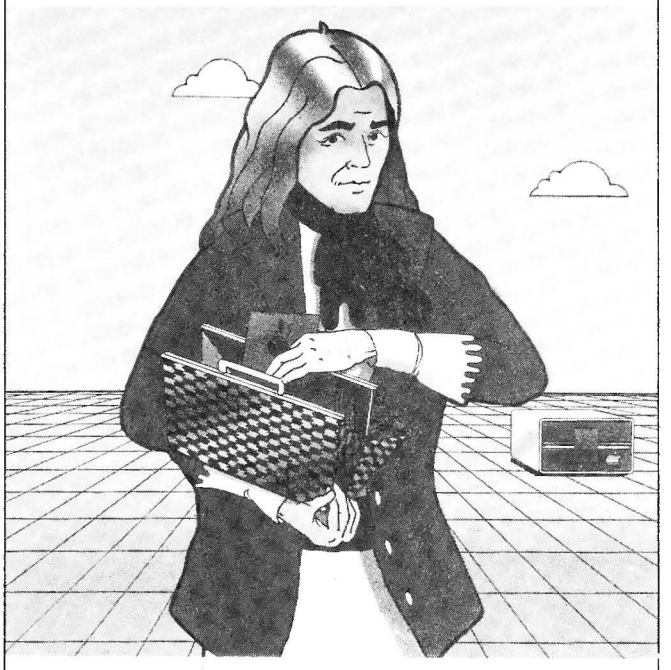
Home 10

This Month	Last Month	
1.	1.	**Home Accountant,** Bob Schoenburg, Larry Grodin, and Steve Pollack, Continental Software
2.	2.	**ASCII Express: The Professional,** Bill Blue and Mark Robbins, Southwestern Data Systems
3.	4.	**Data Capture 4.0,** George McClellan and David Hughes, Southeastern Software
4.	7.	**Personal Finance Manager,** Jeffrey Gold, Apple Computer
5.	9.	**Dow Jones Market Analyzer,** B. C. Burch, RTR Software
6.	3.	**Hayes Terminal Program,** Hayes Microcomputer Products
7.	5.	**Transend 1,** Tim Dygert and Bob Kniskern, SSM
8.	—	**Z-Term: The Professional,** Bill Blue, Southwestern Data Systems
9.	—	**Know Your Apple,** Muse
10.	—	**Family Roots,** Steve Vorenberg, Quinsept

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Softalk Presents The Bestsellers

Balance from Strategic Simulations. *Cosmic Balance* has been around awhile without scoring big, but May buyers took a real fancy to the program.

There was lots of shuffling of position but no changes of membership in the Adventure 5. *Suspended* took over first place, while former leader *The Mask of the Sun* dropped to a fourth-place tie. *The Serpent's Star* rose to second, with *Deadline* third and *Zork I* knotted with *Mask*.

Eight of the Home Education 10 programs made the Top Thirty, and the two that missed were fairly close. In ninth was *The Game Show* from Computer Advanced Ideas, while *Delta Drawing* from Spinnaker was tenth.

As reported earlier, Beagle Bros swept the Hobby 10 by storm. *Bag of Tricks*, *Apple Pascal*, *Zoom Grafix*, *The Complete Graphics System*, and *Graphics Magician* grabbed the bottom five rungs of the roster.

There were few revolutionary developments in Apple III software sales. *VersaForm* regained the list and *Mail List Manager* tied for tenth. *VisiCalc: Advanced Version* continues to ride high, although a fair number of Apple III buyers are opting for the regular *VisiCalc*. *Quick File III* jumped past *PFS: File*.

Dealers weren't exactly raving about the strength of software sales in May, with most reporting them flat to down. But you won't get any quibbles from Beagle Bros, where it seems to pay to mix fun with utility. ◼

Apple-franchised retail stores representing approximately 5.3 percent of all sales of Apple and Apple-related products volunteered to participate in the poll.

Respondents were contacted early in June to ascertain their sales for the month of May.

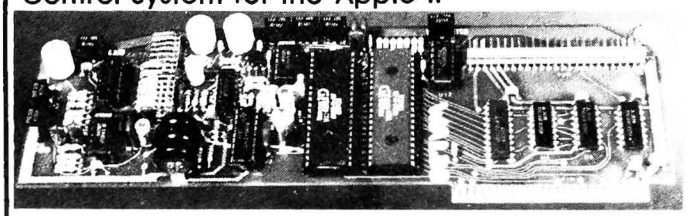
The only criterion for inclusion on the list was the number of units sold—such other criteria as quality of product, profitability to the computer store, and personal preference of the individual respondents were not considered.

Respondents in June represented every geographical area of the continental United States.

Results of the responses were tabulated using a formula that resulted in the index number to the left of the program name in the Top Thirty listing. The index number is an arbitrary measure of relative strength of the programs listed. Index numbers are correlative only to the month in which they are printed; readers cannot assume that an index rating of 50 in one month represents equivalent sales to an index number of 50 in another month.

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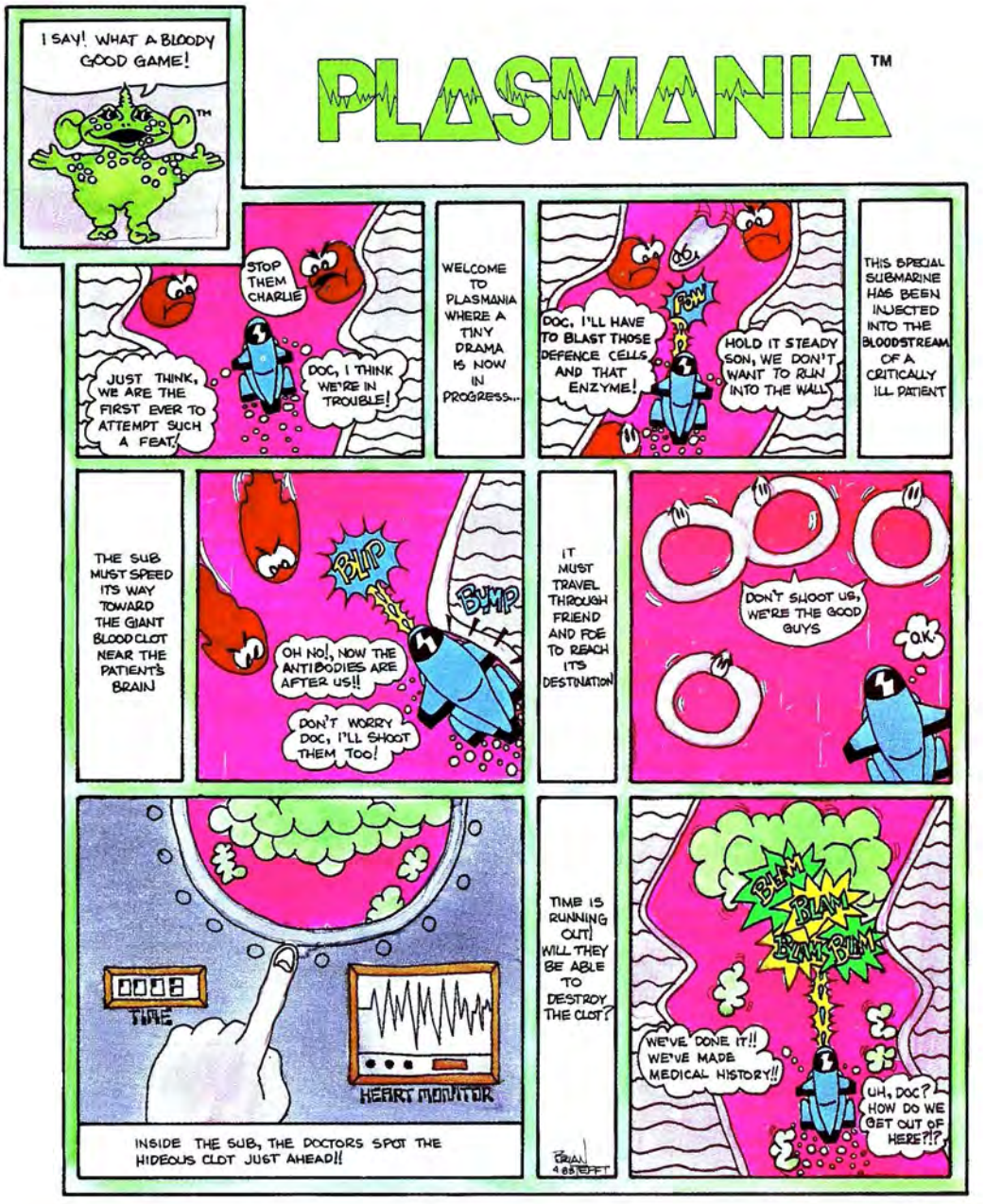
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The Top Thirty

This Month	Last Month	Index	
1.	1.	182.36	**Apple Writer IIe,** Paul Lutus, Apple Computer
2.	3.	98.65	**Home Accountant,** Bob Schoenburg, Larry Grodin, and Steve Pollack, Continental Software
3.	2.	83.21	**VisiCalc,** Software Arts/Dan Bricklin and Robert Frankston, VisiCorp
4.	10.	82.71	**MasterType,** Bruce Zweig, Lightning Software
5.	6.	77.23	**PFS: File,** John Page and D. D. Roberts, Software Publishing Corporation
6.	8.	69.26	**Wizardry,** Andrew Greenberg and Robert Woodhead, Sir-tech
7.	11.	67.26	**Bank Street Writer,** Gene Kuzmiak and the Bank Street College of Education, Broderbund Software
8.	5.	65.27	**Miner 2049er,** Mike Livesay and Bill Hogue, Micro Fun
9.	9.	57.30	**Quick File IIe,** Rupert Lissner, Apple Computer
10.	7.	53.31	**Multiplan,** Microsoft
11.	4.	43.35	**Choplifter,** Dan Gorlin, Broderbund Software
12.	—	33.88	**Double-Take,** Mark Simonsen, Beagle Bros
13.	20.	33.38	**Ultima II,** Lord British, Sierra On-Line
14.	18.	31.89	**PFS: Report,** John Page, Software Publishing Corporation
15.	—	28.90	**DOS Boss,** Bert Kersey and Jack Cassidy, Beagle Bros
16.	13.	24.91	**Typing Tutor,** Image Producers, Microsoft
17.	27.	23.92	**Snooper Troops I,** Tom Snyder, Spinnaker Software
18.	—	21.92	**Pronto DOS,** Tom Weishaar, Beagle Bros
	—	21.92	**Apple Mechanic,** Bert Kersey, Beagle Bros
20.	22.	20.93	**Pinball Construction Set,** Bill Budge, BudgeCo
21.	—	20.43	**Facemaker,** DesignWare, Spinnaker Software
	28.	20.43	**Suspended,** Michael Berlyn, Infocom
23.	26.	19.93	**Mix & Match,** Children's Television Workshop, Apple Computer
24.	—	19.43	**Knight of Diamonds,** Andrew Greenberg and Robert Woodhead, Sir-tech
25.	—	18.93	**Ernie's Quiz,** Children's Television Workshop, Apple Computer
26.	24.	17.94	**Early Games for Young Children,** John Paulson, Counterpoint Software
	—	17.94	**Utility City,** Bert Kersey, Beagle Bros
	15.	17.94	**Screen Writer II,** David Kidwell, Sierra On-Line
29.	—	17.44	**PFS: Graph,** Bessie Chin and Stephen Hill, Software Publishing Corporation
	15.	17.44	**Aztec,** Paul Stephenson, Datamost
	—	17.44	**Apple Logo,** Logo Computer Systems, Apple Computer

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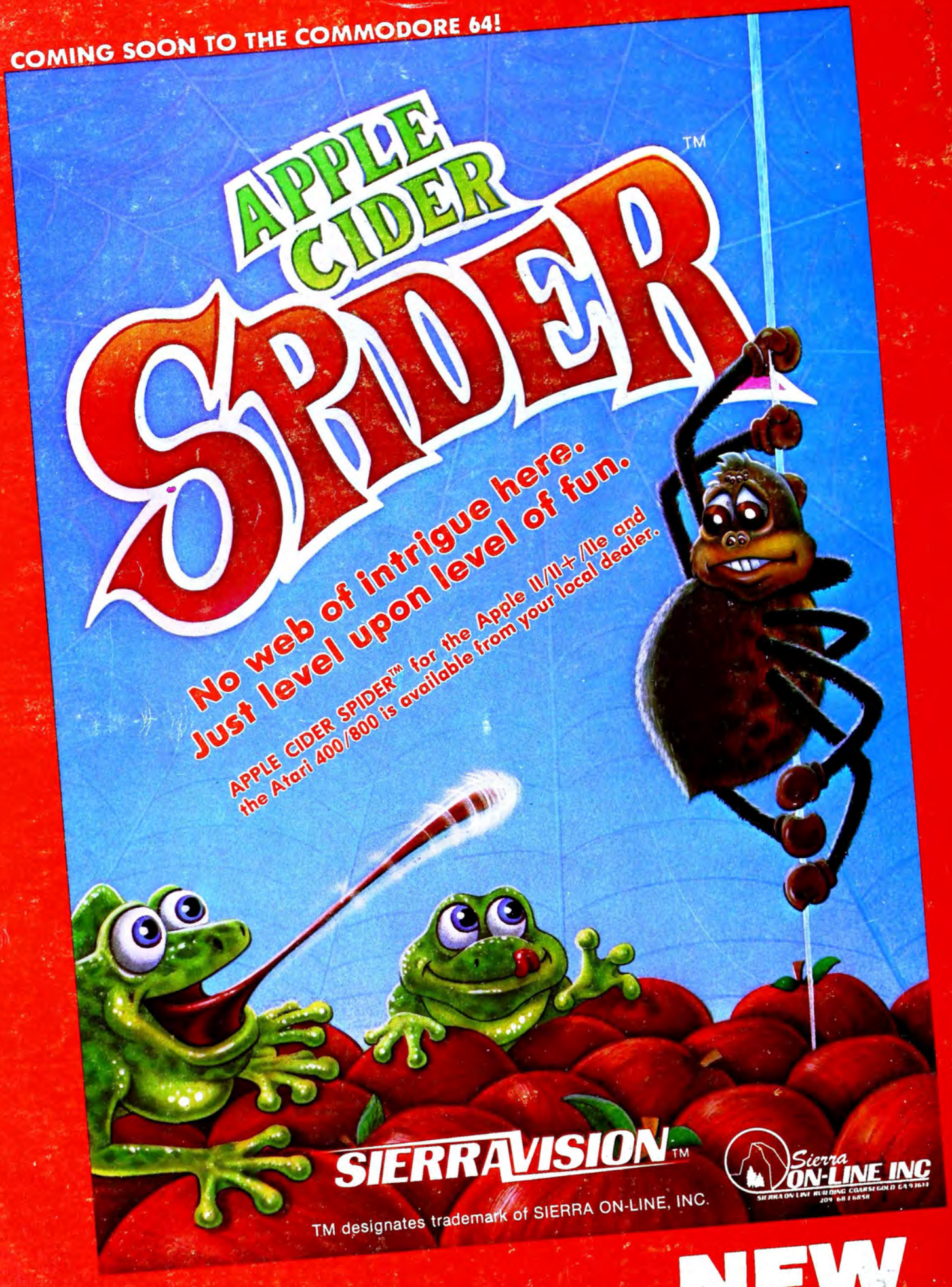
Apple II, II+, IIe Disk
VIC-20 Cartridge



Game design by David Lubar.
Apple version programmed by Lewis Geer.
VIC 20 version programmed by Erich Horn.
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