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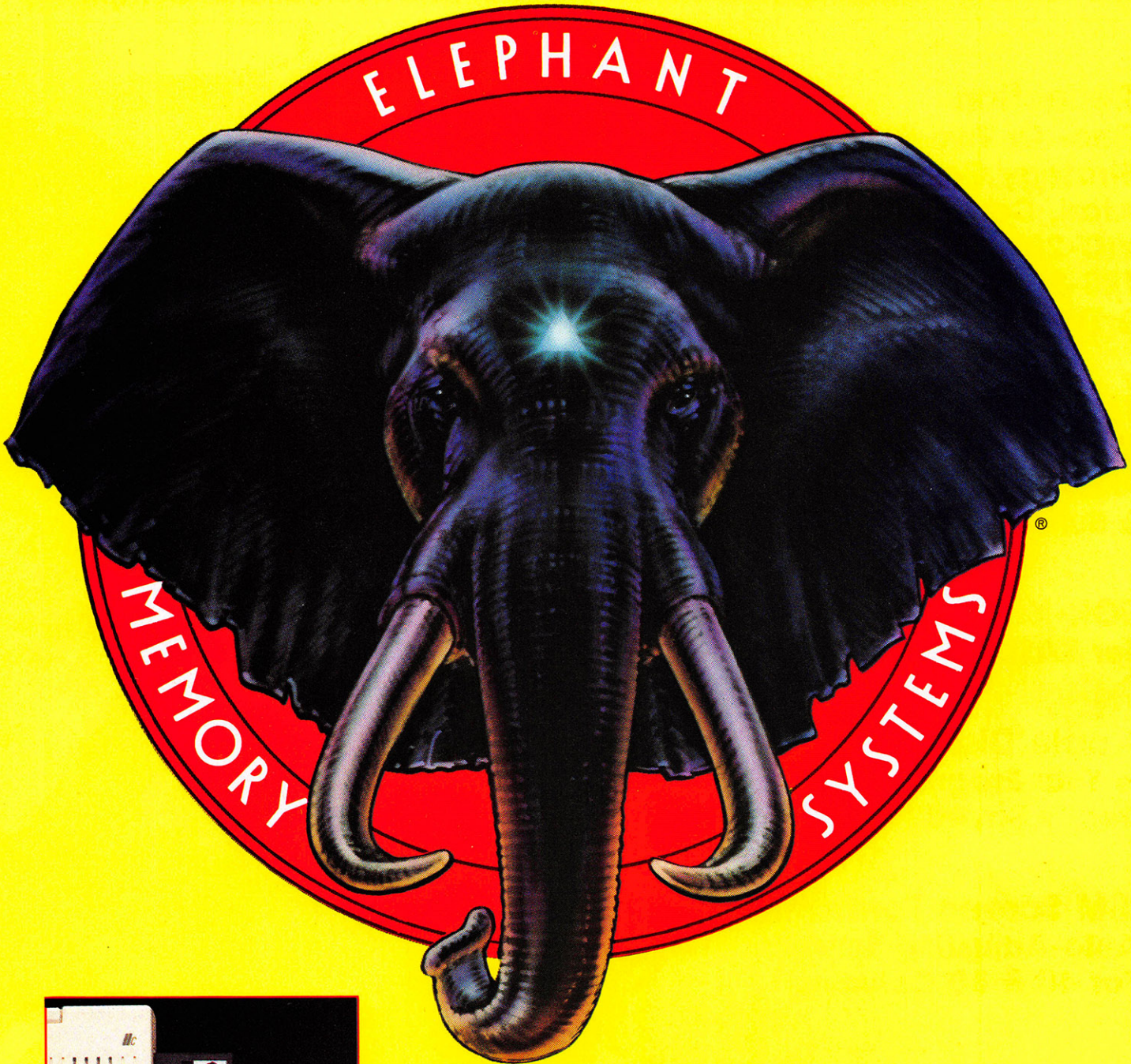
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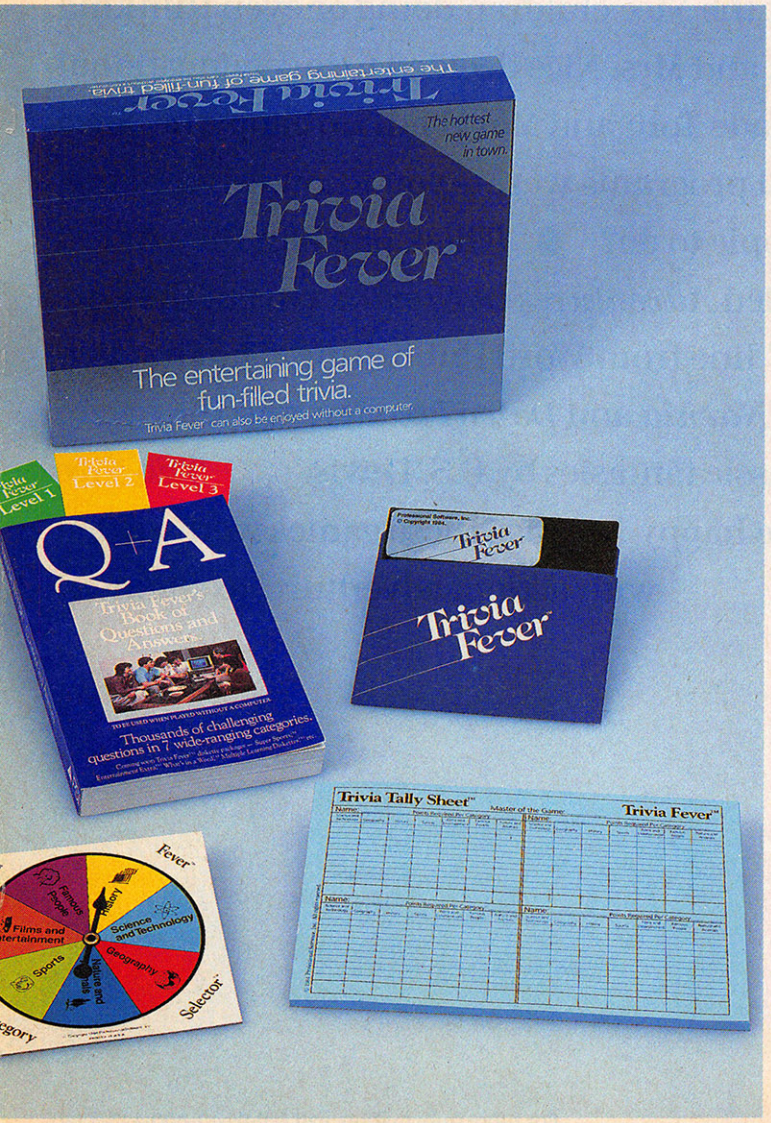
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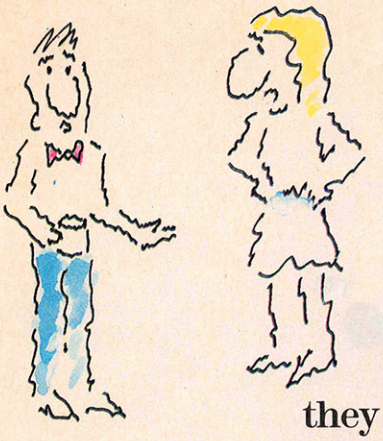
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The Nice Family: Bill, Janet, Tom and Marybeth.

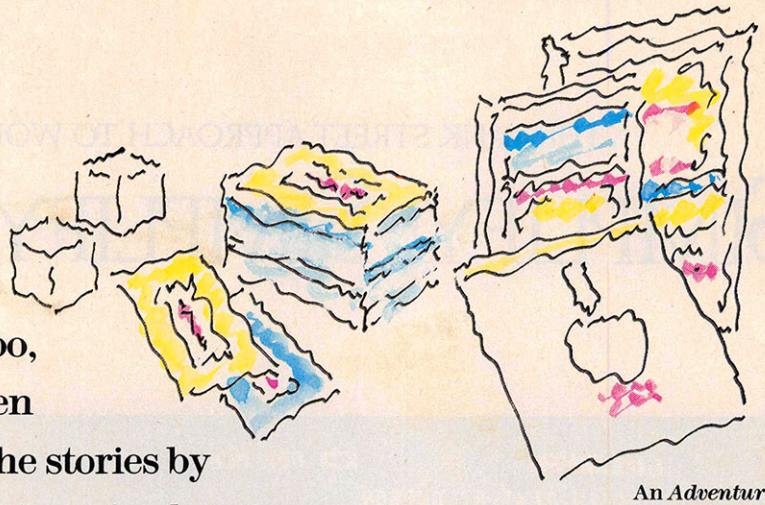
Once upon a time (it was 1984, in fact) and not so far away (right in your neighborhood), there lived a Nice Family: Bill and Janet Nice, and their children, Tom and Marybeth. The Nices owned a home computer, and they liked what they could do with it. But something was wrong. Every time they went to the store to buy a new game, no one was ever happy. ● "Oh no," said Janet Nice. "This won't do at all! These games are not for us!"



"You're right," said Bill. "They're just not nice." You see, all the games were about war and killing and hurting for no good reason. Things that the Nices didn't want the Nice children doing or even thinking about doing. So Mr. and Mrs. Nice decided to buy educational programs. But that made Tom and Marybeth unhappy, because they thought educational programs were—you know—B-o-r-i-n-g. What were these Nice people to do? ● Then, one day, they found some new games called *Adventures in Narnia*, part of the new LifeWare™ line from Word Publishing. The first two games were *Narnia* and *DawnTreader*, and they were based on the classic fantasies by C.S. Lewis. ● The Nice kids were happy because these games were loaded with action, adventure, excitement

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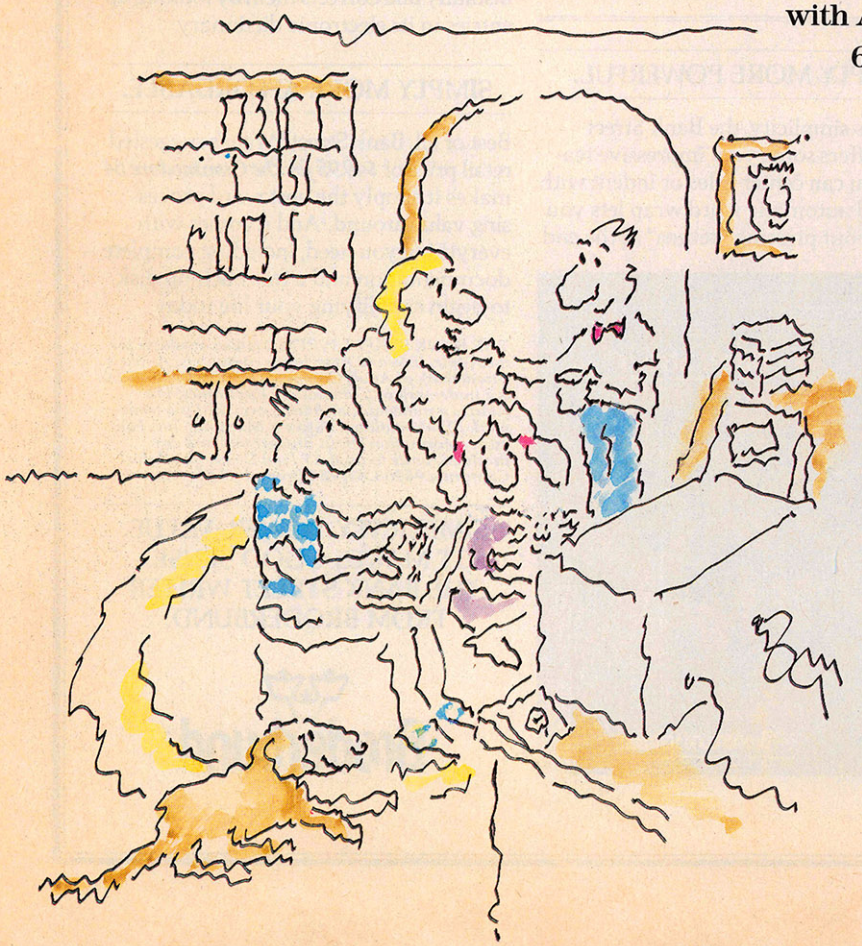
and challenge. Why, they even included things usually found in board games! So everyone in the family could get in on the fun! ● Mr. and Mrs. Nice were happy with *Adventures in Narnia* games, too, because they made their children *think*. And, of course, because the stories by C.S. Lewis present sound concepts and values (no other computer games do). "It's as if these games had our name on them!" said Janet Nice. ● Which brings us to the end of the story. It might be too much to say this family lived happily ever after. But they did live more happily with their computer—and with each other. ● And what could be nicer than that?



An *Adventures in Narnia* game includes diskette, a guide to Narnia, a free C. S. Lewis paperback book and playing pieces usually found in board games.

The End.

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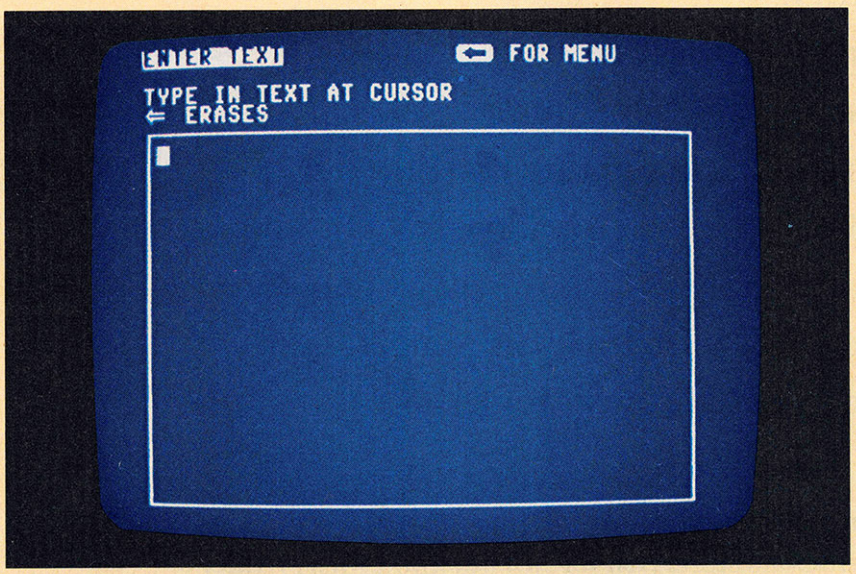
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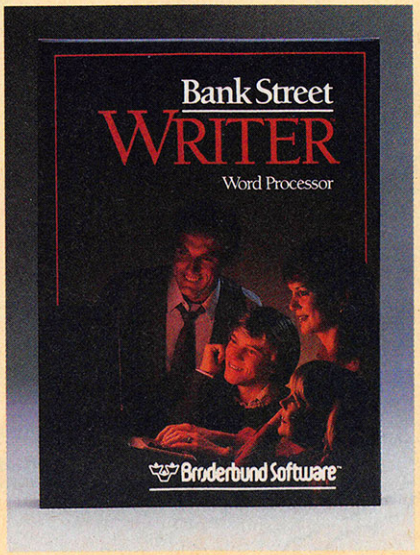
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EDITOR'S NOTES

Senior Editor Richard Mansfield writes about the end of the analog age in this month's Guest Editorial.

Robert Lock
Editor In Chief,
COMPUTE! Publications

We are moving into a digitized world of bar codes, synthetic music, computerized TV, and thousands of other kinds of computerization. This is a major technological and cultural shift, and it's already having an impact on the way we entertain ourselves, communicate, perhaps even on the ways we think.

To better understand what digitization means, let's reflect for a minute on the difference between *analog* and *digital* systems. A rotary-dial phone is analog: To dial a seven, you stick your finger in the seventh hole and drag the wheel around until you hit a bar. Then you release the wheel and there are seven clicks which the telephone company switching network can hear and register as the number seven. In other words, you've sent some information by counting off the number in a physical way. This isn't all that removed from communication via smoke signal or drum.

A digital (Touch-Tone) phone doesn't attempt to imitate the number seven. You just push a button labeled seven and a particular musical tone beeps. It doesn't beep seven times. By previous agreement, that tone represents the number seven.

A fundamental difference between analog and digital is that analog *imitates* the thing it's trying to communicate—it's a physical charade. If you could make yourself very small and walk along a groove in a record album, you'd see canyon walls of vinyl rising and bulging on either side. There would be various bumps in the walls which imitate the sounds of the music. In fact, if you saw big bulges at regular intervals, it's likely you'd be seeing the sound of a drum.

Historically, man has usually assumed that nature itself is based on analogies. For example, some Greek thinkers believed that a chair was composed of millions of little chairs, too small for us to see. There's something reassuring about analogies: They seem to suggest a chain of being, a continuity. But modern physics has revealed a stark, discontinuous, virtually random world of quanta. Tables, they tell us, are made up of accidental packets of reality, thrusting and bumping beneath the quiet surface we observe.

And now music is being quantized. Digital discs measure music by taking samples of it 44,000 times each second. Each of these samples is simply a number, like 1388, which represents what a microphone heard during a particular 1/44,000 second. These numbers are then stored on a small disc which can be read by a laser. On the laser disc, a song is a string of numbers: 1388 42778 42778 42758 and so on. It takes about eight million of these numbers to store a typical three-minute-long song. But a laser can read them and a computer can process them so fast that you think you're hearing real sounds.

They're working on digital TV, too. The picture will come in from the antenna, but it won't be immediately put on the screen. Instead, it will be held inside the TV for a brief instant, translated into numbers, analyzed, and then sent up so you can see it. During this analysis, any blurring, ghosting, or other degradation of the image will be fixed. What you will see will be a tighter, sharper image. You'll also be able to freeze a picture and print it out. A digitized picture, like digitized music, is just a huge collection of numbers. And numbers have several advantages: They are easy to store and transmit, they can be efficiently manipulated, and they cannot be easily degraded.

If a tiny piece of dirt gets on a record, it will add its own sounds to those canyons of vinyl, hissing or popping sounds, depending on the size of the dirt. And with all the miles of phone lines and all the millions of switches, sooner or later there is bound to be an extra click or two when you're trying to dial a seven.

Analog records can be scratched; clicking rotary dials can be misunderstood by a switchboard; ordinary TV signals can suffer during a thunderstorm—the problems with analog are legion. But bad weather, dust, or scratches cannot hurt a number. 1388 is always 1388.

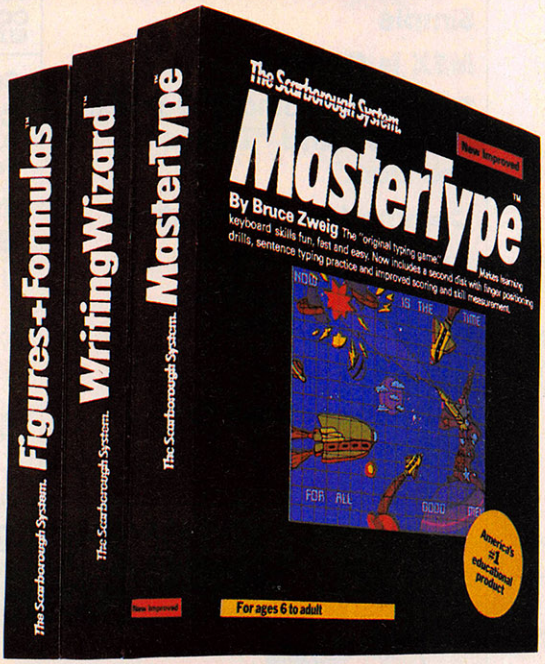
So everywhere you see the effects of digitization. You used to turn up the volume on a radio by turning a knob. Now you're likely to find a button or a pressure pad where the knob used to be. When you press it, nothing behind the button revolves, nothing analog happens. Numbers are simply increasing or decreasing in a microprocessor chip. Many electronic appliances now have no analog knobs at all.

Speed, efficiency, malleability, and integrity are the advantages of digitization. The analog world is in its twilight. It's too early to tell if there are any hidden, unpleasant side effects of digitization, any thrusting or bumping beneath the surface. Yet we increasingly depend on a reality composed of numbers so quick and so immense that we cannot watch them or feel them or even, in many ways, understand them. In a sense, we're turning things over to the computers. They have no trouble at all with numbers.

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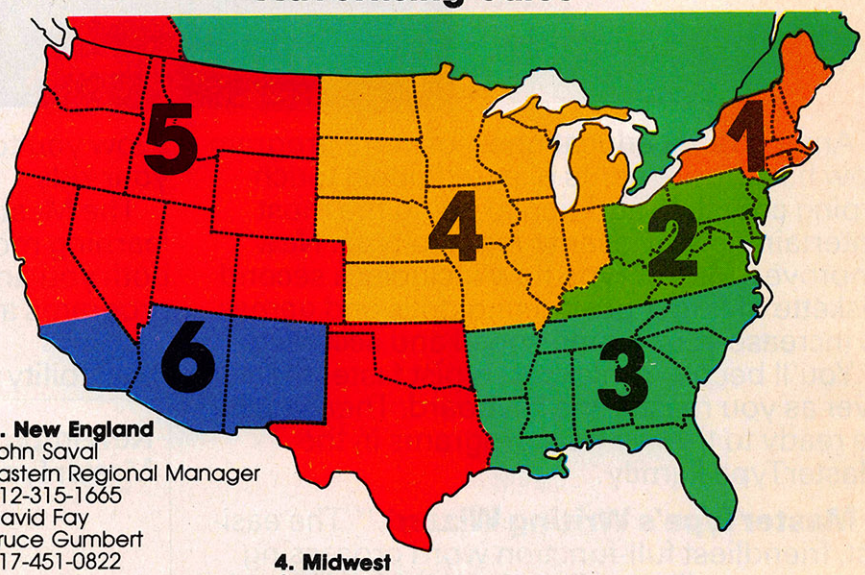
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READERS' FEEDBACK

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TI Reverse Flash

I own a TI-99/4A with Extended BASIC, but have programmed on a number of computers. Several of these computers, such as the Apple and Atari, have reverse video characters. Since the TI lacks reverse characters, I wrote the following short routine to simulate them:

```
100 REM INVERSE CHAR
110 CALL SCREEN(2)
120 FOR I=65 TO 90 :: CALL CHARPA
    T(I,A$):: CALL CHAR(I+32,A$):
    : NEXT I
130 CALL CLEAR
140 FOR I=9 TO 12 :: CALL COLOR(I
    ,2,16):: NEXT I :: FOR I=5 TO
     8 :: CALL COLOR(I,16,2):: NE
    XT I
150 A$="INVERSE"
160 B$="inverse"
170 DISPLAY AT(11,11):A$ :: FOR I
    =1 TO 50 :: NEXT I :: DISPLAY
     AT(11,11):B$ :: FOR I=1 TO 5
    0 :: NEXT I :: GOTO 170
180 END
```

This routine replaces the lowercase letters (produced with the ALPHA LOCK key up) with inverse capitals. First, in line 120, the CHARPAT and CHAR subprograms replace the lowercase letters (characters 97–122) with capitals. Next, in line 140, color codes are assigned to the redefined characters to create inverse characters.

For added effect, a flashing routine similar to that produced with the Apple's FLASH command has been added in line 170.

J. P. Lester

Thank you for contributing this handy routine.

Commodore 1541 Head Alignment

I own a Commodore 64 and a 1541 disk drive. I am having problems loading programs that were saved about two months ago. Programs that were recently saved don't present a problem. When I attempt to load the older programs, the red read/write light flashes the entire time the program is loading. Some programs won't load, period. I've tried to clean my drive, but the problem persists. Can you please tell me what is causing this? I remember reading an article that said when programs are saved in different temperatures, problems may arise. If this is true, can this be the nature of my problem?

Gerry Robinson

Although temperature extremes can damage stored disks, it is probably not the source of your problem. As long as disks are used and stored within the recommended range of 50 to 125 degrees Fahrenheit, you shouldn't have any trouble.

The alignment of the read/write head in your disk drive may be skewed. The stepper motor sometimes slips out of alignment on some models of the 1541. This motor is responsible for precisely positioning the read/write head when the disk is reading or writing data. You should consider taking your drive to a Commodore Service Center to have it checked out.

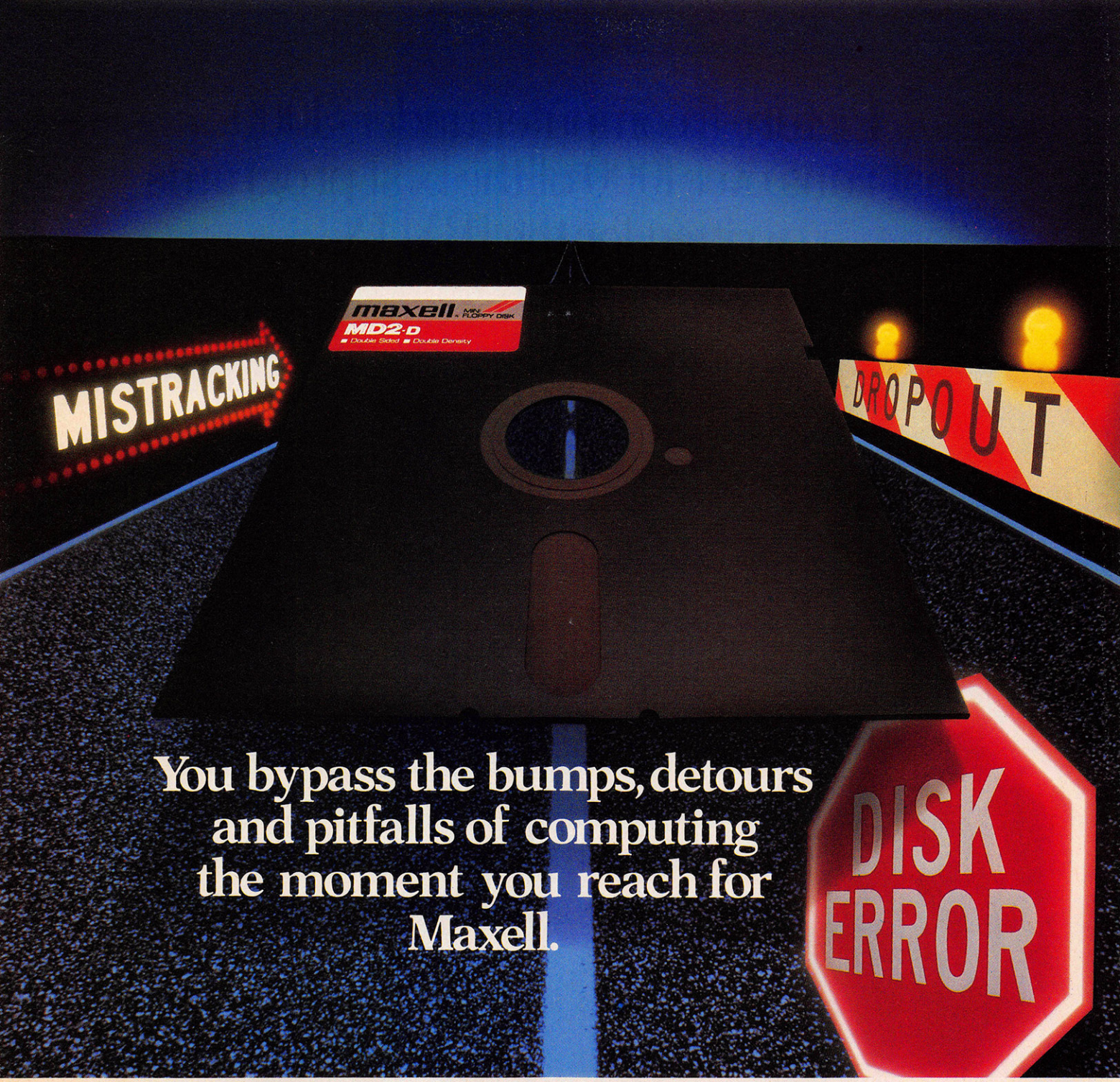
If the red busy light on the front of the drive blinks while you're loading programs, this can indicate the drive is having trouble reading the data on the disk. This is not to be confused with the steadily blinking light encountered with a DOS (Disk Operating System) error. Ideally, the busy light should constantly glow red while reading data on the disk.

Computers And Laser Discs

I was wondering if Atari was planning to produce a laser disc machine for use with its computers. I had read they had planned to do so, but then decided to drop the idea. Is this true?

John Engman

Originally designed to store high-quality video images, the laser disc's power is only now being tapped. Unlike a videocassette recorder, which works like a computer tape drive, a laser disc player has fast random access to any frame, analogous to a computer disk drive. Theoretically, any computer can be interfaced with the relatively simple controls required to drive a laser disc. Digital Research, Inc.,



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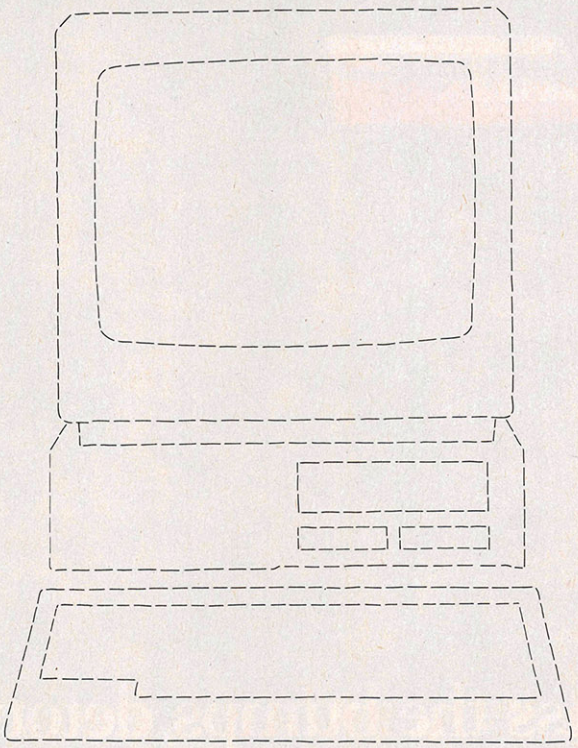


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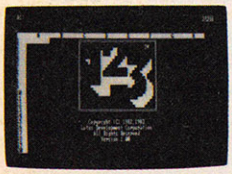
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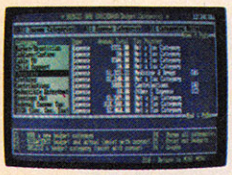
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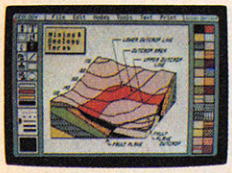
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Display
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Resolution:
4-color: 640h x 200v
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Expandability
Open architecture
Optional 128KB Memory Expansion Attachment(s)
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PC*jr*'s new typewriter-style keyboard adds a nice touch to business, home or educational computing.

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sells the VidLink, a $49 hardware/software package that lets you interface a Commodore 64 to a laser disc player. Versions will soon be available for the IBM PC and Apple II.

Also, while not essential, it's useful if the interface can mix computer and laser disc images so you can superimpose sprites and text with the laser disc image. With a laser disc, surprising realism can be attained in computer backgrounds, but laser discs do not seem to be capable of entirely replacing the bitmapped raster graphics currently used by computers. A laser disc is limited to the available images, whereas computer graphics can be dynamically synthesized.

Since the laser disc can be accessed at random, video can be shown in nonsequential order, branching to different frames under computer control. The laser disc has already proved to be a valuable educational aid, especially when teamed with a computer.

The new Atari 7800 Pro-System videogame machine has a jack on the side for mixing video from a laser disc. A computer keyboard that accepts standard Atari peripherals also was planned for the 7800 Pro-System. Several Japanese companies have shown machines (including a low-cost MSX computer) with laser disc control and video image mixing.

Laser discs have enormous storage capacity. A laser disc can store much more information than a comparably sized conventional magnetic disk, making it an attractive mass-storage alternative. Up to this point, laser discs have been read-only, since storing the information involves burning pits into the disk surface. New technologies such as optical-assisted magnetic recording permit both read and write access. Panasonic sells a read/write optical disk recorder using 8-inch disks. According to the press release, "Each disk can hold the equivalent of 10,000 letter-size documents." The list price is $35,000.

Commodore Plus/64?

After reading about the new Commodore Plus/4, I loved the idea of their BASIC having 60K of user memory, even though I don't care for the reduced graphics and sound capabilities. Is it physically and electronically possible to install the Plus/4's BASIC ROM chip into the 64?

Ken Climer

Although the ROM chips used in the Plus/4 can plug into your 64 physically, as well as respond properly electrically, the software contained in the chips is incompatible with the hardware of the 64. Even though both machines use software-compatible microprocessors, the 64 does not map its memory, graphics, sound, or input/output in the same manner as the Plus/4. An experienced programmer might be able to translate the BASIC, but it would be quite a task. The 64 Super Expander *cartridge offers the same graphics commands found on the Plus/4, although there are no disk commands.*

IBM Feedback

Here are some comments offered by a reader of COMPUTE!'s PC & PCjr *magazine (now incorporated into* COMPUTE!*) on two "Feedback" answers published in the September 1984 issue.*

With respect to the letter from John Bugianesi pertaining to a graphics dump to the Gemini 10X printer: Your suggestion to LPRINT CHR$(27)"A"CHR$(6) does set the proper linefeed for a graphics dump, but the GRAPHICS utility resets the linefeed to an incorrect value for the Gemini.

Also, it *is* possible to enter graphics characters from the PCjr keyboard. First, press the Fn key, then press N. This puts the keyboard into numeric mode. The cursor keys, when pressed, type out numbers. Now, hold down the ALT key and type in the ASCII value of the desired graphics character. When you let go of ALT, the character appears. To get out of numeric mode, press Fn-N again.

N. Thomas Lischer

Thanks for clarifying the problem with dumping graphics to the Gemini 10X printer.

Your second suggestion, however, still doesn't solve the problem of entering all the graphics characters from the PCjr keyboard. Even though ALT can be used to enter any ASCII value, there are still many graphics characters that can be displayed on the screen, but not typed from the keyboard. For example, when you press CTRL-A, a happy face character appears. CTRL-A returns CHR$(1), the value of the happy face. The solid face, CHR$(2), theoretically could be entered with CTRL-B, but this value causes BASIC to move the cursor, not print the character. Some graphics characters cannot be reached even with CHR$, let alone from the keyboard. The only way to access some characters in BASIC is to POKE them directly into screen memory.

Expanding VIC Custom Characters

When the 16K memory expander is plugged into a VIC-20, the BASIC, color, and screen memory locations are moved around. I have used a technique published in your magazine to move these locations in the expanded VIC to the unexpanded VIC's locations. However, doing this sometimes causes the BASIC program to overwrite my programmable characters.

I have tried to protect my character set by moving down the top of user BASIC, but this



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limits the memory so much that I may as well write my programs without my expander. Can you tell me how to locate my programmable characters higher in the user BASIC area without changing the screen, color, and BASIC locations?

Michael Worobec

The major problem encountered when using custom characters on a VIC-20 with 8K or more memory expansion is where to place them.

In the unexpanded VIC, a small amount of memory is usually reserved at the top of user BASIC for the characters. However, this cannot be done in the expanded VIC because the VIC chip (which controls character information) cannot see the expansion memory. In this case, the easiest solution is to move the start of BASIC up a few pages and place the custom characters below BASIC.

For example, if you're using an 8K expander, you can move the start of BASIC to 5632, and place the custom characters at locations 5120–5631. This reserves 512 bytes of memory, enough for up to 64 custom characters.

Here's an example. Clear the computer by turning it off, then on again. Then enter the following statements:

```
POKE 44,22:POKE 5632,0:NEW
```

To make your custom character set visible to the VIC chip, POKE 36869,205. To switch back to the standard set, POKE 36869,192.

Protecting Disks

I am planning to put some floppy disks into a safety deposit box and there is the possibility of some magnetized objects being in the box, too. Is there anything that I could store these disks in that would protect them from magnetism?

Bubba Woods

A magnetic field can penetrate wood, glass, plastic, aluminum, and most other nonferrous materials. However, magnetism cannot penetrate steel, iron, nickel, or cobalt (metals which are attracted to a magnet). Since nickel and cobalt boxes aren't widely available, simply find a small steel box in which to store your disks. However, if the magnetic field is strong, the box itself can become magnetized over time. Also remember that the strength of a magnetic field decreases rapidly with distance from the magnetic object. A steel box located a safe distance from the field would be your best bet.

Atari Telecommunications

I own an Atari 400 with 48K of memory, an 810 disk drive, and 1027 printer. I would like to expand my system with a modem, but I know nothing about them. What would be the best modem to buy? Who can I talk to? Am I limited to conversing with Atari computers or can I converse with other computers? What is a direct-connect modem?

Paul S. Reyes

There are a huge number of third-party (non-Atari) modems available. The acoustic modem has two rubber cups into which you insert the telephone handset, whereas a direct-connect modem attaches directly to the telephone lines. All modems communicate by translating the ones and zeros of data into two tones, which are reconverted into data by the modem on the other end. The disadvantage of an acoustic modem is that outside noise can interfere with the modem tones. Also, some handsets just can't fit into the acoustic cups. The direct-connect modem sends its pulses directly over the phone line, and can automatically dial or answer the phone (although not all direct-connect modems have these features). Early phones without modular jacks must be adapted for use with direct-connect modems.

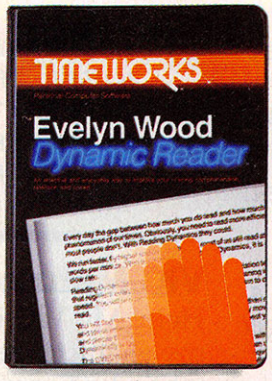
Almost all third-party modems plug into an RS-232C serial port. This is an extra option on many computers, including the Atari. The Atari 850 Interface Module has four RS-232C ports, but is hard to find these days. Some companies sell modems that plug into the joystick ports, and Atari sells a direct-connect modem that needs no additional interface. The Atari modem comes with its own software, but is not compatible with other modem software. You need this software to turn your computer into a dumb terminal, permitting you to see what's coming in over the modem, and letting you type to send out information over the modem. Advanced modem programs let you record everything coming in (downloading), or transmit a block of information to the other computer (uploading).

There's a huge world waiting for you on the other end of the modem. You are not limited to communicating with other Ataris. Large data base services like The Source, Dow Jones, and CompuServe offer news, stock quotations, electronic mail, games, even computer programming in FORTRAN, COBOL, and more. Prices for these services start at $5 per hour of connect time.

Also, there are thousands of public-access bulletin boards. These boards are set up by individuals who dedicate their computer and modem to a kind of mass communication. Bulletin boards let callers read and leave messages, even send and receive public-domain programs. Special-interest bulletin boards range from ham radio boards to religious and adult-only programming.

Atari Keyboard Scanning

I own an Atari 800. When I OPEN #1,4,0,"K:", GET #1,N, press the letter A, and PRINT N, I get the number 65. But when I PRINT PEEK(764)



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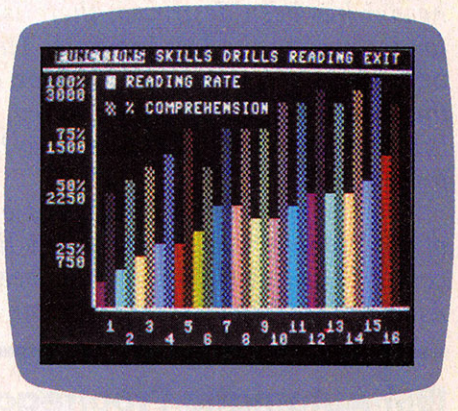
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and press A, I get a different number. Are there any PEEKs that will get me 65? Or is there another way to OPEN and GET so it doesn't pause?

Brian Worley

Location 764 holds the value of the last key pressed. This value is not in Atari ASCII (ATASCII), but represents the row and column of the key pressed. When no key has been pressed, PEEK(764) returns a 255. If you don't want to wait for a keypress, yet get the ATASCII value once the key is pressed, use something like this:

```
100 OPEN #1,4,0,"K:"
110 IF PEEK(764)=255 THEN 130
120 GET #1,N:PRINT N,CHR$(N):EN
    D
130 PRINT "Still waiting...":GO
    TO 110
```

Commodore 64 Lost Leader

I have a program on tape for the Commodore 64, but the beginning was accidentally erased, wiping out the header. Because the 64 saves its programs twice, I was wondering if there is a way to load the second, undamaged copy.

Joe Monnin

It's true that Commodore computers automatically save programs twice on tape. However, if the tape header has been destroyed, there is very little hope for recovering the lost program. The header contains important information on the type of file and where the data it contains is to be stored. Without this, the LOAD routine won't know how to handle the program.

If the header was intact, but one of the copies of the program was damaged, it's likely that you could still recover the program (see "VIC/64 Tape Aids" in the November 1983 issue of COMPUTE!).

IBM Automatic Proofreader Enhancement

Some readers have been having problems with SAVE and LOAD on the IBM Automatic Proofreader. A space must be used between the command and the filename. Leaving it off causes a syntax error:

SAVE "filename" *[correct]*
SAVE"filename" *[incorrect]*

Reader Mike Duch offers the following modification that lets you leave out the space between the command and the filename:

```
270 DELIMITER=INST(TEXT$," "):COMMA
    ND$=TEXT$:ARG$="":IFDELIMITER T
    HEN COMMAND$=LEFT$(TEXT$,DELIMI
    TER-1):ARG$=MID$(TXT$,DELIMITER
    +1):GOTO280
275 DELIMITER=INSTR(TEXT$,CHR$(34))
    :COMMAND$=TEXT$:ARG$="":IF DELI
    MITER THEN COMMAND$=LEFT$(TEXT$
    ,DELIMITER-1):ARG$=MID$(TEXT$,D
    ELIMITER)
620 IF INSTR(ARG$,".")=0 THEN ARG$=
    ARG$+".asc"
```

VIC Metamorphosis

Help! My VIC is changing. I recently noticed that my character set has been relocated. In the past, when I powered up my VIC, the location for the character set (36869) used to be 240. Now it is 192. Can you tell me why?

Scott D. Killen

Odds are that when you get the value of 192 at powerup, you have 8K or more of expansion memory plugged in. The normal powerup value for the unexpanded VIC is 240. Memory location 36869 does more than just indicate the location of the character set. It also points to the start of screen memory.

When you use 8K or more of expansion memory with the VIC, a few things change. Screen memory moves to 4096–4607, color memory to 37888–38399, and the start of user BASIC moves to 4608. In other words, the value of 36869 is not changing because the character set is moving, but because screen memory is relocating.

Moving The 64 Kernal

I was given two Commodore 64 games on a disk for Christmas, but could not get either of them to work. The disk drive returned the error message "Invalid command." My dad and I think that there is an error in our Kernal, because we've used the same disk drive with other 64s and both games have loaded and run fine. We saved the Kernal ROM from another 64 to disk, then loaded the Kernal into the RAM beneath the ROM. We then executed POKE 0,PEEK(0) AND 253 to disable the ROM, thus replacing the Kernal with the RAM-loaded one, but this did not work. Is this the right command to turn the Kernal off?

John Brooks

The Kernal is another name for the 64's operating system. Although it is responsible for communicating with the disk drive, it seems unlikely that this would cause the disk error, especially if you are having no other problems. A hardware malfunction in your 64 could just as easily be the culprit. Nonetheless, the command you should use is POKE 1,PEEK(1) AND 253. This will effectively remove the ROMs from $A000–$BFFF and $E000–$EFFF, revealing the underlying RAM. If you save both these ranges on another machine using a machine language monitor, you can load the two files into your 64. If you only want to load the Kernal from

["Hi, we're from Europe. Where's the gold?"]

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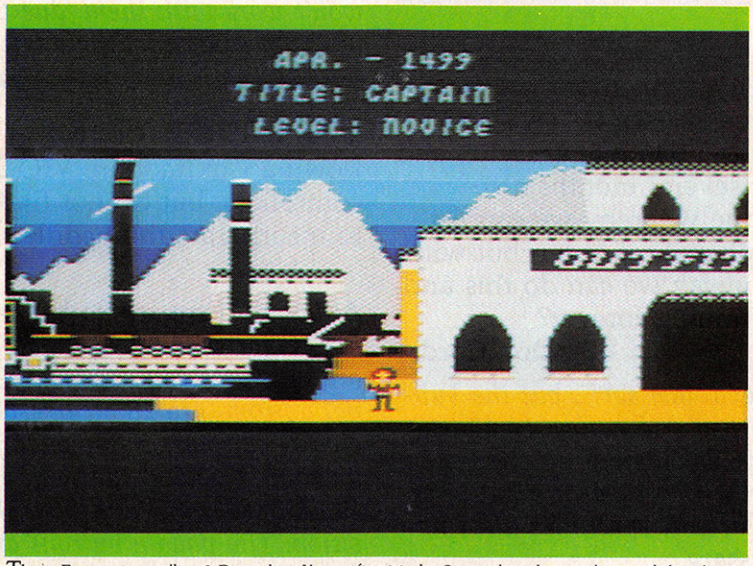
It's a kind of adventure. An unusually rich and technically impressive one with new continents to explore, natives to encounter, resources to manage and trade routes to establish. But beyond all the neat stuff *Seven Cities* throws up on the screen, there's something else happening here.

It feels quite odd to look at the map and see nothing. Of course you have to explore the more than 2800 screen new world in order to map it. But the way the natives act, the way you get older, the way seasons change and your men behave, and the way your reputation preceeds you gives you a sort of feeling that's unexpected in computer games. It's deeper. Maybe a little disquieting. It plays as much in your head as it does inside your computer.

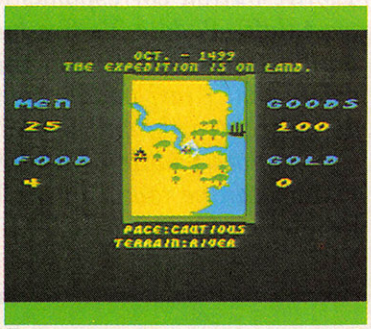
Seven Cities does all this with the real world or, better still (since the "new" world really isn't anymore), it will construct any number of completely detailed hemispheres for you to try your hand with.

Designed by Ozark Softscape (the people who made M.U.L.E., *Infoworld's* "Strategy Game of 1983"), *Seven Cities* is about as near a recreation of history as has ever been accomplished, with or without a computer.

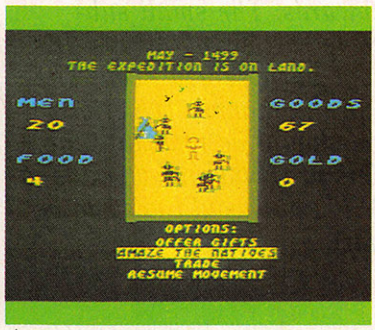
Find it. Stomp around in it. See if you can't do a better job than all the celebrated figures who got us into the mess we have to deal with today.



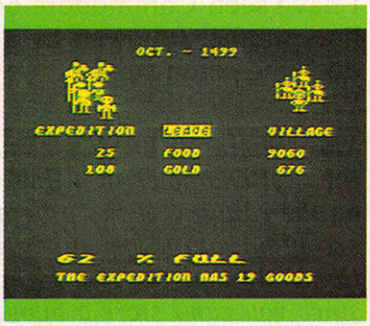
This is Europe, in scrolling 3-D graphics. You outfit, visit the Crown, launch your ships, and if you're cut out for this, you return later to tell all sorts of wild stories about what it's like over there.



There are over 2800 screens to explore in the new world. As you scroll through them, seasons change.



Animated natives surround you. They have no reason to trust you. The drum beat quickens.



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the other machine, but don't want to change BASIC, you must copy the contents of the BASIC ROM to the underlying RAM with this statement:

```
FOR I=40960 TO 49151:POKE I,PEEK(I):NEXT
```

After the Kernal and BASIC have been copied or loaded into RAM, use the aforementioned POKE, or simply POKE 1,53.

A BASIC Sort

My daughter has written an inventory program to list our music cassettes. It uses DATA statements to list type of music, name of cassette, and performer. We have for several months attempted to write a routine whereby we can list all the performers in alphabetical order, but without success. Is there any way we can do this and not have the program running forever?

Don Cordry

There are a number of good, fast sorts, but the bubble sort is one of the shortest and easiest to understand and modify. It works by comparing every item to the one beneath it. If the two items are out of order, they are switched. The sort continues until no more exchanges are necessary.

The name comes from the way lower-ranked data tends to "bubble" upwards. The small subroutine below can be used to sort string arrays. It's easy to modify for whatever purpose you need. The variable N should be set to the number of performers, and all the performers should be read into the array prior to the sort. This program will work as is with most versions of BASIC, but would need to be modified to run on an Atari.

```
5000 EX=0
5010 FORI=1TON-1
5020 IFA$(I)>A$(I+1)THENT$=A$(I):A$(I)=A$
     (I+1):A$(I+1)=T$:EX=1
5030 NEXT I
5040 IFEX<>0THEN5000
5050 RETURN
```

Commodore Compatibility

I have a Commodore 4032 computer with a Commodore 2031 disk drive. I am thinking about buying a Commodore 64, but only if the 2031 drive can be used with it. Is there any way this can be done?

Robert D. Byers

The 4032 computer and 2031 disk drive communicate over the IEEE-488 parallel bus. Bytes are sent eight bits at a time. The Commodore 64 and its 1541 disk drive use a serial bus that is similar to the IEEE-488, but it sends bytes one bit at a time. You cannot directly attach your IEEE-488 disk drive to the 64, but several manufacturers sell IEEE interfaces for the Commodore 64, some as low as $100. With an IEEE interface plugged into the cartridge port, your 2031 will transfer data faster than a 1541. There are also IEEE interfaces that attach through the serial port.

In addition, your drive is read and write compatible with the 1541, so you should be able to load most commercial software. Unfortunately, few of these interfaces are perfect. Some software just won't work with them, due to changes in the memory map caused by the addition of the interface.

VIC Paddle PEEKs

I own a Commodore VIC-20 and a set of paddle controllers, but cannot find the commands used to incorporate the paddles into my programming.

Brad Mills

Although there are no built-in commands in VIC BASIC for reading the paddles, there are two memory locations you can read. Location 36872 returns a value from 0 to 255 (corresponding to a counter-clockwise rotation) for paddle 1. Paddle 2 is read by location 36873 in the same manner. In BASIC, use PEEK(36872) or PEEK(36873) to read the paddle position. The paddle buttons are read by checking the locations normally used to read the joystick. Paddle 1's fire button corresponds to a joystick position of west (left). Paddle 2's fire button is synonymous with a right deflection of the joystick. Also, be aware that Atari paddle controllers used on the VIC do not return the full 0–255 range provided by Commodore paddle controllers. Additional information can be found in the VIC-20 Programmer's Reference Guide, *or* COMPUTE!'s Mapping the VIC.

Commodore Colons

I have seen Commodore 64 programs that have a line number followed by a colon. What purpose does the colon serve?

Mike Wells

Most Microsoft BASICs allow you to put a colon as the first character in a line, and this has no effect on the running of the program (except to slow execution a bit). The superfluous colon is often used to merely insert a visual gap in the program listing, since you can't store a blank program line. Since many BASICs delete any leading spaces after a line number, the colon is also used to indent lines for increased readability, since spaces after a colon are preserved.

Atari Versus Commodore Disk Drives

I read in a lot of articles that the Atari disk drive is an intelligent drive like the Commodore 1541. But isn't it true that you have to load the disk operating system (DOS) into the Atari before it

[OH NO, NOT AGAIN.]

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Now for the third question. Why a sequel? Well, there are sequels and there are sequels. The good ones happen because people just haven't had enough of a good thing. Obviously we're here to tell you that *Archon II: ADEPT* falls into the right category.



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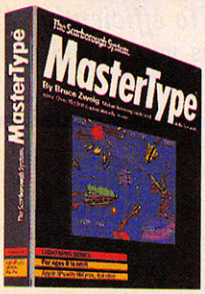
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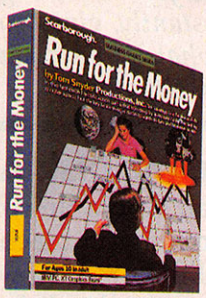
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can use the disk drive, whereas the 1541 has DOS built in? Do you really think this qualifies the Atari as an intelligent drive?

Jerry Cole

Good question. An intelligent peripheral is merely one with its own microprocessor, making it a kind of computer in its own right. Intelligent modems can dial phone numbers automatically. Most printers are intelligent peripherals. Years ago, a printer couldn't even print characters on its own. The computer had to turn the daisywheel, strike the character, advance the carriage, and perform linefeeds by commanding the slave circuitry in the printer. Other "dumb" peripherals include the cassette drive, simple modems, and most joystick-type controllers. The television screen could be considered a dumb peripheral. Some computers use one smart drive with a controller, then add unintelligent slave drives which depend on the smart drive.

There's no question that the 1541 is more intelligent than the Atari drive. The 1541 does all disk operations on its own. The VIC or 64 merely has to give some commands. The original Commodore PET was not able to access the disk on its own, so a RAM-loaded DOS was impossible, forcing Commodore to put the DOS in its 4040 disk drive along with the extra RAM and ROM required to support the DOS in the drive. It was necessary to carry over this technique to the 1541 in order to preserve compatibility with PET/CBM 4040 disks.

The Atari 810 (or the new 1050) drive can only read sectors, write sectors, and format disks on its own. Nonetheless, there are real advantages to controlling the drive from the computer. If there is ever a bug in DOS, it's much easier to re-issue a new version of DOS than to have to replace ROM chips in the drive itself. It's also easier to customize and modify DOS when it's in RAM. When the computer controls primitive disk access, far more flexibility and even greater speed is possible. For example, on the 1541, disk errors must be requested from the drive, so it's easy to miss the blinking light, then later find your program wasn't saved. On the Atari, disk errors are tied right into BASIC.

On the other hand, no computer memory is used up when a 1541 is added to a VIC or 64, which is a vital consideration for a 5K VIC. The only real disadvantage of a RAM-loaded DOS is that some memory is made unavailable for other programming.

Electronic Spreadsheets

What is a spreadsheet? What is it used for?

Andrew Hansen

A spreadsheet is a computerized version of a ruled notepad like the ones often used by accountants. The electronic worksheet consists of a number of rows and columns. A cell, which can hold a number, a label, or a formula, is one of the spaces created by the intersection of row and column lines.

For example, a column could be labeled Expenses. *Under* Expenses *you would list a column of numbers. The last cell could then hold a formula to add up everything in the column, so this sum always appears in the last cell. The power of spreadsheet software derives from the fact that you could change any number in the column, and the sum would then be updated instantly. And spreadsheets offer a wide range of mathematical and logical operations.*

In effect, a spreadsheet is an intuitive and effective programming language for making calculations and setting up large, interactive models. The fact that you can change any value, then see the results instantly, gives you the ability to efficiently play "what if" on a massive scale, as you model complex situations.

Apple ML Disk Access

I own an Apple IIe computer and do a lot of my programming in machine language. One of the things I'm currently working on is a program that accesses the disk drive from ML using the RWTS and File Manager routines in DOS. The way to access these routines is to JMP to location $3D9 for RWTS or to $3D6 for File Manager. At each of these locations is another JMP that goes somewhere in DOS. In Apple's new Disk Operating System, ProDOS, there is nothing at these addresses to JMP to RWTS or File Manager. Could you tell me how to access RWTS and File Manager from ProDOS?

Daniel Wilson

Apple's ProDOS operating system might resemble DOS 3.3 when used from BASIC; but, as you have discovered, it is quite different when used from machine language. The RWTS ("Read or Write a Track and Sector") and File Manager subroutines are parts of DOS 3.3, not the Apple IIe, and aren't included in ProDOS. Instead, all operating system services are requested by calling the ProDOS MLI (Machine Language Interface). There are 24 functions that can be requested through the MLI, including many of the functions performed by the DOS File Manager.

Unlike DOS 3.3, which works only with Disk II drives, ProDOS is designed to work with many different disk drives, each with its own method of storing data. ProDOS organizes data into "blocks" of 512 bytes, which may or may not correspond to the size of the sector used by the storage device. The MLI contains functions to read and write individual blocks from disk, which are barely equivalent to RWTS's functions, but these are intended only for diagnostic and repair purposes. For ordinary use, direct disk access is not recommended because file

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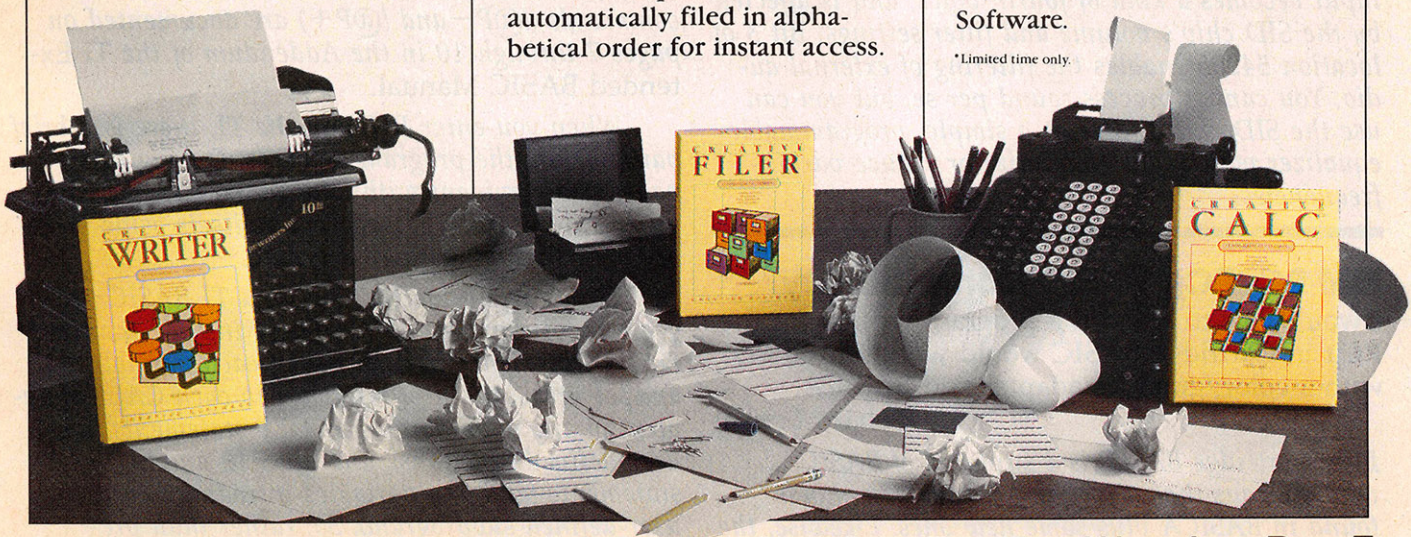
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operations are provided which could do the same job.

The MLI is called by a JSR $BF00 instruction, followed by three bytes of data. The first byte is the number of the MLI function being requested, and the second and third bytes contain the address of the parameter list for the request. These three bytes must be placed in your program immediately after the JSR $BF00 instruction. The MLI function dispatcher increases the return address on the stack by three to skip over these bytes.

Although the MLI performs many of the same functions as the DOS File Manager, there is no compatibility between the two. ProDOS has a completely different set of function codes, error codes, and parameter list formats. Information about these codes, the structure of ProDOS, and lots more, is available in the Apple ProDOS Technical Reference Manual. *This publication is available from most Apple dealers and is intended for advanced programmers who want to use ProDOS from machine language.*

Commodore 64 Audio Input

I own a Commodore 64 and have had no problems with it at all. Documentation of all its features is another story. I know that the 64 has an audio input located on the audio/video port on the back of the unit. However, I have not been able to find any literature on how to access this feature. Could you please tell me how to use it? What memory locations are affected?

Kevin Caylor

The audio input pin is used to mix in an external sound source. You can test this by feeding the sound output of another 64 into the audio input. When mixing in another audio source, be sure it's at the same low level as SID chip output. (Feeding in an amplified signal could destroy your SID chip.) Intended for chaining SID chips together, the audio input becomes a kind of fourth voice, and is affected by the SID chip's volume and filter settings. Bit 3 of location 54295 enables the filtering of external audio. You cannot process sound per se, but you can use the SID chip's filter as a simple, programmable equalizer which will emphasize or reduce various frequencies.

IBM PC/PCjr BASIC Compatibility

I would like to know if a program written for the PCjr in Cartridge BASIC would work on the PC with a color/graphics adapter and BASICA.

Richard Bookal

PCjr Cartridge BASIC is a superset *of BASICA, which means that it contains all the commands found in BASICA plus some new ones. Likewise, the PCjr has all the graphics and sound features found in an IBM PC equipped with the color/graphics adapter, plus some enhancements. Therefore, programs written for a PCjr with Cartridge BASIC will run on a PC with a color/graphics adapter and BASICA only if the extra commands and features are not used.*

An example of a new Cartridge BASIC command is PCOPY. Briefly, this command copies an image from one screen page to another. But only the PCjr with Cartridge BASIC has this capability. If you attempt to run the program on a PC, BASICA won't know how to interpret PCOPY and an error will result.

An example of an enhanced feature on the PCjr is SCREEN 5, a graphics mode with 320 × 200-pixel resolution and 16 simultaneous colors. A program written for the PCjr using SCREEN 5 won't run on a PC equipped with the color/graphics adapter, because the PC's 320 × 200 graphics mode (SCREEN 1) is capable of displaying only four simultaneous colors.

If you want to write programs on a PCjr with Cartridge BASIC that will be compatible with a PC and BASICA, you'll have to avoid using all of these new commands and features. For your guidance, IBM's Cartridge BASIC manual generally states when a command is available only in Cartridge BASIC. It would also help to acquire a BASICA manual and familiarize yourself with a PC outfitted with the IBM color/graphics adapter.

Instant TI RUNs

Quite awhile ago I read about a command for the TI-99/4A which causes a program to RUN instantly after you hit ENTER. I looked through many books and articles and did not find this information. Can you help?

Dorr Wilson

It sounds like you are describing the pre-scan commands available with Extended BASIC. *These commands (!@P− and !@P+) are documented on pages 7 through 10 in the Addendum of the* TI Extended BASIC Manual.

When you enter RUN on the TI, there is a brief pause before the program executes. During this pause (most evident with long programs), the computer "pre-scans" the program and sets aside memory for variables, arrays, and data.

Only certain instructions in a TI BASIC program require pre-scanning. These include the first DATA statement, the first use of each variable and/or array, the first reference to each CALL statement of any subprogram, all DEF statements (for user-defined functions), and all SUB and SUBEND statements (and any variables introduced in the user-defined subprogram). So, rather than pre-scanning an entire program, you can pre-scan only part of it by appropriately positioning the pre-scan

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commands (!@P+ to turn pre-scan on and !@P− to turn it off). in many cases, this greatly reduces the initial pause.

Although you can scatter the pre-scan commands throughout your program where necessary, there is a more efficient way to use this option. Simply collect all the statements you want pre-scanned on one line without regard to syntax and place a GOTO at the beginning of the line. This prevents the other statements on the line from executing during the program run. Here's an example of this technique:

```
100 DATA 5
110 GOTO 120 :: I :: X :: Y :: Z
    :: CALL CLEAR :: CALL SCREEN
    :: CALL CHAR :: CALL HCHAR ::
     CALL VCHAR :: !@P-
120 CALL CLEAR :: CALL SCREEN(14)
130 CALL CHAR(97,"FFFF0000FFFF000
    0")
140 READ X :: FOR I=1 TO X :: CAL
    L HCHAR(X+I,10,97,X):: CALL V
    CHAR(15,X+I,97,X):: NEXT I
150 READ Y,Z
160 DATA 10,20
170 DISPLAY AT(20,5):Y,Z
180 FOR I=1 TO 1000 :: NEXT I
```

For other examples using these commands, consult the Extended BASIC Manual Addendum.

Upgrade A VIC To A 64?

I have expanded my VIC-20 to 32K. I want to know if I can run 64 software on it, because the expansion cartridge says, "Expands VIC to C-64 power."

Thomas A. Roznovsky

The VIC and 64 are inherently incompatible machines. The only similarity in power between a 32K VIC and a 64K Commodore 64 is that both machines would have roughly the same amount of BASIC programming space. If memory alone distinguished these machines, the expansion cartridge would suffice. But even though the VIC and 64 use almost identical microprocessors, the video, sound, and input/output hardware are completely different. The difference in screen width (22 versus 40 columns) is not a trivial consideration either. The VIC and 64 will never be able to run all of each other's software. Some BASIC programs that avoid hardware-specific features like sound and graphics will, however, run interchangeably on the VIC and 64.

Atari Numeric I/O

In the course of my Atari programming, I have found the need to store numbers on disk with BASIC. The Atari PUT/GET commands only store numbers from 0 to 255. I'd like to know if there's any way to store larger numbers.

A. J. Allie

All input/output works a character (or byte) at a time. When you PUT a number to disk, you are sending a character in the range 0–255. GET retrieves a character as a number from 0 to 255. PUT and GET are indeed compact ways to store and retrieve numbers in this range, since only one byte is needed for what is printed on the screen as up to three digits. One way to store quantities outside the one-byte range is to break up a number into pieces. A number from 0 to 65535 can be broken into two bytes with a statement like this:

```
HIGHBYTE=INT(NUMBER/256):LOWBYTE=
NUMBER-HIGHBYTE*256:PUT#1,LOWBYTE
:PUT#1,HIGHBYTE
```

The variable NUMBER (in the range 0–65535) is broken into the two variables HIGHBYTE and LOWBYTE. You can then PUT these numbers to disk as characters. When you want to GET back the numbers, use a statement like this:

```
GET#1,LOWBYTE:GET#1,HIGHBYTE:NUMB
ER=LOWBYTE+256*HIGHBYTE
```

There is a much easier way to store and recall numbers. This method does not limit the range of the number. You can store any number the Atari can hold in a variable. Although less memory-efficient, you merely PRINT# (print-file) the number to a file, then use INPUT# (input-file) to read the number back.

PRINT# and INPUT# work exactly like their normal BASIC counterparts, but instead of reading from the keyboard and writing to the screen, input/output is redirected to tape, disk, modem, etc. You must always INPUT# the numbers in the same order they were written to disk. Additionally, when writing the numbers, each number must end with a carriage return, just as you must use the RETURN key to terminate keyboard INPUT.

You can also PRINT# strings to disk and read them back into a string variable. INPUT# can read the data written from one variable into another variable name. VAL and STR$ can be used to convert strings to numbers and vice versa. Try this small program to get an idea of how PRINT# and INPUT# work.

```
FG 100 DIM A$(1),F$(20):GRAPHICS 0
IM 110 PRINT "(C)reate file, or (R)e
       ad file";:INPUT A$
MC 120 PRINT "Enter filename (includ
       e D: for disk":? "or use C: f
       or cassette)";:INPUT F$
CM 130 IF A$="R" THEN OPEN #1,4,0,F$
       :FOR I=1 TO 10:INPUT #1;A:PRI
       NT I,A:NEXT I:CLOSE #1:END
KF 140 PRINT "Enter 10 numbers.":OPE
       N #1,8,0,F$:FOR I=1 TO 10:PRI
       NT I;:INPUT A:PRINT #1;A:NEXT
        I:CLOSE #1:END
```

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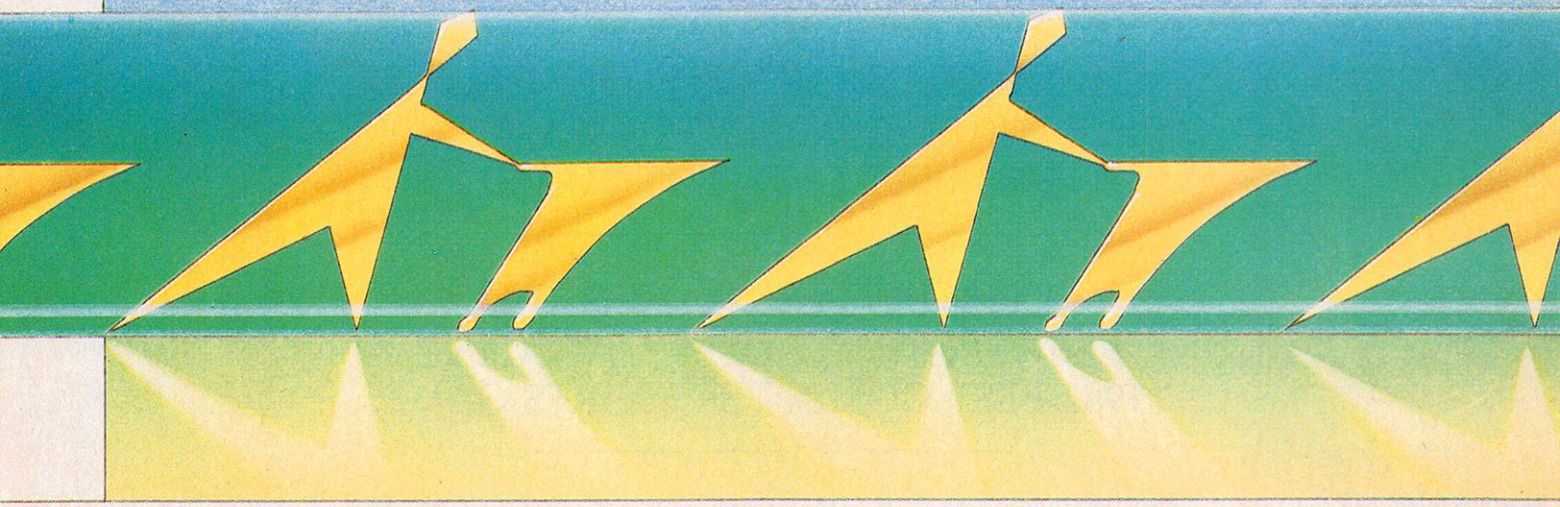
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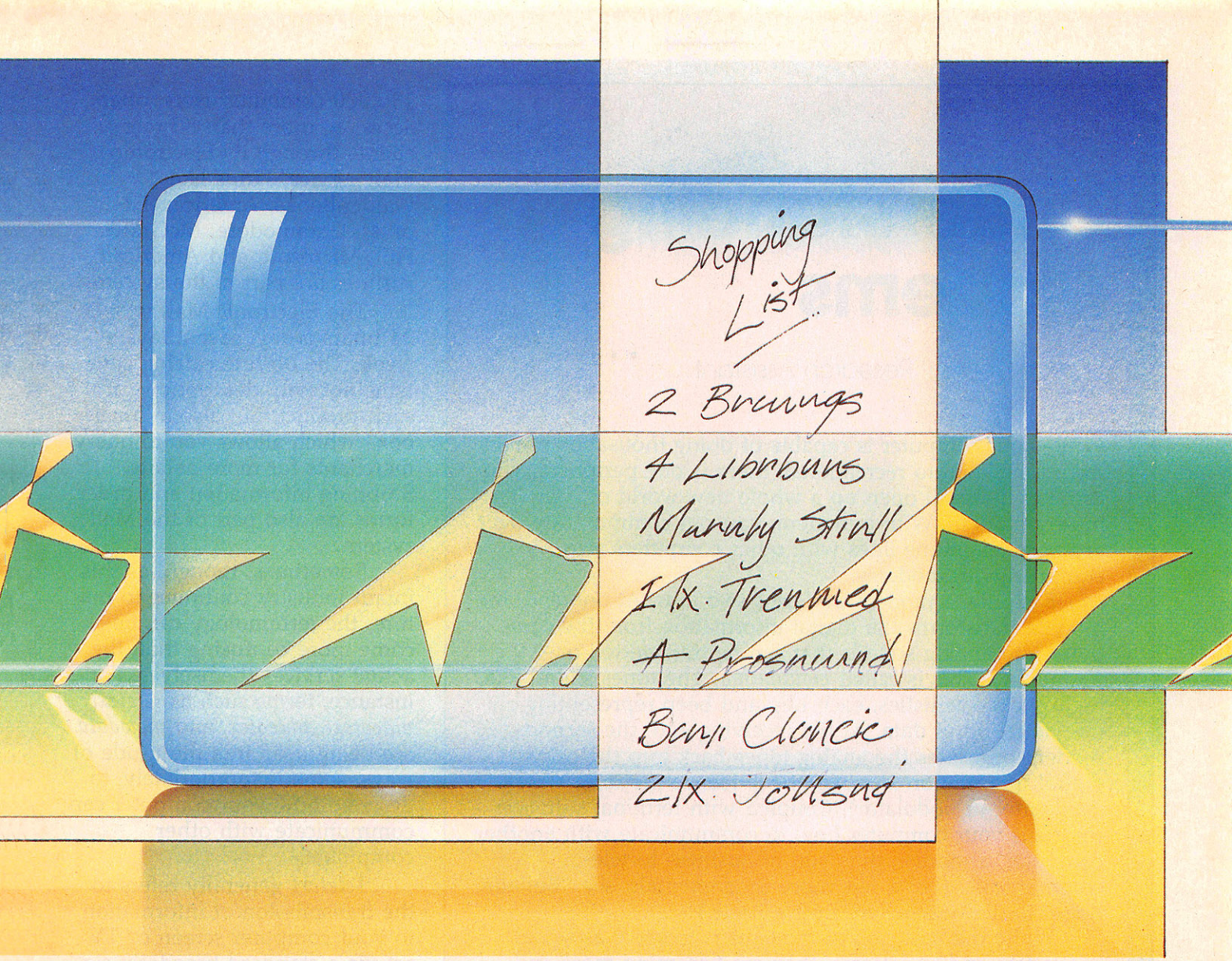
Selby Bateman, Features Editor

"When the going gets tough, the tough go shopping" is a tongue-in-cheek, modern American proverb which reveals a lot about our urge to browse, bargain, and buy. Of course, shopping, in one form or another, is one of the oldest and most popular customs in almost every society.

But shopping habits changed little until late in the nineteenth century, when a few astute retailers discovered that many people preferred to do at least some of their shopping the easy way—without trudging from store to store, without the disappointment of learning that their sought-after product was out of stock, and without fighting crowds of competing shoppers. At the same time, millions of people in rural America who lived far away from big cities simply were unable to shop for the things they wanted to buy. So retailers like Sears, Roebuck & Co. created a multibillion-dollar business by popularizing catalog shopping—comparing and ordering products by mail and by telephone.

Electronic shopping malls and on-line storefronts have emerged from science fiction into reality. You can already shop for, compare, order, and purchase literally thousands of products using your home computer. Within the next several years computer-based shopping services will offer far more—and increasingly sophisticated—buying options.

We're now on the verge of another shopping revolution, this time made possible by the rise of another new communications system: personal computing and telecommunications. Using your computer as a remote terminal, you can gain access to a growing number of computer-based shopping and banking services. Some examples are CompuServe, Inc.'s Electronic Mall, Compu-U-Card of America, Inc.'s Comp-U-Store, Chemical Bank's Pronto Home Information and Banking System, and Keycom Electronic Publishing's Keyfax Interactive Information Service in Chicago.



There are also experimental *videotex* systems for home use which feature dedicated video terminals capable of receiving and displaying signals with superior graphics and other advantages. Knight-Ridder's Viewtron system in Miami, with its AT&T Sceptre terminal, is perhaps the furthest along in this area. But major companies, including CBS; Sears, Roebuck; IBM, and many others are researching the possibilities of on-line shopping services.

Although in today's urbanized America practically everyone lives near a big city, shopping center, or suburban mall, the very popularity of modern marketplaces keeps alive some of the big advantages of catalog shopping: the absence of crowds and traffic, and the convenience of buying from your own living room. Coupled with credit cards, the climate for shop-at-home services might be even better than it was in the nineteenth century. Besides that, on-line stores can potentially offer greater discounts if volume is high enough, because their overhead can be lower. And all shoppers have one thing in common—everyone likes a good buy.

"I believe it's going to be a steady, geometric growth as the services become available and as the industry discovers which services people want," says Merrill Millman, president of American Home Networks. Based in Illinois, American Home Networks is scheduled in December to go on-line with its American People/Link telecommunications system throughout the continental United States. The system will be accessible by virtually all home computers and will initially feature electronic mail service, a party-line communications service, an electronic bulletin board, and games.

"I think there will be success in areas connected with user interaction, electronic mail, information retrieval, games. And merchandise ordering—I think that's great," says Millman. "Right now on CompuServe, for instance, you can order from Sears, Roebuck & Co., and I think that's fantastic."

In fact, CompuServe, with a subscription base of more than

Understanding Modems

Sharon Darling, Research Assistant

While your computer is capable of doing thousands of jobs, from functional to recreational, there is one peripheral you can buy that will open up a whole new world of computing—a modem. With a modem, you can communicate over ordinary telephone lines with other computers also equipped with modems.

Basically, a modem performs two jobs. At one end, the modem transforms the digital information from the computer into analog sounds that can be transmitted over the phone line. This is called *modulation*. The tones sound like high-pitched whistles, each blip and beep representing an individual bit of data. At the receiving end, the second modem translates the analog tones back into the original digital information *(demodulation)*. Hence the term *modem* (*mo*dulator-*dem*odulator). Coupled with terminal software that tells your computer how to communicate with another computer, a modem puts you in business to telecommunicate. (For a few more fundamentals, see "Bulletin Board Basics" elsewhere in this issue.)

While the basic job of modems is to serve as signal converters and translators, they are becoming more and more sophisticated. The new breed of modems can automatically dial phone numbers, answer phone calls, sign on to commercial information services, retrieve data, and perform other tasks under program control with no human intervention.

That's not to say that people aren't buying less expensive modems—they are, and in great numbers, says Jerry Hussong, director of consumer sales for Anchor Automation, Inc., a modem manufacturer. "People are buying [inexpensive modems] and they're having a great time with them. Then they come back a couple of months later and say, 'Hey, this is nice, but I'm lazy—I want something that will automatically answer the phone.' "

Besides making modems more sophisticated, modem designers and programmers are also trying to make the devices easier to use. They're trying to overcome the intimidation some people feel when they sit down to a desk filled with new technology—especially computers and modems. But that fear should fade as more people become involved with personal computers, manufacturers feel.

"People are not so much intimidated by telecomputing as they are by the whole idea of computing itself," says

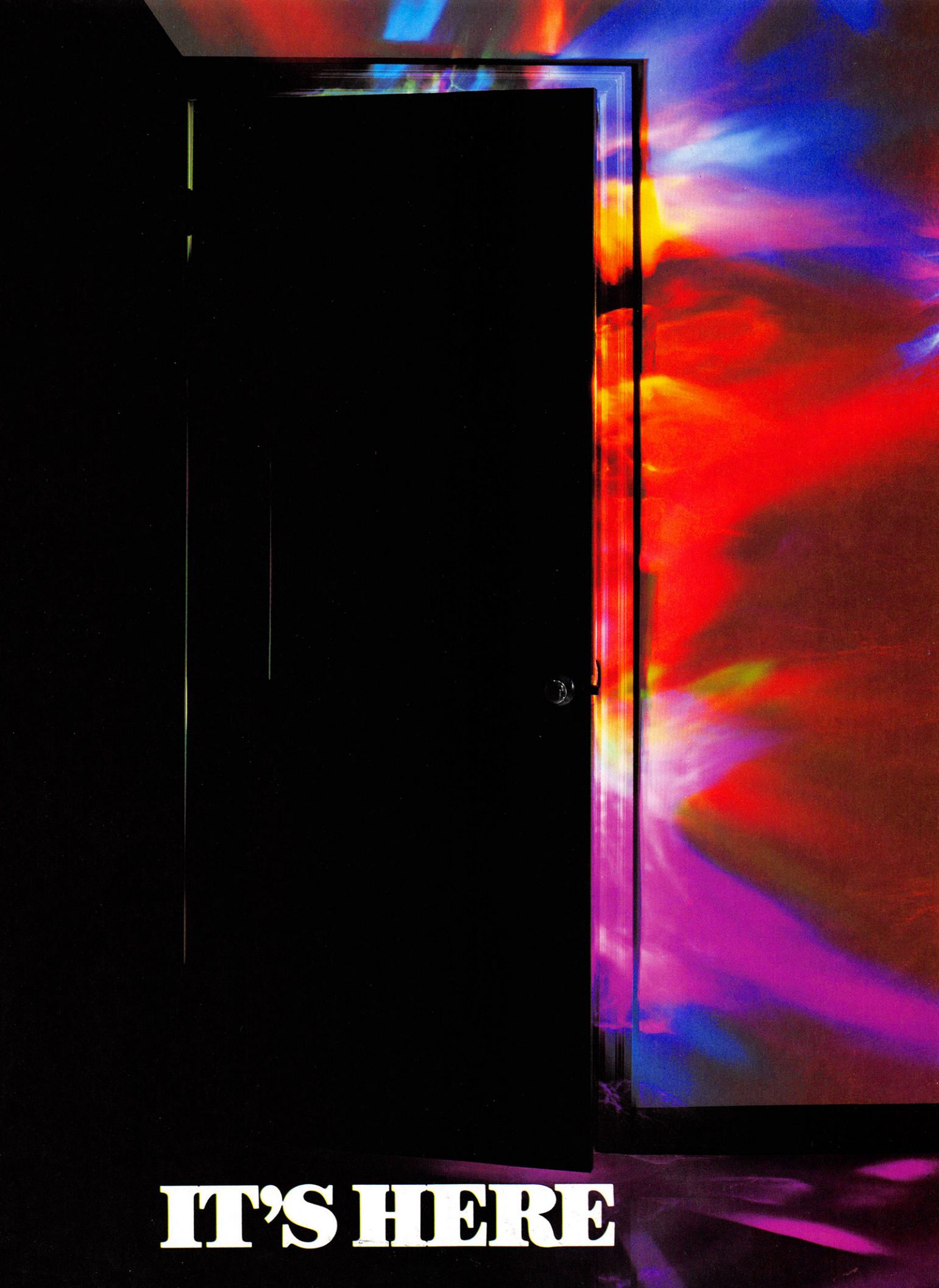
130,000 computer users, offers access to more than 80 merchants through its Electronic Mall service. Firms like WaldenBooks, American Express, Commodore, McGraw-Hill, Microsoft, and American Airlines are part of the system.

The Electronic Mall is open 24 hours a day, seven days a week. The on-line catalog contains not only descriptions of each product, but also a "mailbox" which allows you to query merchants for more details. Shipping information and order forms are also part of the Mall system.

Sometimes, though, as this infant industry continues to mature, the terminology can become more confusing than the actual services themselves. For instance, terms such as *teletext*, *videotext*, *videotex*, and *viewdata* are being used in a multitude of ways, some inappropriately, to describe how your computer can communicate with other computers.

Teletext generally refers to the transmission of information to your computer screen or TV set via a standard broadcast signal, giving you access to that information without letting you fully *interact* with what you see. For example, some data base services might let you receive encyclopedia information. You can control what you see and the speed at which you view it, but you can't ask questions and get responses. What you see is what you get—basically a one-way link.

Videotex—sometimes referred to as *videotext* or *viewdata*—is interactive. What you see is just a starting point for what you can get by using your computer to talk to the remote computer, usually a mainframe system. Thousands of people can communicate with the mainframe at the same time. Examples of these interactive, or two-way, videotex systems


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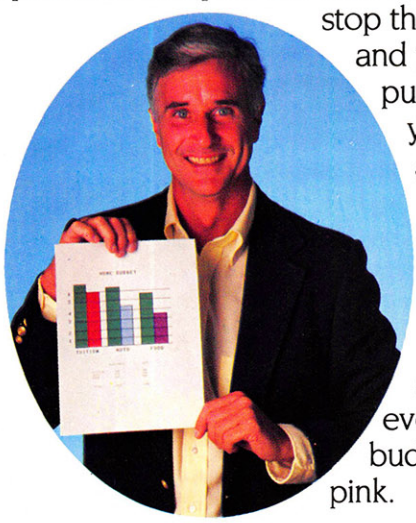
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QUESTIONS & ANSWERS

Q: Why do I need a printer?

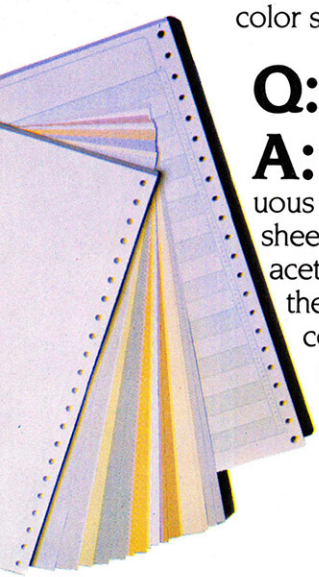
A: You might as well ask, "Why do I need crayons?" When it comes to communicating, "putting it on paper" is still the best way to get your message across. You can have lots of computer equipment, but without the OKIMATE 10, it doesn't mean very much. Unless you get your letter, report, term paper or party invitation off the screen and down on paper, nobody's going to see it.

Q: What makes the OKIMATE 10 better than any other printer?

A: Because the OKIMATE 10 is unlike any other printer. First, it prints in COLOR. Up to 26 beautiful colors. Second, it prints up to 240 words a minute, so quietly you can talk in a whisper right next to it and still hear every word! And third, it prints letter quality, every time.

Q: What about graphics and pictures?

A: The OKIMATE 10 does it all. Graphs, charts, symbols, pictures, illustrations, and special drawings! With a compatible drawing package, anything you create on your screen can be printed in full color; a disk drive is required for color screen printing.



Q: What kind of paper can I use?

A: Just about any kind of smooth paper you want. From continuous feed computer paper to single sheets. From mailing labels to plastic acetate for overhead transparencies, the OKIMATE 10 prints crisp, clean, colorful images you'll be proud to send to friends, teachers, business associates, or frame and hang right in your own living room!



Q: Is the OKIMATE 10 easy to use?

A: As easy as "PLUG 'N PRINT!" No other printer is easier to use than the OKIMATE 10. Connecting the printer to your Commodore or Atari computer is, literally, a snap. The exclusive PLUG 'N PRINT package snaps into the printer. One cable connects it directly to your computer or disk/tape drive. Turn it on and you're in business. Once your OKIMATE 10 is up and running, the "Learn-to-Print" software program (included) teaches you printer basics—the "Color Screen Print" disk (also included) automatically prints everything on the screen in a single stroke. As a matter of fact, most of your printing can be done with just one command.

Q: What's the printer like in operation?

A: In one word: easy! Incredibly easy! The ribbon comes in a "Clean Hands" cartridge. So it's as easy to change as the tape in your audio cassette player.



Q: What about reliability?

A: Okidata has built the reputation of its complete line of printers on quality, dependability and rugged construction. The OKIMATE 10 is no exception. Don't let its light weight and compact size fool you. This printer is not a toy. It's a workhorse.

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include home banking, services which let you buy stocks and bonds and make other financial transactions, on-line computer games, and electronic shopping.

Telecommunications experts are convinced that teletext will be a widespread, though limited, mass-market technology since it can be made inexpensive. There is disagreement, however, about how widespread the penetration of videotex will be. Will it become a mass-market service?

"That depends on how you define *mass*," says Gary H. Arlen, head of Arlen Communications, Inc., a Washington, D.C., research firm specializing in electronic communications. The publisher of *Videotex/Teletext News*, Arlen predicts that videotex will come into its own in the late 1980s.

"It's going to be widespread and cut across a number of lines," he says.

But that doesn't mean, he cautions, that the great majority of American people who now have televisions will have access to videotex in the same way. There are limiting factors—chiefly cost and functionality—which to some extent will control the spread of videotex systems.

"The biggest problem in that whole general industry is that they've been mostly selling the glitter of this new technology—which really isn't a new technology—without bothering to explain to people in any real way why they would want to subscribe," says Steven Weissman, a videotex expert and the director of information services analysis for the market research firm of International Resource Development, Inc.

"The whole utility of it has been largely ignored until recently," says Weissman. "They love what the concept embodies—as do I. But as a consumer, Nick Wreden of Hayes Microcomputer Products, Inc., a pioneer in sophisticated modems for personal computers. "They're not just scared of a modem, they're scared of everything connected with a computer."

"Modems, computers—no matter how sophisticated we all claim to be—are scary," adds A. W. Johnson, a vice president at Code-A-Phone Corporation. "They take us out and test our ability to learn, our ability to understand new things, and to remember and use the new tools. Risky business, because we might expose our ignorance."

Code-A-Phone makes a new telephone with a built-in modem. It's designed for business use and should help people get used to new technology, says Johnson, because "it's a nice, plain-looking, ordinary telephone that everybody feels comfortable with."

Sounds Or Silence

There are several things to consider before buying a modem. First you'll have to decide which type to get. Modems can be either *acoustic-coupled* or *direct-connect*. Acoustic modems were developed first and used to be cheaper and more popular, but lately direct-connect models have drastically dropped in price and are pushing many acoustic modems off the market.

Acoustic modems have a pair of soft rubber cups into which the telephone handset fits snugly. One cup contains a speaker, which generates the tones to be transmitted over the phone line, and the other cup contains a microphone, which in turn receives the tones sent by the other modem. If you listen closely to an acoustic modem, you can hear the high-pitched whistling of the tones being transmitted.

Acoustic modems have two main drawbacks: Many newer phones have nonstandard handsets which won't fit into the rubber cups; and since acoustic modems depend on a tight seal between the handset and the cups, a poor fit means the telecommunications link can be garbled by outside room noises.

Direct-connect modems bypass the handset and the cups. They connect directly into any modular phone jack and work in total silence. Some direct-connect modems look



Acoustic-coupled modems like this Atari model grip the telephone handset with tightly fitting rubber cups to keep outside noises from interfering with communications.

just because I love it isn't enough to make me go and spend money on it. And a lot of consumers feel the same way."

The AT&T Sceptre terminal required by the Viewtron service costs subscribers $600 each. Though quite sophisticated, the terminal can be used only with the Viewtron system itself. The Sceptre is essentially a videotex graphics decoder which lets the transmitter send high-resolution graphic images rather than the all-text or blocky computer graphics available on conventional computer-based shopping services.

While services such as CompuServe tap into a base of subscribers who already own computers, the hardware requirements for Viewtron and a few other videotex systems mean hefty expenditures of money to get started. The tradeoff, of course, is that with Viewtron an advertiser can present you with high-quality images not yet possible through a system like the Electronic Mall, which depends primarily on text to sell its products.

"The Sceptre terminal being sold in Miami now will never see the light of day outside of Florida," says Gary Arlen. "AT&T admits that. The Model One, as they call it, is very limited—expensive, dumb, it doesn't do very much. At the same time, a lot of software for Commodore computers—as low as sixty bucks for a Commodore and typically two hundred to two hundred and fifty bucks for an IBM PC—does the same kind of thing. The only problem is that the software doesn't fully implement the NATLTS protocol—the presentation-level protocol that the system operators are using.

"The problem with that," explains Arlen, "is that the software may only have a color palette of eight or sixteen colors, depending on the board that you have to put in your PC. If someone wants to advertise something and they want to display their logo, which is in Kodak Yellow, and the software or the board can't display that particular shade of yellow, the advertiser loses interest in offering his material on that system. So, obviously, the Sceptre terminal is dedicated to overcoming that problem."

What results is a classic Catch-22 situation: Advertisers won't advertise unless they can display their products in a sophisticated fashion; system operators can't produce that signal yet without charging subscribers for expensive terminals; and consumers aren't willing to pay that much.

What will solve this problem in the next few years and allow a greater proportion of the population to take part in advanced on-line shopping is the develop-



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ment of cheaper, more flexible hardware and software.

"The most exciting things are those things coming from the electronic imaging world," says Arlen. "There are a lot of folks at IBM, Wang, and DEC [Digital Equipment Corporation], almost everywhere, working on new imaging systems to present photographic quality images rather than the computer graphic images.

"You start doing this with the AT&T concept—that is, with a box, hopefully cheaper, that can be used in connection with a standard TV set. Or more likely—and this is really the key—the digital TV sets that will be coming into the market next year," Arlen adds. "By the time the price comes down a little, and people start buying them—that's three or four years away—the equipment will then be out there to display the kinds of things that electronic marketers want to display."

Despite the so-called high-resolution graphics available on today's personal computers, notes Arlen, when you try to display a picture of the latest Paris fashion, it still looks too much like a dress made out of a child's Lego blocks. Even the Sears, Roebuck catalogs of 80 years ago could plug their products with better pictures.

In the long run, then, today's text-based shopping services will give way to newer technologies.

"I'm impressed with what CompuServe and CompuCard have done, but that isn't for everybody," says Arlen. "It's worse than looking things up in a catalog. It's not as easy as flipping through pages and comparing prices.

"If you know you want to buy a digital watch, say, Seiko model LX2271, or whatever, and you know the model number, you're presented with an array of model numbers. But if you have to start reading and comparing which has the larger readout, which has the light on it, which has a videogame on it, you lose the value [of the system]."

In spite of the limiting factors which Arlen, Weissman, and others mention, they nonetheless have great expectations for the future of videotex. As with most types of computer technology, rapid advances seem to go hand-in-hand with dwindling prices.

And response to the new on-line systems has so far been quite good, says Robert McBride, a senior vice president with Chemical Bank's Pronto Home Information and Banking System, based in New York.

"We just hit the 10,000-subscriber mark toward the end of July, and the rate of new signup has continued at a very good pace," he says. "We are actively pursuing now the



like cartridges and plug into an expansion port on the computer, while others are stand-alone units that hook up between the computer and your phone. There are also internal modems which fit into the expansion slots inside some computers, and modems built into telephones, such as Code-A-Phone's Tel-A-Modem 212A.

Fast Talking

Another factor to consider when buying a modem is the speed at which it communicates. Naturally, faster modems are more desirable, but they also cost more. Modem speeds are expressed in *bits per second* (bps) or *baud rates* (the latter term is technically incorrect but commonly used). Modems for personal computers generally work at either 300 bps (roughly 30 characters per second) or 1200 bps (120 characters per second). Although some very expensive modems can transmit up to 9600 bps, ordinary phone lines have trouble with anything coming over the wires faster than 2400 bps.

Faster modems save money as well as time, because they cut long-distance phone bills and reduce the access time on commercial information services, which charge by the hour. At 1200 bps, words stream by faster than most people can read, so the better terminal programs let you capture everything and save it on your disk drive or printer for later perusal.

High-speed telecommunications in the future will depend on what phone companies can do to fix their lines, some of which have been in use since the 1920s, says Wreden. "As soon as they're upgraded to fiber optics or whatever, then you can speed up your transmission because you cut down line noise and that sort of thing."

For today, 1200 bps seems to be the new standard in offices. When large files are being *uploaded* (sent) or *downloaded* (received), the extra cost of a faster modem can be recovered after just a few long-distance phone calls. But there's still a large market for the slower modems, explains Hussong, especially among home users. "There are too many local bulletin boards, and far too much out there



Direct-connect modems, such as this Volksmodem, plug right into the modular phone jack and are generally more reliable than acoustic modems.

small-business customer and applying the same home banking applications to business accounts. And the reception there has been quite strong."

Although Pronto does not yet offer home shopping services, Chemical Bank is aware of the potential.

"What we envision is that the number of services that can be provided over a network such as Pronto is really mind-boggling and limitless. At this point in time, the on-line securities and investment service seems to be something that is directly applicable to the financial role we play. But certainly telemarketing, shopping, purchasing airline or theater tickets, dictionary services, encyclopedia services—there's just a whole gamut of possibilities."

Pronto users can bank at home, pay bills, transfer funds, determine balances, see electronic statements, track budgets, and balance checkbooks.

Chemical Bank also has licensing agreements with eight other banks, ranging from San Francisco's Crocker National Bank to Bankers Trust of South Carolina.

In the Chicago area, the popularity of the Keyfax Interactive Information Service is being closely watched by videotex observers because of the system's relatively low cost (a $10 to $15 monthly base rate with a one-time $40 software package), and because it is accessible by home computers. In addition to its data base services, financial options, home banking, and educational packages, home shopping will be offered as well.

One indication of things to come is the introduction of a new videotex decoder by Telelogic, Inc., of Cambridge, Massachusetts, shown first at the Videotex 84 trade show last spring. The unit, called Tex, is being sold for

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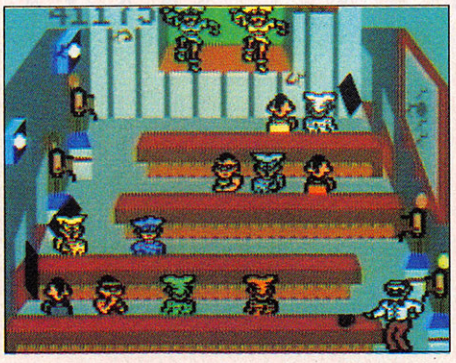
State _____ Zip _____

OUR ARCADE GAMES WE BROUGHT



Bally Midway's Spy Hunter puts you in the driver's seat of the hottest machine on four wheels. You're after enemy spies. The situation is life and death. You'll need every weapon you've got – machine guns, and guided missiles, oil slicks and smoke screens. But the enemy is everywhere. On the road, in the water, even in the air. So you'll have to be more than fast to stay alive in Spy Hunter. You'll need brains and guts, too.

Do you have what it takes?



Bally Midway's Tapper would like to welcome you to the fastest game in the universe.

You're serving up drinks in some of the craziest places you've ever seen. And the service better be good, or else. You'll work your way through the wild Western Saloon to the Sports Bar. From there to the slam dancing Punk Bar and on into the Space Bar full of customers who are, literally, out of this world.!

Are you fast enough to play Tapper? If you have to ask, you probably already know the answer.



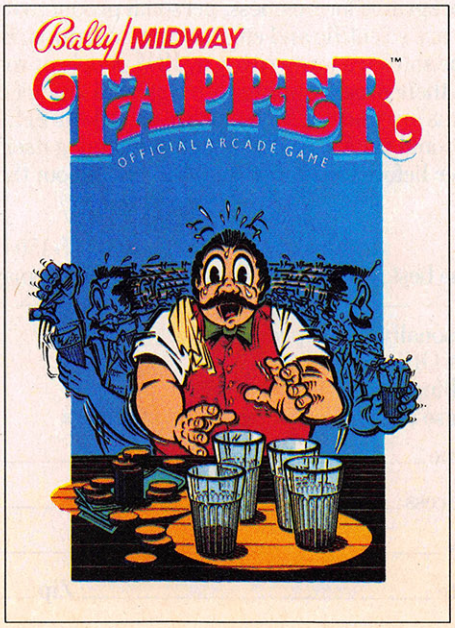
Bally Midway's Up 'N Down by Sega. In this game, a crash is no accident.

In fact, it's the whole object of the game. You'll race your baja bug over some of the worst roads south of any border. Leap dead ends, gaping canyons and oncoming traffic in a single bound. And if anyone gets in your way, crush 'em.

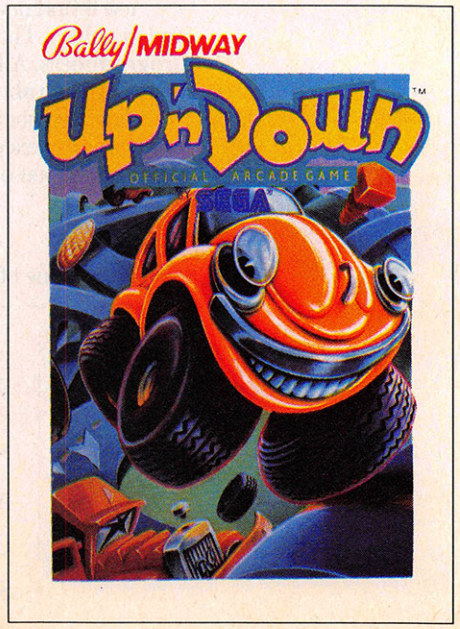
Crashing, bashing Up 'N Down. It's one smash hit that really is a smash.



The #1 Arcade Game of 1984.



Nominated as Most Innovative Coin-Op Game of 1984 by *Electronic Games* magazine.



#1 Arcade Hit, *Play Meter* Conversions Poll, 8/1/84.

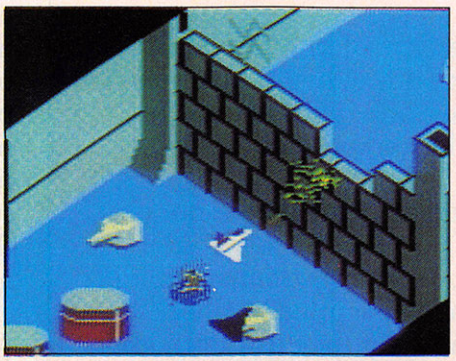
WERE SUCH BIG HITS, THEM HOME.



Sega's Congo Bongo rocked the home game world when it shot up to Number 3 on the Billboard chart this summer.

And now it's available for even more home systems. So check the chart and get ready for jungle action. You'll pursue the mighty ape Congo up Monkey Mountain and across the Mighty River. Do battle with dangerous jungle creatures. Ride hippos, dodge charging rhinos and try to avoid becoming a snack for a man-eating fish.

Congo Bongo. It's fast and it's fun. But be careful. It's a jungle in there.



Sega's Zaxxon. If you haven't played Zaxxon, you must have been living on another planet for the past few years.

And now the ultimate space combat game is available for even more home systems. You'll pilot a space fighter through force fields and enemy fire on your way to do battle with the mighty Zaxxon robot. Countless others have gone before you in this Hall of Fame game. But this time your life is in your own hands.

Zaxxon killed them in the arcades. But compared to what it will do to you at home, that was child's play.

	SPY HUNTER	TAPPER	UP 'N DOWN	CONGO BONGO	ZAXXON
Atari 2600 cartridge	✓ NEW	✓ NEW	✓ NEW	✓	✓
Atari 5200 cartridge				✓	✓ NEW
Atari Computers* cartridge	✓ NEW	✓ NEW	✓ NEW	✓	✓ NEW
Atari Computers† diskette	✓ NEW	✓ NEW	✓ NEW		✓
ColecoVision & ADAM cartridge	✓ NEW	✓ NEW	✓ NEW	✓ NEW	✓
Commodore 64 cartridge	✓ NEW	✓ NEW	✓ NEW	✓	✓ NEW
Commodore 64 diskette	✓ NEW	✓ NEW	✓ NEW	✓ NEW	✓
Apple II, IIe, IIc diskette	✓ NEW	✓ NEW	✓ NEW	✓ NEW	✓
IBM PC diskette	✓ NEW	✓ ** NEW	✓ NEW	✓ ** NEW	✓ ** NEW

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*Atari 400, 800, 600XL, 800XL and 1200XL. (Congo Bongo cartridge: 400, 800 and 800XL.)
†Atari 800, 600XL, 800XL and 1200XL.
**Also available for IBM PCjr.

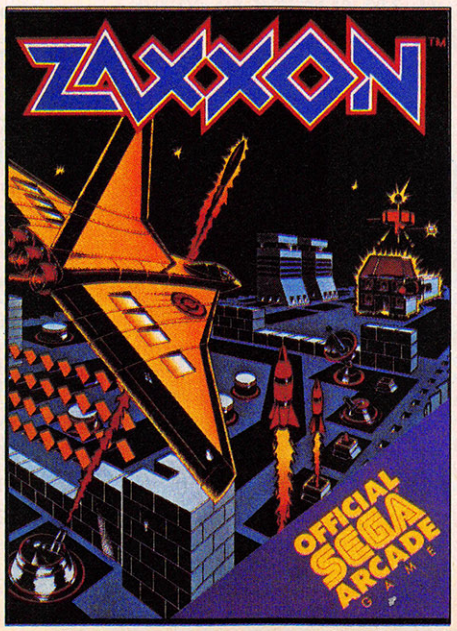
All new games are scheduled to be in your stores for Christmas. Check your local dealer.

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Arcade and Home Smash. Hit #3 on *Billboard* magazine's Top Video Games survey.



One of only ten games ever to make *Electronic Games'* Hall of Fame.

available at 300....If you're only getting on there to talk to some friends, or to read a bulletin board, there's no need to spend the money for a 1200—it's actually more intelligent and economical to be at 300 baud."

Other features that add to the versatility—and price—of a modem are auto-answering (the modem can take phone calls from other computers by itself); auto-dialing (the modem can place calls by itself); auto-redialing (the modem automatically redials a call if the line is busy); and self-testing (the modem makes sure everything is hooked up and working properly).

Another consideration is the type of phone system you have. While some modems work with either Touch-Tone or rotary (pulse) phones, others work only with one or the other. Adapters are available to let certain modems work with certain types of systems.

Like other computer peripherals, modems are not generic items. Some modems plug into RS-232 serial interfaces and will work with a number of different systems, while others are designed only for specific computers. Check advertisements and brochures carefully for this information.

Terminal software usually must be purchased separately, acquired through a user group, or typed in from a book or magazine.

Lower Prices Coming

Modem prices currently range from about $49 to $1000 or more. Last year the least expensive models cost about $80. A few years earlier they were hardly available for less than $200. Competition will continue to drive prices down, Hussong says, and by the end of this year 1200 bps modems should cost around $300–$500. In 1985, he estimates, 1200 bps modems will cost $250–$400 and 2400 bps modems should cost under $1000. A major force behind the lower prices is a new modem-on-a-chip designed by Texas Instruments. More computers are starting to come with built-in modems as a standard feature, too.



Code-A-Phone's Tel-A-Modem 212A is a telephone with a built-in modem and two phone lines for simultaneous voice and data transmissions.

$100 to providers of information services, such as banks, who can then offer the units to their own customers.

Using a Touch-Tone phone, you dial the service you wish to contact and place the phone handset on the Tex decoder. Menus displaying available services appear on your television screen, from which you make selections by using the telephone keypad. The one-piece unit includes a decoder that translates the information transmitted from the host computer plus a modulator which connects to a TV's antenna terminals. The computer service sends the text and graphics over the phone lines to be received and decoded by Tex.

The decoder uses the Prestel graphics protocol, which was developed for Great Britain's commercial videotex services.

The system is as easy to use as a bank's automatic teller machine, says Telelogic President William J. Harris. "This combination of low price and ease of use will help bring videotex technology to a large number of people."

Tex units are being tested already by the National Bank of Detroit for its Video Information Provider (VIP), a telebanking pilot project.

While videotex may still be in its infancy, don't expect it to stay that way for long. The text-based shopping services you can access now will soon be joined by low-cost national videotex systems in just a few years. And telecommunications specialists agree that the market for those services will be the same people who today have been among the first to use personal computers, VCRs, and similar technological advances.

"No one's doing a satisfactory job yet," says Arlen. "But everyone is trying very, very hard." ©

Meet your kid's new teachers.



At first glance, they look like funny creatures right out of a computer game shoot 'em up. But underneath the funny surface, they represent one of the most serious approaches to home education you've ever heard of.

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These amazing teachers are called Tink and Tonk. They come from Sprout. Software for kids 4 to 8.

The beauty of Sprout is how we balance entertainment with a healthy dose of education.

While kids are having fun at home, they're reinforcing what they've learned at school. Things like the alphabet, spelling, vocabulary, counting, adding, and pattern recognition.

You'll also like how Sprout prevents boredom. Our games grow up, instead of wear out. As kids get older, the game gets harder—with many variations and many decisions to make.

Sprout didn't learn how to do all this overnight. You see, we've got a hundred years of experience to lean on. (Our parent company is SFN, the country's #1 textbook publisher for elementary and high schools.)



We've also got the experience of Mercer Mayer, who has written or illustrated 80 children's books. He dazzles kids with ideas and pictures that keep them coming back for more.

So let TINK!TONK!™ software teach your kids. And when they play at the computer, they won't be playing around. They'll be learning something.

sprout

Games that grow up. Instead of wear out.

Compatible with Atari,® Commodore,® Apple,® and IBM.®

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The Bulletin Boarding Of America

Kathy Yakal, Feature Writer

According to dozens of recent magazine and newspaper articles, some psychologists are worried that personal computer hobbyists are spending so much time with their computers that they're becoming isolated from other people and the outside world.

But ironically, communication with people in the outside world is the focus of a fast-growing application for personal computers today: telecomputing. Electronic Bulletin Board Systems (BBS's) are providing a forum for new friendships and the exchange of information between computer owners. And it's a forum not bounded by neighborhoods or physical distances. BBS's offer free public-domain software, technical assistance, and contact with people across the street or across the country.

With the addition of a modem and a simple terminal program, a personal computer can help foster, rather than hinder, communication.

A Grassroots Movement

If you've ever logged on to a major information service such as CompuServe, you were probably overwhelmed by the wealth of menus and features available. A BBS is not nearly that sophisticated, but consider this: Most are operated by average people out of their homes, on equipment they purchased themselves or with a local user group.

The earliest BBS's came online in the late 1970s. Many served as information boards for fledgling user groups. Club officers would post important messages and meeting notices, and store public-domain software for members to download. Some computer stores also set up BBS's to allow customers easy and up-to-date access to prices and inventory information. And a few people—people who were willing to devote their computer system and a lot of time—started boards simply because they enjoyed making it easier for computer owners to get in touch with each other.

Hundreds of boards have come and gone since those early days, but hundreds more remain.

* * *

John Semenek, a Chicago, Illinois computer programmer/analyst, bought an Atari 800 a couple of years ago. Intrigued by its sound and graphics capabilities, he joined a local user group and started looking for Atari bulletin boards in the Chicago area.

He found only one. Now there are at least 20 in that metropolitan area alone, and Semenek's is one of them.

"I started it as a service to our user group, though it's not limited to those people," he says. "It really extends the usage of a home computer." Semenek estimates that if someone normally spends five hours a week with their home computer, buying a modem boosts that figure by about 300 percent.

* * *

If you made a printout of all of the BBS phone numbers

THERE'S A COMPUTER BORN EVERY MINUTE...

GIVE IT A HOME.

For **$89.95** with the CS-1632 you can house your computer, peripherals, and accessories without spending a fortune.



For those with a large computer family the CS-2748 gives you all the room you need for your computer, monitor, printer, peripherals, software, etc. at a price that's hard to believe: **$299.95.**



The CS-1632 computer storage cabinets compact yet functional design fits almost anywhere while housing your computer monitor, joysticks, software, books and peripherals all for only $89.95.
The slide out shelf puts the computer at the right height and position for easy comfortable operation.
The fold up locking door keeps unwanted fingers off the key board when not in use.
To store joysticks just turn them upside down and slide them into the inverted storage rack.
Twist tabs on the back of center panel allow for neat concealed grouping of wires, while power packs rest hidden behind center panel on shelf.
The slide out software tray has room for 14 cartridges or cassettes and up to 30 diskettes. Most brands of software will fit between the adjustable partitions with a convenient hook for the spare key at rear.
Stand fits Atari 400 & 800, Commodore 64 & VIC 20, Ti 99/4A and TRS-80.
Cabinet dimensions overall 36" high x 33-7/8" wide x 16" deep.





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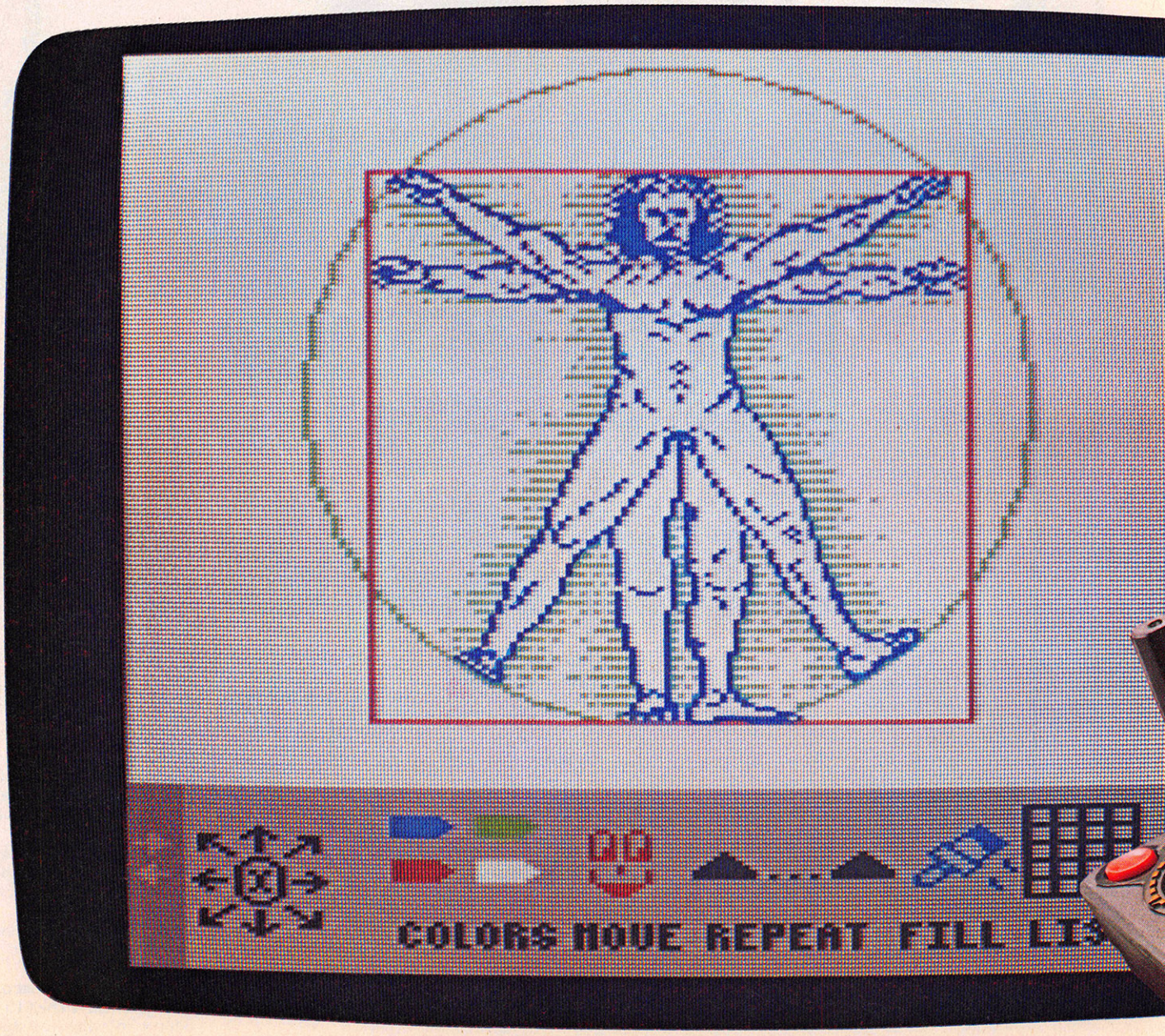
Immediate shipment if in stock. If not, allow 3-4 weeks for delivery. If personal check is sent allow additional 2 weeks. CS-1632 ships UPS freight collect from Oregon. CS-2748 ships by truck freight collect from Oregon. Prices subject to change. Shipment subject to availability.

Both the CS-1632 and CS-2748 ship unassembled in two cartons. Assembly requires only a screwdriver, hammer, and a few minutes of your time.
Choice in simulated woodgrain of warm golden oak or rich natural walnut finish.

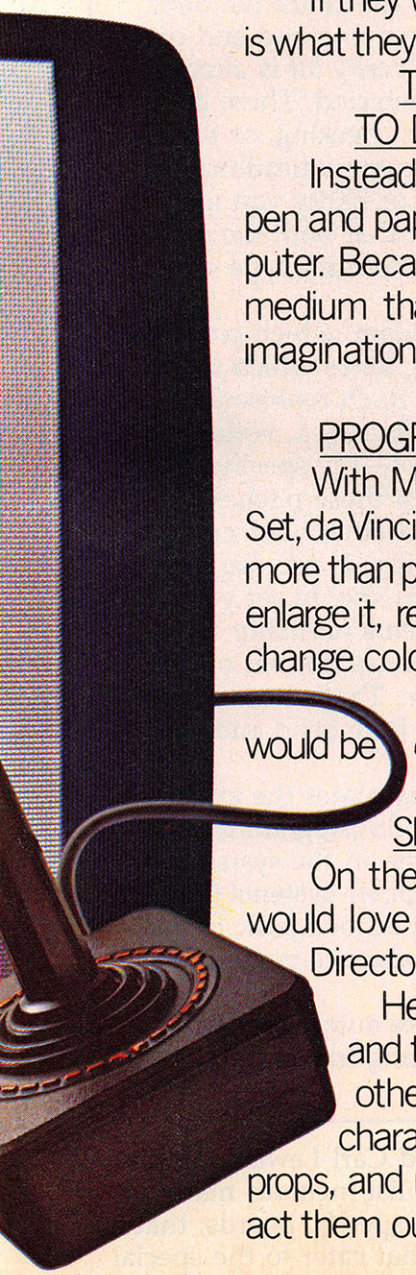
The two slide-out shelves put the keyboard at the proper operating height while allowing easy access to the disk drives.
The bronze tempered glass door protecting the keyboard and disk drives simply lifts up and slides back out of the way during use.
Twist tabs on the back of the center panel allow for neat concealed grouping of wires while a convenient storage shelf for books or other items lies below.
The printer sits behind a fold down door that provides a work surface for papers or books while using the keyboard. The lift up top allows easy access to the top and rear of the printer. A slot in the printer shelf allows for center as well as rear feed printers.
Behind the lower door are a top shelf for paper, feeding the printer, and a bottom shelf to receive printer copy as well as additional storage.
Stand fits same computers as the CS-1632 as well as the Apple I and II, IBM-PC, Franklin and many others.
The cabinet dimensions overall: 39-1/2" high x 49" wide x 27" deep.
Keyboard shelf 20" deep x 26" wide. Disk drive shelf 15-34" deep x 26" wide. Top shelf for monitor 17" deep x 27" wide. Printer shelf 22" deep x 19" wide.

HYTEC SYSTEMS

Computer prog
da Vinci, Shakesp
Al Capp would ha



grams for kids that eare, Dickens and ve loved.



If they were starting out today, this is what they could start with. Pixelwerks.

THE OTHER WAY TO DRAW AND WRITE

Instead of a brush and canvas, a pen and paper, they'd create on a computer. Because Pixelwerks is the first medium that can keep up with their imaginations.

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With Mr. Pixel's Programming Paint Set, da Vinci (or any 8-year old) could do more than paint a picture. He could also enlarge it, repeat it, move it around, and change colors. Instantly.

And at the same time, he would be developing his programming skills. Painlessly.

SHOW DIRECTOR

On the other hand, Shakespeare would love to play around with Show Director.

He'd use it to create plots and think up one scene after another, and he'd get a big cast of characters, lots of backgrounds, props, and musical sound effects to act them out.

BANK STREET STORYBOOK

Dickens wouldn't be able to keep his hands off Bank Street StoryBook by George Brackett.

Not only could he write his own story, but he could also illustrate the scenes and characters he sees in his mind.

MR. PIXEL'S CARTOON KIT

Maybe Al Capp wouldn't be satisfied with cartoons that just sit on the page after he tried Mr. Pixel's Cartoon Kit. Because he could make his cartoons come to life by animating them. His characters could move around, and even react to each other.

Every kid has a touch of creative genius buried inside. The job of Pixelwerks is to bring it out, with more features, more options and more flexibility than other programs.



In short, we supply the tools. Kids supply the imagination.

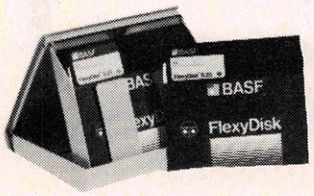
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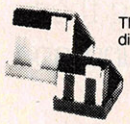
Every once in a while, someone takes the simple and makes it elegant. This unit holds 50 5¼" diskettes, has grooves for easy stacking, nipples to keep diskettes from slipping and several other features. We like it.

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Bulletin Board Basics

Gregg Peele,
Assistant Programming Supervisor

When you press a key to send a character from your computer to another system, you set in motion a series of events.

First, your *terminal software*—the program that tells your computer how to communicate with another computer—sends the character to a device called a UART, which stands for Universal Asynchronous Receiver Transmitter. (The VIC-20 and Commodore 64 computers do not have a UART. Instead, they use special built-in software to emulate a UART.) The UART breaks the eight-bit byte that makes up the character into a serial stream of eight sequential bits, then adds special bits to the character. *Start* and *stop bits* are added to signal the beginning and end of the byte (character) being sent, and the *parity bit* is altered to allow any transmission errors to be detected. There are a couple of different systems for this error-checking, or *parity-checking*. Like most other factors in telecommunications, the most important thing is not which type of parity you use (you don't have to use parity at all), but that both the sending and receiving systems agree to use the same type of parity.

All the bits are then sent to the modem, which converts them from their digital form into analog tones which a telephone can transmit. A tone of a certain pitch represents a binary 0, and another tone represents a binary 1. Following the Bell 103 standard for modem *protocol*—the specific rules of the road for communications—both of these pitches are within a specific range determined by whether your modem is set to originate or answer a transmission. If you are linking to a bulletin board system (BBS), you should set your modem to originate. Bulletin board systems normally set their modems in answer mode. Modems use one set of frequencies to listen and another set to talk. That's how a computer can use a single telephone line to both send and receive.

The receiving computer's modem translates the analog tones back into digital data, which the BBS program uses to control some function or print a character on the system operator's (sysop's) screen. If the two computer systems are in *full duplex mode*, then the characters are echoed back to the sender from the receiver. These echoed characters are then printed on the sender's screen.

In *half-duplex*, the characters sent are automatically printed on the sender's screen before being transmitted, but listed on the People's Message Service of Santee, California (619-561-7277), the list would stretch out to about the length of a good Carl Lewis long jump.

The list includes many machine-specific boards; that is, boards that cater to the special

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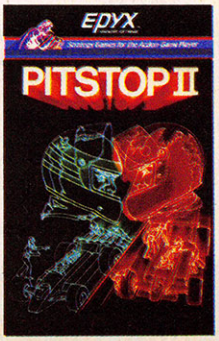
A split screen shows you your position and that of your opponent, a digital clock displays time and a lap counter gives you your race position as you race against each other in pursuit of the checkered flag. You can also play against the computer and take a practice lap or race against the computer controlled pace car as you prepare for real head-to-head competition. Step up to PITSTOP II because auto racing is not a solo sport.

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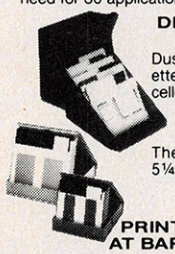
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communication is only one-way; characters are not echoed. Full duplex is considered best since, with half-duplex, there is no direct way to tell whether the other system is receiving you. Full duplex lets you know immediately if your connection is working correctly.

Just as communication between humans requires a common language, the language of computers must be agreed upon by both parties. ASCII (American Standard Code for Information Interchange) is a standard code representing each letter, number, and punctuation mark, plus a few common control keys. The Commodore 64, VIC, and Plus/4 computers use a modified version of ASCII. To access an ASCII BBS system with these computers, you must have a terminal program which translates the normal Commodore codes to ASCII.

Even with such a program, certain incompatibilities may exist between systems which use ASCII. For instance, BBS systems may offer an option for an extra linefeed with each return character. If your terminal program includes a linefeed (moves the cursor down a line) when you hit RETURN, you won't need the extra linefeed. Other characters may also cause problems. The delete character, for instance, which is usually CHR$(127), may be CHR$(20) or even another character on some systems. Hopefully, your terminal program will allow you to alter the characters sent and received so you can match the computer you're communicating with. If you have questions about the codes used with a particular system, leave a note for the sysop. Most sysops are technically proficient and are glad to help you make your system work with their BBS.

Transferring programs and other files over the phone lines (uploading/downloading) is one of the most useful functions of BBS communications. This can be a complex procedure, often requiring a special terminal program designed specifically for a certain type of BBS. These programs are designed to compensate for noise in phone lines which may garble characters.

Often, to insure accuracy, a *checksum* is added to each block of transmitted data. The checksum indicates whether a bit has been scrambled during transmission. If an error occurs, the data is sent again. This process is repeated until the entire file is successfully transferred.

The two communicating computers handle all of this automatically. Such communication between two computers without human intervention is called *handshaking*. In this case, handshaking lets each computer know if the blocks of data were properly sent and received.

Since there are several different file transfer schemes, be sure that your particular program is compatible with the BBS you're calling. Again, the sysop can help you decide on the appropriate program to use with the BBS.

interests of people with Apples or Commodores or Ataris or TIs or IBMs or Radio Shack computers. No matter what kind of computer you have, you can access any of these boards, but you won't be able to download any of the public domain

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software.

There are boards containing nothing but movie reviews, religious boards, "Dial-Your-Match" boards (computer dating services), boards for people who work with CP/M, adventure game boards, boards for lawyers, boards for aviators—boards tailored to just about any special interest.

Most BBS's, however different their reason for existence, follow a similar format. Once you've logged on to a few, you'll begin to recognize the general process of interacting with them, even though commands may differ.

Probably the first thing most people do when they call is check the message files. Nearly all BBS's let users read and write messages to individuals or the general public. In fact, some exist solely for that reason.

Many of the messages are technical queries or requests for information on hardware and software. Some messages advertise items for sale, or items sought. Some are just running conversations between different users. And quite often, one caller will start a debate on some topic that is picked up by others and carried on for weeks.

The second most popular BBS feature, say many sysops (*sys*tem *op*erators), is the ability to upload and download public-domain software. This is especially true on boards run by user groups; instead of standing in a long line at a user group meeting to copy a disk, club members can call the BBS and download that month's offerings.

Other features commonly found on bulletin boards include ads from local computer stores; bulletin sections where callers can post meeting notices or industry news, or call attention to books or magazine articles; "chat mode," or on-line conversation with the sysop if he or she is available; a classified ad section, which allows callers to advertise items for sale or trade; and lists of other BBS's.

* * *

Stan and Susie Subeck recently added an unusual feature to their Chicago-area Atari BBS: an on-line games section. Atari owners can choose from a few adventure games—even a trivia quiz—and play while connected to the board.

"At first, everyone said that would be impossible on an Atari," says Susie. "Actually, it's very simple. It just takes a lot of disk space."

Like many sysops, the Subecks started their bulletin board to provide support to other Atari owners. And, says Susie, as an educational tool for her 12- and 13-year-old children. "The kids have learned a lot about computers by helping with the maintenance on the board."

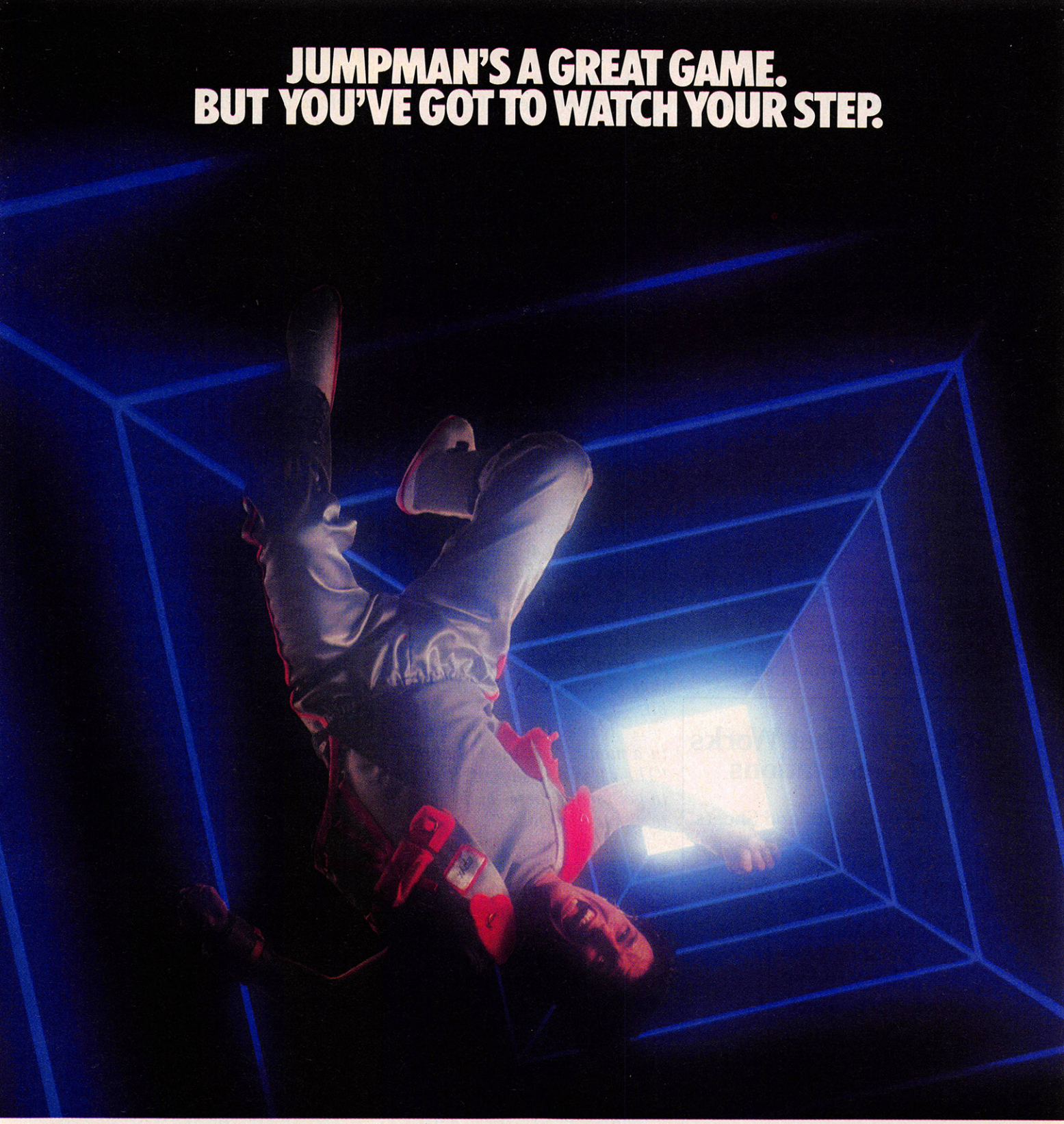
It was their 13-year-old daughter's habit of talking in "Valspeak" (Valley Girl jargon) that sparked an idea for the board's theme. Called "Valley Girl BBS," the Subecks' board has command menus written in Valspeak, as well as a glossary to understanding the Southern California lingo. Callers to this BBS don't delete messages: They "bag" them. And you don't exit the board: you "de-val." Crude callers are "grody" or "nerds."

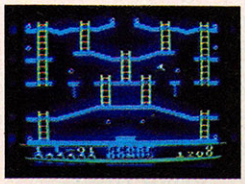
* * *

Try to be patient. BBS's are single-user networks (only one person may be on-line at a time), unlike commercial information services, which are multi-user networks capable of simultaneously handling thousands of callers. When calling a BBS, chances are you'll get lots of busy signals before you get through. A modem with auto-dial and auto-redial can ease the frustration.

Another problem you may encounter is finding numbers of bulletin boards that suit your interests. A good place to start

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Both games force you to make tough choices. Should you avoid that Alienator, climb to the top and try to work your way down, or try to hurdle him and defuse the bombs closest to you before they go off?

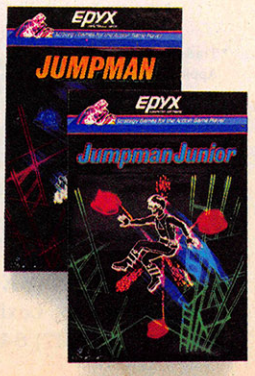
If you move fast you'll earn extra lives. But if you're not careful, it's a long way down.

So jump to it. And find out why Jumpman and Jumpman Jr. are on a level all their own.

One to four players; 8 speeds; joystick control. Jumpman has 30 screens. Jumpman Jr. has 12 screens.

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*1983 C.E.S. award winner.

looking is the People's Message Service mentioned above. The list is several thousand bytes long, so make sure you've got enough file space if you plan to download it. If you want, you can enter your area code and get a list of only those boards in your own region (to avoid a hefty long-distance bill).

Noisy phone lines and faulty hardware or software can give you a screenful of garbage, even on the most reliable boards. If this happens, disconnect and try again, checking to make sure your modem is connected properly. If it persists, wait a couple of days and call back: The sysop may have corrected the problem.

A few words about etiquette: Most BBS's run 24 hours a day, seven days a week, but some don't. Please observe the limited calling hours of those exceptions, and remember to check what time zone you're calling. A phone call from Sacramento to Boston at 9:00 local time may awaken an East Coast sysop out of a midnight slumber. Limited BBS hours usually mean the phone line is also used for business or personal purposes.

Most BBS's don't tolerate obscenity and the uploading of copyrighted software, and sysops are quick to ban such callers from their systems. Many BBS's are switching to closed systems (requiring a password and sometimes a membership fee) for that reason.

* * *

When he wasn't acting in San Francisco Bay area theatrical productions, Kent Fillmore was working as a maintenance man at a local hotel in the late 1970s. The hotel manager was using an Apple for record-keeping, and suggested that Kent play around with it a bit.

"I went through the manual in a month," recalls Fillmore. "Then I said to myself, 'I'm going to get one of these, and I'm going to change my job.' "

Fillmore now does research and development for Pacific Alchemical, a company specializing in educational software and programming utilities. His interest in bulletin boards led him to pitch a proposal for a nationwide network of BBS's to a software retail firm.

The plan is to have one franchise in every area code of the country, a BBS that will offer information on software available through retail company software brokers. It's primarily a commercial venture, but there's a bonus for user groups. Fillmore's system is set up so there can be several boards within one BBS, and he's offering those boards to local user groups to use for their own purposes.

The first BBS in the system, Draco-Net, has been running out of Fillmore's home on an Apple II for about three months now, and he's enjoying the interaction with fellow users. "I honestly don't know what the fascination is with bulletin boards," he says. "It's a whole new way of dealing with people. You can literally create your own personality if you want."

* * *

Sysops spend an average of more than $3000 to put a BBS on-line and an additional $50 per month to keep it running, according to a recent survey conducted by Ric Manning, editor of *Plumb*, a monthly telecommunications newsletter.

Besides this drain on the sysop's wallet, a lot of time is involved. Manning reports that general maintenance, data entry, and other chores can take up to 50 hours a month.

The biggest problem sysops encounter is heavy usage at peak times, which they defined as 6:00 p.m. to 11:00 p.m.

Tim Renshaw, sysop of the AVC Commodore BBS in Indianapolis, Indiana, tells of another problem. "The twits," he says, "the callers who have very little sense of good taste and like to leave obscene messages. That's really tapered off, though. It used to be a daily event."

Hundreds of boards have fallen by the wayside because the scales tipped too far for the sysops: The bad outweighed the good.

But Renshaw and other sysops anticipate even better things over the next year. Things like more graphics, increased storage space (enabling more users, on-line games, and room for more messages and programs), and BBS software that supports a wider variety of communication standards.

Sysops continue to support each other and improve their systems as manufacturers work on the cheaper, faster, easier-to-use modems anticipated in the future. The bulletin boarding of America is well on its way. ©

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Reflection

Sean Puckett

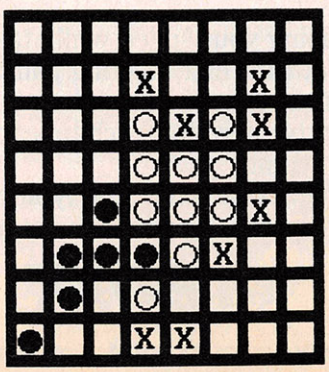
"Reflection" is a fast-paced computer version of reversi. You can play it as a strategy game with two people or challenge the brain of the computer. It was originally written for the Atari (24K), and we've added versions for the Commodore 64, unexpanded VIC-20, TI-99/4A (16K and regular BASIC), Apple, IBM PC (with 64K, BASICA, and the color/graphics adapter), PCjr (with Cartridge BASIC), and TRS-80 Color Computer (with Extended Color BASIC). A joystick is required for the Atari, 64, VIC, and Color Computer.

Through the ages, people have devised many pastimes to exercise their minds. The most well-known match of wits is chess, with backgammon and checkers running close behind. Another board game, reversi, is not as popular, but combines the logic of these games with the action and excitement of a good football game.

The trouble is, some players can become so excited that they tend to get carried away and attempt a forward pass with the board, or they fumble and scatter the chips everywhere (a method most often employed by sore losers). A computer version of reversi is ideal. The computer can act as a referee, permitting only legal moves, or it can be a ruthless opponent.

"Reflection" gives you the option of playing either way—against another person or against the computer. The rules are quite simple. Players take turns placing chips on the board, one piece per turn. To capture your opponent's pieces, you sandwich a row of them between one of your existing pieces and the one you're laying down. You can capture one or several pieces this way. The row can be vertical, horizontal, or diagonal. Once a piece is captured, it turns into your color and effectively becomes one of your pieces.

In this example, the black player can capture pieces by placing one of his chips on any spot marked here with an X:



The best move is either the one that captures the most pieces, or the one which leaves your own pieces less vulnerable—depending on the stage of the game. Sometimes you can place a single piece to capture more than one row of chips. Each player must capture at least one enemy piece per turn, or the turn is forfeited. When all of one player's pieces have been captured, or when neither player can make a legal move, the chips are tallied and the victory is awarded.

Because capturing an enemy piece converts it to your color, the game can reverse directions very quickly. A winning player can suddenly find himself far behind, with most of his chips flipped to the opponent's color.

Playing Reflection

The Atari version of Reflection uses one or two joysticks. You can play against another player or against the computer, and you can select whether black or white moves first. Move the large cursor with the joystick, then press the button to place your piece. You can put down only one piece per move, and only on empty squares. If you place your chip so it doesn't capture any enemy pieces, the program removes the piece and you forfeit your turn. You must purposely forfeit in this way if you can't make a legal move. If neither player can make a move, press E on the keyboard to end the game.

All other versions except the VIC version play much like the Atari version, but have extra options. When playing against the computer, there are two levels of computer intelligence. Level two plays better, but naturally it takes longer for the computer to make up its mind.

These versions also let you set up the board prior to play. On all computers except the Color Computer, press W to set down a white chip, B for a black chip, and space to skip a square. You continue left to right, top to bottom, until you reach the lower-right corner. On the Color Computer, use a joystick plugged into port 2 to move to any square, where you type W for a white chip, B for a blue chip, or space bar to leave an empty square.

The 64 version of Reflection requires a joystick plugged into port 2. The VIC-20 uses a single joystick for both players. Both the Apple and IBM versions use a diamond-shaped arrangement of keys to move the cursor: I for Up, M for Down, J for Left, and K for Right. The TI-99/4A version uses the arrow keys E, S, D,

and X. When you've moved the cursor to the desired position, press the space bar to place your piece. As with the Atari version, you forfeit your turn and lose the piece if you place it so that no enemy pieces are captured. Press Q to end the game on the TI-99/4A, and E for all other versions.

Before loading the Apple version, first enter this direct statement:

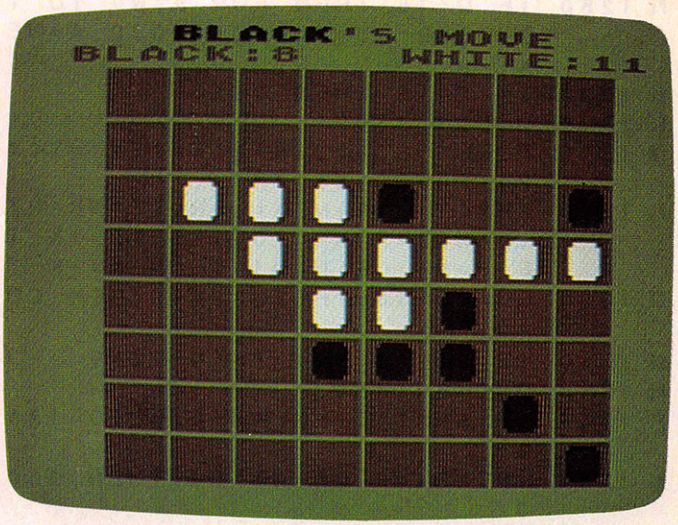
```
POKE 104,64: POKE 16384,0: NEW
```

Similarly, enter PCLEAR 1 before loading the Color Computer version.

Program 1: Reflection For Atari

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
ML 1000 N1=1:N2=2:N0=0:N3=3:N4=4:N
        5=5:N6=6:N7=7:N8=8:N9=9:O2
        =N2
BB 1009 GRAPHICS 23:POKE 708,20:PO
        KE 709,0:POKE 710,15:POKE
        712,198:POKE 711,30:GOSUB
        1950:GOSUB 1720:UI=N1
LE 1010 DL=PEEK(560)+256*PEEK(561)
        :POKE DL+N3,70:POKE DL+N6,
        N6:DIM M$(40):DL=DL+UI:H=I
        NT(DL/256):L=DL-H*256
GI 1011 M$="{5 SPACES}reflection
        {5 SPACES}":GOSUB 1940
EF 1020 M$="{4 SPACES}press start
        ":POKE 560,L:POKE 561,H
CI 1030 COLOR UI:FOR A=N1 TO 88:PL
        OT 16,A:DRAWTO 142,A:NEXT
        A
EL 1040 DIM X(N8),Y(N8):Z=UI:COLOR
         0:FOR A=N1 TO 88 STEP 11:
        Y(Z)=A+N2:Z=Z+UI:PLOT N0,A
        :DRAWTO 142,A:DRAWTO 146,A
        +4:NEXT A
KC 1050 Z=UI:FOR A=16 TO 142 STEP
        16:X(Z)=A+N4:Z=Z+UI:PLOT A
        ,UI:DRAWTO A,88:DRAWTO A+4
        ,92:NEXT A
JI 1051 COLOR N0:PLOT 143,N1:DRAWT
        O 143,89:DRAWTO 0,89
LN 1060 DIM BO(N9,N9)
BI 1070 FOR A=N0 TO N9:FOR B=N0 TO
         N9:BO(A,B)=N0:NEXT B:NEXT
         A
KC 1080 RESTORE 1080:FOR A=N1 TO N
        4:READ B,C,D:BO(B,C)=D:NEX
        T A:GOSUB 1810:DATA 4,4,2,
        5,5,2,4,5,3,5,4,3
OD 1090 GOSUB 1940:E=PEEK(711)
BG 1110 IF PEEK(53279)=N6 THEN FOR
         A=53248 TO 53251:POKE A,N
        0:NEXT A:GOTO 1130
MA 1120 GOTO 1110
AJ 1130 M$="{4 SPACES}<O>NE PLAYER
        {8 SPACES}<t>wo player":GO
        SUB 1940
JE 1132 OPEN #UI,12,0,"K:":GET #UI
        ,K:IF K=79 THEN PL1=1:GOSU
        B 2100
AC 1140 M$="{3 SPACES}<W>HITE FIRS
        T{7 SPACES}<b>lack first":
        GOSUB 1940
CP 1150 GET #UI,K:IF K=87 THEN TUR
        N=UI:GOTO 1180
LN 1160 IF K=66 THEN TURN=N2:GOTO
        1180
KF 1170 SOUND N0,255,10,15:POKE 53
        768,UI:FOR D=UI TO 500:NEX
        T D:SOUND N0,N0,N0,N0:GOTO
         1150
CO 1180 MOVE=N4:M$="  use joystick
         to{7 SPACES}move cursor"
        :GOSUB 1940:FOR D=N1 TO 10
        00:NEXT D:NW=N2:NB=N2
AG 1190 M$="  press trigger to
        {6 SPACES}enter move":GOSU
        B 1940:FOR D=UI TO 500:NEX
        T D:DIM F$(10):F$="WHITEb l
        ack"
NE 1200 M$(1)=" ":M$(40)=" ":M$(2)
        =M$:XP=4:YP=4:M$="
        {4 SPACES}":M$(5)=F$(TURN*
        5-4,TURN*5):M$(10)="'S MOV
        E":M$(22)="BLACK:"
HB 1210 M$(28)=STR$(NB):M$(32)="WH
        ITE:":M$(38)=STR$(NW):GOSU
        B 1940:DATA 243,1,121,4
ON 1215 IF TURN=2 AND PL1 THEN GOS
        UB 2200:GOSUB 1355:GOTO 13
        47
PO 1220 RESTORE 1210:IF TURN=N2 TH
        EN RESTORE 1220:DATA 121,1
        ,243,4
DG 1230 TG=N2:GOSUB 1700:CO=N8:GOS
        UB 1690:F=N1:K=N1
GH 1240 POKE 77,N0:Q=STICK(N0):IF
        (Q=10 OR Q=14 OR Q=N6) AND
         (YP>N1) THEN YP=YP-N1
AL 1245 IF PEEK(764)=42 THEN 1600
MP 1250 IF (Q=10 OR Q=11 OR Q=N9)
        AND (XP>N1) THEN XP=XP-N1
BF 1260 IF (Q=N6 OR Q=N7 OR Q=N5)
        AND (XP<N8) THEN XP=XP+N1
PL 1270 IF (Q=N9 OR Q=13 OR Q=N5)
        AND (YP<N8) THEN YP=YP+N1
```



"Reflection," Atari version.

```
PL 1280 IF Q<15 THEN FOR A=N0 TO 1
        2 STEP N3:SOUND 0,0,0,A:NE
        XT A:SOUND 0,0,0,0
ED 1290 IF Q=15 THEN 1310
BE 1300 GOSUB 1690
EH 1310 POKE 53248,48+X(XP):Y1=Y(Y
        P)+P0+20:Y4=YP
AJ 1320 PM$(Y1,Y1+N7)=CUR$(F*N8-N7
        ,F*N8):POKE 704,CO:F=F+K:I
        F F=N4 OR F=N1 THEN K=-K
CE 1330 CO=CO+16:IF CO=264 THEN CO
        =8
KF 1340 IF STRIG(N0) THEN 1240
BE 1343 GOSUB 1350
PL 1344 IF WW=1 THEN WW=0:GOTO 124
        0
KA 1347 IF NB=N0 OR NW=N0 THEN 160
        0
FM 1348 IF NB+NW=64 THEN 1600
DG 1349 TURN=3-TURN:GOTO 1200
GM 1350 IF BO(XP,YP)>0 THEN RESTOR
        E 1350:TG=3:GOSUB 1700:WW=
        1:RETURN :DATA 162,.5,144,
        .5,243,3
JD 1355 IF DE=1 THEN DE=0:RETURN
AN 1360 BO(XP,YP)=(N3-TURN)+1:B=XP
        :A=YP:MOVE=MOVE+1
KB 1365 GOSUB 1820:GOSUB 1420:GOSU
        B 1450:GOSUB 1520
MA 1380 IF TURN=N1 THEN NW=NW+N1
JI 1390 IF TURN=N2 THEN NB=NB+N1
DD 1400 IF TAKE<>1 THEN RETURN
FN 1401 B=XP:A=Y4:M$="  no piece t
        aken.{3 SPACES}FORFEITURE
         OF MOVE":GOSUB 1940:BO(B,
        A)=0:C=1:CX=X(B):CY=Y(A)
FL 1402 GOSUB 1790:O2=N2:TG=N3:RES
        TORE 1402:GOSUB 1700:DATA
        243,1,243,1,243,4
NE 1403 FOR D=N1 TO 500:NEXT D:IF
        TURN=N1 THEN NW=NW-N1
CH 1404 MOVE=MOVE-N1:IF TURN=N2 TH
        EN NB=NB-N1
KK 1405 RETURN
HK 1420 FOR A=N1 TO N8:I(A)=N1:NEX
        T A:TAKE=N1
DA 1430 FOR A=N1 TO N8:IF BO(XP+RX
        (A),Y4+RY(A))=N0 THEN I(A)
        =N0
HJ 1435 ZZ=I(A)+ZZ
GD 1440 NEXT A:RETURN
JA 1450 FOR A=1 TO 8:IF I(A)=N0 TH
        EN 1510
BM 1460 FOR B=1 TO 8:X2=XP+RX(A)*B
        :Y2=Y4+RY(A)*B
HO 1470 IF X2<N1 OR X2>N8 OR Y2<N1
         OR Y2>N8 THEN B=10:I(A)=N
        0:GOTO 1500
JC 1480 J=BO(X2,Y2):IF J=E THEN I(
        A)=B:ZZ=ZZ+B-1:B=10:GOTO 1
        500
EB 1490 IF J=N0 THEN I(A)=N0:B=10
EH 1500 NEXT B
GB 1510 NEXT A:RETURN
FL 1520 FOR U=N1 TO N8:IF I(U)<N2
        THEN 1590
JN 1530 FOR V=N1 TO I(U)-N1:B=XP+R
        X(U)*V:A=Y4+RY(U)*V
DI 1540 IF BO(B,A)=N5-E THEN BO(B,
        A)=N5-BO(B,A):GOSUB 1820:T
        AKE=N0:GOTO 1560
EI 1550 NEXT V:NEXT U:RETURN
AB 1560 IF E=N3 THEN NW=NW+N1:NB=N
        B-N1
AB 1570 IF E=N2 THEN NB=NB+N1:NW=N
        W-N1
GD 1580 NEXT V
HM 1590 NEXT U:RETURN
KK 1600 WH=88:BL=88:FOR A=N1 TO N8
        :FOR B=N1 TO N8:C=N1:R=BO(
        B,A)
MD 1610 IF R=N3 THEN BL=BL-N1:COLO
        R N3:PLOT N0,BL:DRAWTO N4,
        BL+N1:DRAWTO N9,BL
BB 1620 IF R=N2 THEN WH=WH-N1:COLO
        R 2:PLOT 150,WH:DRAWTO 154
        ,WH+N1:DRAWTO 159,WH
AF 1630 NEXT B:NEXT A
AP 1640 IF WH=BL THEN M$="
        {6 SPACES}Tie Game":GOSUB
        1940:GOTO 1675
EP 1650 Z=710:M$="{5 SPACES}WHITE
        wins!":IF BL>WH THEN Z=709
        :M$="{5 SPACES}black wins!
        "
BL 1660 GOSUB 1940
IN 1670 FOR A=200 TO N0 STEP -4:FO
        R B=A TO A+50 STEP 12.5:PO
        KE Z,B:SOUND N0,B,10,15:NE
        XT B:NEXT A:SOUND N0,N0,N0
        ,N0
BK 1671 DATA 243,2,243,2,217,1,193
        ,1,217,1,243,1,162,2,162,2
        ,162,1,144,1,193,1,182,1,2
        17,2,217,2,217,1,182,1,193
        ,1
AK 1672 DATA 217,1,243,8
JH 1673 O2=N1:RESTORE 1671:TG=19:G
        OSUB 1700:FOR D=N1 TO 500:
        NEXT D:GOTO 1677
JA 1675 DATA 243,1,162,1,193,1,162
        ,1,243,1,162,1,193,1,162,1
        ,243,1,162,1,182,1,193,1,2
        43,8
FA 1676 O2=N1:TG=13:RESTORE 1675:G
        OSUB 1700:FOR D=N1 TO 500:
        NEXT D
CG 1677 D=N1^N1^N1^N1^N1^N1^N1
NL 1678 GOSUB 1690:M$="{4 SPACES}P
        ress start{10 SPACES}or br
        eak":GOSUB 1940
GH 1679 POKE 53248,0:IF PEEK(53279
        )<>6 THEN 1679
ME 1680 RUN
BD 1690 PM$(N1)="{,}":PM$(2048)="
        {,}":PM$(2)=PM$:RETURN
GB 1700 FOR A=N1 TO TG:READ B,C:C=
        C*O2:G=14:FOR Q=N1 TO C:FO
        R D=N1 TO 4:SOUND 0,B,10,G
        :G=G-(G>0)
OK 1710 NEXT D:NEXT Q:NEXT A:RETUR
        N
```

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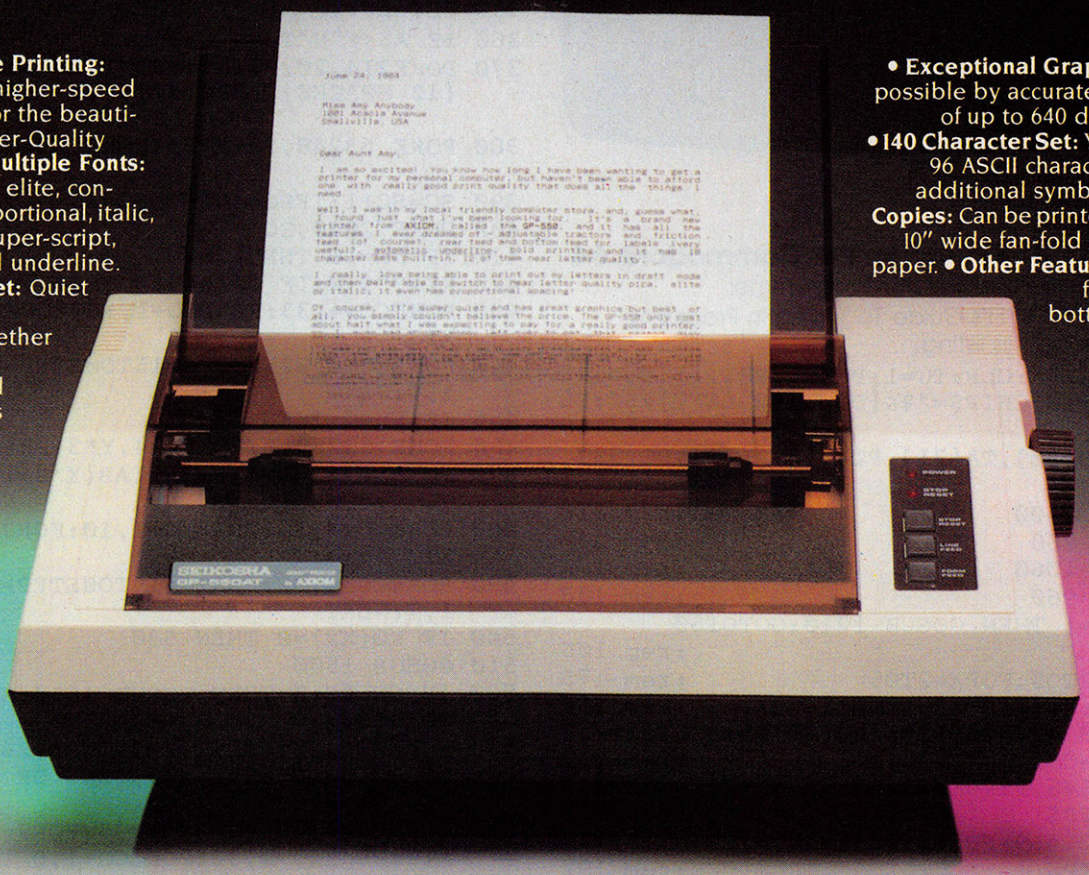
C-11/84

```
JC 1720 DATA -1,-1,0,-1,1,-1,-1,0,
        1,0,-1,1,0,1,1,1
BO 1730 RESTORE 1720:DIM RX(8),RY(
        8),I(8):FOR A=N1 TO 8:READ
         B,C:RX(A)=B:RY(A)=C:NEXT
        A:RETURN
EB 1760 DATA 204,1,217,1,230,4,114
        ,4
IM 1770 TG=21:GOSUB 1700
LA 1780 RETURN
FL 1790 COLOR C:FOR DR=N1 TO N6:PL
        OT CX,CY+DR:DRAWTO CX+N7,C
        Y+DR:NEXT DR:PLOT CX+N1,CY
        :DRAWTO CX+N6,CY
KM 1800 PLOT CX+N1,CY+N7:DRAWTO CX
        +N6,CY+N7:RETURN
DD 1810 FOR A=N1 TO N8:FOR B=N1 TO
         N8:GOSUB 1820:NEXT B:NEXT
         A:RETURN
JO 1820 E=BO(B,A):LOCATE X(B)+N4,Y
        (A)+N4,F
MF 1830 IF F=N1 AND E>N1 THEN GOSU
        B 1900:RETURN
PK 1840 IF F=E OR (F=N1 AND E=N0)
        THEN RETURN
OB 1850 GOSUB 1690:POKE 53249,X(B)
        +48:YP=Y(A)+20+P1:POKE 705
        ,15*(F=N3):R=N4
IG 1860 PM$(YP,YP+N7)=CHIP$(R*N8-N
        7,R*N8):C=N1:CX=X(B):CY=Y(
        A):GOSUB 1790
BG 1870 FOR R=N4 TO N1 STEP -N1:PM
        $(YP,YP+N7)=CHIP$(R*N8-N7,
        R*N8):SOUND N0,R*10,10,D:N
        EXT R
BL 1880 GOSUB 1900
LC 1890 RETURN
JB 1900 GOSUB 1690:POKE 53249,X(B)
        +48:YP=Y(A)+20+P1:POKE 705
        ,15*(E=N3)
GK 1910 FOR R=N1 TO N4:PM$(YP,YP+N
        7)=CHIP$(R*N8-N7,R*N8):SOU
        ND N0,R*10,12,N5:NEXT R
NB 1920 SOUND N0,N0,N0,N0
PO 1930 C=E:CX=X(B):CY=Y(A):GOSUB
        1790:POKE 53249,0:RETURN
OB 1940 POKE 87,N1:POSITION N0,N0:
        ? #6;"{40 SPACES}";:POSITIO
        N N0,N0:? #N6;M$;:POKE 87,
        N7
KP 1941 RETURN
KG 1950 DIM PM$(2048):PM=INT(ADR(P
        M$)/1024)*1024:IF PM<ADR(P
        M$) THEN PM=PM+1024:ST=PM-
        ADR(PM$):POKE 54279,PM/256
AF 1960 POKE 559,46:POKE 53277,N3:
        POKE 623,N1
HF 1970 P0=ST+512:P1=P0+128:P2=P1+
        128:P3=P2+128:DIM CUR$(100
        ),CHIP$(100):PM$(N1)="{,}"
        :PM$(2048)="{,}":PM$(2)=PM
        $
FH 1980 CUR$="{BACK S}{6 E}
        {BACK S}{,}{BACK S}BBBB
        {BACK S}{3 ,}<$$<{5 ,}{2 X}
        {3 ,}"
MK 1990 CHIP$="{3 ,}{2 X}{5 ,}{X}<
        <{X}{3 ,}<{4 BACK S}<{,}
        {BACK S}{6 INSERT}{BACK S}
        "
KC 2000 RETURN
FH 2100 RESTORE 2150:DIM E1(8,8),P
        T(8,8):FOR L=1 TO 8:FOR T=
        1 TO 8
CM 2110 READ A:PT(T,L)=A:NEXT T:NE
        XT L
KF 2120 RETURN
DM 2150 DATA 16,-6,6,2,2,6,-6,16,-
        6,-12,-2,-2,-2,-2,-12,-6
FJ 2160 DATA 6,-2,6,2,2,6,-2,6,2,-
        2,2,1,1,2,-2,2
FK 2170 DATA 2,-2,2,1,1,2,-2,2,6,-
        2,6,2,2,6,-2,6
DP 2180 DATA -6,-12,-2,-2,-2,-2,-1
        2,-6,16,-6,6,2,2,6,-6,16
KL 2200 E=2:HI=-32000:FOR Y4=1 TO
        8:FOR XP=1 TO 8
AB 2210 IF BO(XP,Y4)>0 THEN 2290
EO 2220 ZZ=0:GOSUB 1420:IF ZZ=0 TH
        EN 2290
FC 2230 ZZ=0:GOSUB 1450:IF ZZ=0 TH
        EN 2290
AN 2240 TT=NW+NB:QW=(TT/8)*(ZZ-1)+
        PT(XP,Y4)*((65-TT)/8)
MK 2250 IF QW>HI THEN HI=QW:H1=XP:
        H2=Y4:GOTO 2290
FI 2265 IF HI=0 THEN 2290
AK 2270 IF QW/HI>0.8 AND QW/HI<1.2
         THEN TR=INT(RND(1)*2)+1
HH 2280 IF TR=1 THEN TR=0:HI=QW:H1
        =XP:H2=Y4
BF 2290 ZZ=0:NEXT XP:NEXT Y4
JP 2300 IF HI=-32000 THEN TAKE=1:D
        E=1:M$="NO POSSIBLE MOVES.
        ":GOSUB 1940:FOR I=1 TO 10
        00:NEXT I
DB 2310 IF (H1=1 OR H1=8) AND (H2=
        1 OR H2=8) THEN GOSUB 2350
FH 2320 XP=H1:YP=H2:Y4=H2:RETURN
PF 2350 IF H1=1 AND H2=1 THEN 2450
PJ 2360 IF H1=1 AND H2=8 THEN 2500
PP 2370 IF H1=8 AND H2=1 THEN 2550
ML 2380 FOR I=3 TO 8:PT(I,7)=I-3:N
        EXT I
MM 2390 FOR I=3 TO 8:PT(7,I)=I-3:N
        EXT I
KG 2400 RETURN
MD 2450 FOR I=1 TO 6:PT(2,I)=6-I:N
        EXT I
ME 2460 FOR I=1 TO 6:PT(I,2)=6-I:N
        EXT I
KN 2470 RETURN
ME 2500 FOR I=1 TO 6:PT(I,7)=6-I:N
        EXT I
MG 2510 FOR I=3 TO 8:PT(7,I)=I-3:N
        EXT I
KJ 2520 RETURN
MF 2550 FOR I=3 TO 8:PT(I,2)=I-3:N
        EXT I
MK 2560 FOR I=1 TO 6:PT(7,I)=6-I:N
        EXT I
KO 2570 RETURN
```

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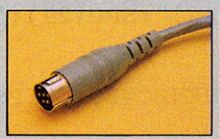
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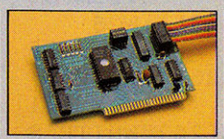
The GP-550 is available with control codes and character set that match with IBM-PC and all of its "Look Alikes." This means that your software, including Lotus 1-2-3, will work with our GP-550 PC model.

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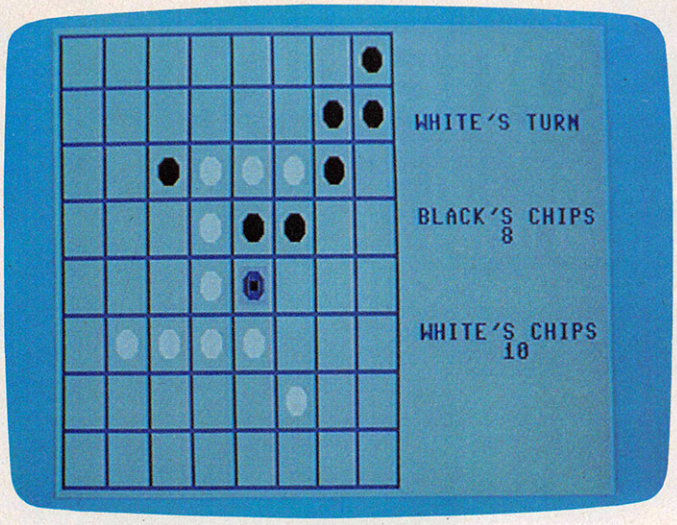

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"Reflection," 64 version.

Program 2: Reflection For Commodore 64

Version By Chris Poer, Editorial Programmer
Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
10 POKE56,56:CLR:TU=1:POKE53281,15:CO=542
   72:SC=13:CHIP$="%&{DOWN}{2 LEFT}#$":PL
   =1                                  :rem 158
20 DIM BO(80),TA(71),PT(71),A(71),PO(80)
                                       :rem 51
30 GOSUB 2500                          :rem 170
40 GOSUB 760                           :rem 129
50 GOSUB 1060                          :rem 172
60 GOSUB 960                           :rem 133
70 IF DE=1 THEN GOSUB 1210:GOTO150
                                       :rem 105
80 FORY=2TO5:FORX=2TO5                 :rem 175
90 READA:PO(Y*9+X)=A:NEXT:NEXT         :rem 159
100 BO(30)=2:BO(31)=1:BO(39)=1:BO(40)=2:B
    C=2:WC=2                           :rem 137
110 POKE646,1:POKE214,9:PRINT:PRINTTAB(10
    );CHIP$                            :rem 189
120 POKE214,9:PRINT:POKE646,0:PRINTTAB(13
    );CHIP$                            :rem 192
130 POKE646,0:POKE214,12:PRINT:PRINTTAB(1
    0);CHIP$                           :rem 232
140 POKE214,12:PRINT:POKE646,1:PRINTTAB(1
    3);CHIP$                           :rem 237
150 FL=1:X=4:Y=4:WC$=STR$(WC)+" ":BC$=STR
    $(BC)+" "                          :rem 203
160 IF TU=1 THEN M$="{BLU}BLACK'S TURN":G
    OTO180                             :rem 169
170 M$="{BLU}WHITE'S TURN"             :rem 237
180 POKE 214,4:PRINT:PRINTTAB(26);M$:POKE
    214,10:PRINT:PRINTTAB(31);BC$      :rem 20
190 IF PL=1THENAL=BC+1:GOTO210         :rem 19
200 AL=WC+1                            :rem 82
210 POKE214,16:PRINT:PRINTTAB(31);WC$
                                       :rem 255
220 POKE214,9:PRINT:PRINTTAB(26)"BLACK'S
    {SPACE}CHIPS"                      :rem 111
230 POKE214,15:PRINT:PRINTTAB(26)"WHITE'S
     CHIPS"                            :rem 193
240 IF CM=1 AND TU=PL THEN GOSUB 1930:GOT
    O450                               :rem 0
250 POKE53269,1                        :rem 44
260 JV=PEEK(56320):FR=JVAND16:JV=15-(JVAN
    D15):S=0                           :rem 162
270 IF JV=1 AND Y>0 THEN Y=Y-1:GOTO320
                                       :rem 84
280 IF JV=2 AND Y<7 THEN Y=Y+1:GOTO320
                                       :rem 89
290 IF JV=4 AND X>0 THEN X=X-1:GOTO320
                                       :rem 86
300 IF JV=8 AND X<7 THEN X=X+1:GOTO320
                                       :rem 85
310 GOTO330                            :rem 99
320 POKECO+4,17:POKECO+1,25:FORI=1TO20:NE
    XTI:POKECO+4,16{6 SPACES}          :rem 191
330 GET A$:IF A$<>"E"THEN 380          :rem 214
340 POKE214,20:PRINT:PRINTTAB(26)"ARE YOU
     SURE";SPC(27);"YOU WANT TO END"
                                       :rem 108
350 GET A$:IF A$="Y" THEN 1740         :rem 224
360 IF A$<>"N"THEN 350                 :rem 96
370 POKE214,20:PRINT:PRINTTAB(26)"
    {12 SPACES}";SPC(27);"{15 SPACES}"
                                       :rem 170
380 POKE 53248,32+X*24:POKE53249,58+Y*24
                                       :rem 145
390 SC=SC+1:IFSC=16THENSC=13           :rem 202
400 POKE 2040,SC                       :rem 75
410 IF FR=16 THEN 260                  :rem 39
420 XY=Y*9+X:IF BO(XY)>0 THEN 260      :rem 84
430 POKECO+4,33:POKECO+1,10:FORJ=1TO50:NE
    XTJ                                :rem 209
440 POKECO+4,32:FOR J=15TO0STEP-1:POKECO+
    1,T:NEXT                           :rem 20
450 IF FL=0 THEN 530                   :rem 238
460 POKE 53269,0:POKE214,Y*3:PRINT:rem 215
470 POKE 646,TU-1:PRINTTAB(X*3+1);CHIP$
                                       :rem 32
480 POKECO+4,33:POKECO+1,10:FORJ=1TO50:NE
    XTJ                                :rem 214
490 POKECO+4,32:FOR J=15TO0STEP-1:POKECO+
    1,T:NEXT                           :rem 25
500 IF PO(XY)=0 THEN 530               :rem 249
510 GOSUB 1500                         :rem 220
520 IF CHIPS>0 THEN GOSUB 1610:BO(XY)=TU:
    GOTO650                            :rem 67
530 POKE214,20:PRINT:PRINTTAB(26)"{BLU}IL
    LEGAL MOVE";SPC(29);"END OF TURN"
                                       :rem 175
540 POKECO+4,33:POKECO+1,5:FORJ=1TO300:NE
    XTJ:POKECO+4,32:POKECO+1,0         :rem 115
550 FORJ=1TO150:NEXTJ                  :rem 53
560 IF FL=0 THEN 630                   :rem 241
570 POKECO+4,33:POKECO+1,10:FORJ=1TO150:N
    EXTJ                               :rem 7
580 POKECO+4,32:FOR J=15TO0STEP-1:POKECO+
    1,T:NEXT                           :rem 25
590 POKE646,15:POKE214,Y*3:PRINT       :rem 168
600 PRINTTAB(3*X+1);CHIP$              :rem 223
610 POKECO+4,33:POKECO+1,10:FORJ=1TO50:NE
    XTJ                                :rem 209
620 POKECO+4,32:FOR J=15TO0STEP-1:POKECO+
    1,T:NEXT                           :rem 20
630 POKE214,20:PRINT:PRINTTAB(26)"
    {12 SPACES}";SPC(29);"{11 SPACES}"
                                       :rem 171
640 GOTO 700                           :rem 106
650 IF TU=1THENBC=BC+CHIPS+1:WC=WC-CHIPS:
    GOTO670                            :rem 20
660 WC=WC+CHIPS+1:BC=BC-CHIPS          :rem 48
670 FORQ=1TO8                          :rem 30
680 IF XY+OF(Q)>-1THEN PO(XY+OF(Q))=1
                                       :rem 124
690 NEXTQ                              :rem 47
700 TU=3-TU                            :rem 134
710 IF WC=0 OR BC=0 OR WC+BC=64 THEN 1740
                                       :rem 78
```

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```
720 GOSUB 750                          :rem 181
730 IF XY=0 OR XY=7 OR XY=63 OR XY=70 THE
    N GOSUB 2350                       :rem 116
740 GOTO 150                           :rem 106
750 FORI=0TO71:TA(I)=0:NEXT:RETURN
                                       :rem 173
760 PRINT"{CLR}{BLK}":PRINTTAB(14)"REFLEC
    TION"                              :rem 20
770 PRINTTAB(10)"{2 DOWN}(W)HITE MOVES FI
    RST"                               :rem 254
780 PRINTTAB(10)"(B)LACK MOVES FIRST"
                                       :rem 185
790 GET A$:IF A$="W"THENTU=2:GOTO810
                                       :rem 62
800 IF A$<>"B"THEN790                  :rem 91
810 PRINTTAB(13)"{2 DOWN}(N)ORMAL BOARD"
                                       :rem 154
820 PRINTTAB(8)"(D)ESIGN YOUR OWN BOARD"
                                       :rem 129
830 GET A$:IF A$="D"THENDE=1:GOTO850
                                        :rem 9
840 IF A$<>"N"THEN830                  :rem 102
850 PRINTTAB(14)"{2 DOWN}(O)NE PLAYER"
                                       :rem 29
860 PRINTTAB(13)"(T)WO PLAYERS"        :rem 102
870 GET A$:IF A$="T"THEN950            :rem 180
880 IF A$<>"O"THEN870                  :rem 111
890 CM=1:PRINTTAB(11)"{2 DOWN}WHAT LEVEL?
     (1-2)"                            :rem 34
900 GET A$:LE=VAL(A$):IFLE<1ORLE>2THEN900
                                       :rem 176
910 PRINTTAB(9)"{2 DOWN}COMPUTER PLAYS (B
    )LACK"                             :rem 148
920 PRINTTAB(9)"COMPUTER PLAYS (W)HITE"
                                       :rem 151
930 GETA$:IFA$="W" THEN PL=2:GOTO950
                                       :rem 50
940 IFA$<>"B" THEN 930                 :rem 92
950 RETURN                             :rem 126
960 A$="{A}**{R}**{R}**{R}**{R}**{R}**{R}
    **{R}**{S}"                        :rem 193
970 B$="-{2 SPACES}-{2 SPACES}-{2 SPACES}
    -{2 SPACES}-{2 SPACES}-{2 SPACES}-
    {2 SPACES}-{2 SPACES}-"            :rem 76
980 C$="{Q}**+**+**+**+**+**+**+**{W}"
                                       :rem 228
990 D$="{Z}CC{E}CC{E}CC{E}CC{E}CC{E}CC{E}
    CC{E}CC{X}"                        :rem 252
1000 PRINT"{CLR}{BLU}":PRINT A$        :rem 112
1010 FORI=1TO7                         :rem 58
1020 PRINTB$:PRINTB$:PRINTC$           :rem 17
1030 NEXTI:PRINTB$:PRINTB$:PRINTD$;
                                       :rem 16
1040 RETURN                            :rem 165
1050 GOTO 1050                         :rem 197
1060 PRINTTAB(11)"{2 DOWN}LOADING IN SPRI
     TES"                               :rem 3
1070 FORI=832TO1024                    :rem 60
1080 READ A:POKEI,A                    :rem 69
1090 NEXTI                             :rem 82
1100 POKE 2040,15:POKE53287,4          :rem 27
1110 IF PEEK(14616)=63 THEN 1150       :rem 102
1120 POKE56334,PEEK(56334)AND254       :rem 13
1130 POKE1,PEEK(1)AND251               :rem 99
1140 FORI=0TO1023:POKEI+14336,PEEK(I+5324
     8):NEXT                           :rem 63
1150 POKE1,PEEK(1)OR4                  :rem 207
1160 POKE56334,PEEK(56334)OR1          :rem 117
1170 FORI=14336+280TO14336+311         :rem 96
1180 READA:POKEI,A:NEXT                :rem 191
1190 POKE53272,(PEEK(53272)AND240)+14
                                       :rem 236
1200 RETURN                            :rem 163
1210 POKE53248,32:POKE53249,58:POKE53269,
     1                                 :rem 98
1220 PRINT"{HOME}{6 DOWN}{BLU}";TAB(26)"T
     YPE (B) FOR":PRINTTAB(27)"BLACK CHIP
     {2 DOWN}"                         :rem 56
1230 PRINTTAB(26)"TYPE (W) FOR":PRINTTAB(
     27)"WHITE CHIP{2 DOWN}"           :rem 91
1240 PRINTTAB(25)"TYPE SPACE FOR":PRINTTA
     B(29)"NO CHIP"                    :rem 27
1250 FORY=0TO7:FORX=0TO7               :rem 15
1260 POKE53248,32+X*24:POKE53249,58+Y*24
                                       :rem 191
1270 GET A$:XY=X+Y*9                   :rem 118
1280 IF A$="W"THENWC=WC+1:BO(XY)=2:GOTO13
     50                                :rem 11
1290 IF A$="B"THENBC=BC+1:BO(XY)=1:GOTO13
     50                                :rem 204
1300 IFA$=" "THEN POKECO+4,17:POKECO+1,25
     :FORI=1TO20:NEXTI:POKECO+4,16:GOTO14
     50                                :rem 207
1310 U=U+1:IFU=6THENU=1                :rem 139
1320 IFU=1THEN SC=SC+1:IFSC=16THENSC=13
                                       :rem 117
1330 POKE 2040,SC                      :rem 126
1340 GOTO 1270                         :rem 203
1350 POKE646,BO(XY)-1                  :rem 181
1360 POKECO+4,33:POKECO+1,10:FORJ=1TO50:N
     EXTJ                               :rem 4
1370 POKECO+4,32:FOR J=15TO0STEP-1:POKECO
     +1,T:NEXT                         :rem 71
1380 POKE214,Y*3:PRINT                 :rem 59
1390 PRINTTAB(X*3+1);CHIP$             :rem 22
1400 POKECO+4,33:POKECO+1,10:FORJ=1TO50:N
     EXTJ                              :rem 255
1410 FORE=1TO8                         :rem 59
1420 POKECO+4,32:FOR J=15TO0STEP-1:POKECO
     +1,T:NEXT                         :rem 67
1430 IF XY+OF(E)>-1THEN PO(XY+OF(E))=1
                                       :rem 142
1440 NEXTE                             :rem 77
1450 NEXTX:NEXTY                       :rem 51
1460 PRINT"{HOME}{6 DOWN}{BLU}";TAB(26)"
     {12 SPACES}":PRINTTAB(27)"
     {10 SPACES}{2 DOWN}"               :rem 1
1470 PRINTTAB(26)"{12 SPACES}":PRINTTAB(2
     7)"{10 SPACES}{2 DOWN}"           :rem 235
1480 PRINTTAB(25)"{14 SPACES}":PRINTTAB(2
     9)"{7 SPACES}"                    :rem 203
1490 RETURN                            :rem 174
1500 CHIPS=0:FORI=1TO8:L=1:V=0:XX=0
                                       :rem 165
1510 V=V+OF(I):IF XY+V>70 OR XY+V<0 THEN
     {SPACE}1550                       :rem 227
1520 IF BO(XY+V)=5 THEN 1550           :rem 215
1530 IF BO(XY+V)=3-TUTHENXX=1:L=L+1:GOTO1
     510                               :rem 164
1540 IF XX=1 AND BO(XY+V)=TUTHENGOSUB1570
                                       :rem 192
1550 NEXT                              :rem 10
1560 RETURN                            :rem 172
1570 W=1:V=0                           :rem 143
1580 V=V+OF(I):TA(XY+V)=TU             :rem 73
1590 W=W+1:IF W <= L-1 THEN 1580       :rem 86
1600 CHIPS=CHIPS+W-1:RETURN            :rem 236
1610 FORI=0TO71                        :rem 112
1620 IF TA(I)=0 OR TA(I)=5 THEN 1720
                                       :rem 47
1630 POKE646,TU-1:L=INT(I/9)           :rem 124
```

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```
1640 POKE214,L*3:PRINT                    :rem 45
1650 POKECO+4,33:POKECO+1,10:FORJ=1TO15:N
     EXTJ                                 :rem 7
1660 POKECO+4,32:FOR J=15TO0STEP-1:POKECO
     +1,T:NEXTJ                           :rem 147
1670 PRINTTAB((I-9*L)*3+1);CHIP$          :rem 53
1680 POKECO+4,33:POKECO+1,10:FORJ=1TO15:N
     EXTJ                                 :rem 10
1690 POKECO+4,32:FOR J=15TO0STEP-1:POKECO
     +1,T:NEXTJ                           :rem 150
1700 BO(I)=TU                             :rem 217
1710 POKECO+4,32:FOR J=15TO0STEP-1:POKECO
     +1,T:NEXTJ                           :rem 143
1720 NEXTI                                :rem 82
1730 RETURN                               :rem 171
1740 PRINT"{HOME}":FORI=3TO24:PRINTSPC(25
     )"{15 SPACES}";:NEXTI                :rem 57
1750 IF BC>WC THEN M$="BLACK":HI=BC:LO=WC
     :GOTO1780                            :rem 179
1760 IF BC<WC THENM$="WHITE":HI=WC:LO=BC:
     GOTO1780                             :rem 214
1770 T1=1:HI=BC:LO=WC                     :rem 251
1780 Z=INT(HI/6):FORY=0TOZ:FORX=26TO31
                                          :rem 162
1790 IF X+Y*6-26=HI THEN X=31:GOTO1840
                                          :rem 103
1800 POKECO+4,33:POKECO+1,X+Y*4:FORJ=1TO5
     0:NEXTJ                              :rem 220
1810 POKECO+4,32:FOR J=15TO0STEP-1:POKECO
     +1,T:NEXT                            :rem 70
1820 IF X+6*Y-26<BC THEN POKE1384+X+Y*40,
     81:POKE55656+X+Y*40,0                :rem 169
1830 IF X+6*Y-26<WC THEN POKE1384+X+7+Y*4
     0,81:POKE55656+X+Y*40+7,1            :rem 132
1840 NEXT:NEXT                            :rem 133
1860 PRINT"{HOME}{3 DOWN}":IF T1=1 THENPR
     INTTAB(28)"TIE GAME":GOTO1880
                                          :rem 116
1870 PRINTTAB(27);M$;" WINS"              :rem 90
1880 PRINTTAB(27)HI;" TO ";LO             :rem 120
1890 PRINT"{5 DOWN}":PRINTTAB(25)"PLAY AG
     AIN Y/N"                             :rem 254
1900 GETA$:IF A$="N" THENPOKE197,0:SYS197
                                          :rem 65
1910 IF A$<>"Y" THEN 1900                 :rem 207
1920 GOTO10                               :rem 102
1930 HY=-32000:POKE53269,0                :rem 155
1940 HI=-32000:FORXY=0TO71                :rem 8
1950 IF BO(XY)>0 OR PO(XY)=0 THEN NEXT:GO
     TO2040                               :rem 181
1960 GOSUB 1500:IFCHIPS=0THENNEXT:GOTO204
     0                                    :rem 106
1970 TT=WC+BC:QW=TT/8*CHIPS+PT(XY)*(65-TT
     )/8                                  :rem 194
1980 IFLE=2ANDCHIPS=A1THENQW=10000:rem 95
1990 IF LE=2 AND REC=0 THEN GOSUB 2110:NE
     XT:GOTO2040                          :rem 161
2000 IF QW>HI THEN HI=QW:H1=XY:NEXT:GOTO2
     040                                  :rem 192
2010 IF HI=0THENNEXTXY:GOTO2040           :rem 168
2020 IF QW/HI>.85 AND QW/HI<1.15THEN ZZ=I
     NT(RND(1)*2):IFZZ=1THENHI=QW:H1=XY
                                          :rem 31
2030 NEXT                                 :rem 4
2040 IF LE=2 AND REC=1 THEN RETURN
                                          :rem 127
2050 IF (HI=-32000 AND LE=1) OR (HY=-3200
     0 AND LE=2) THEN FL=0:CHIPS=0
                                          :rem 122
2060 XY=H1                                :rem 47
2070 IF LE=2 THEN XY=H2                   :rem 239
2080 GOSUB 750                            :rem 230
2090 Y=INT(XY/9):X=XY-Y*9                 :rem 31
2100 RETURN                               :rem 163
2110 A1=AL:FORE=0TO71                     :rem 222
2120 A(E)=BO(E)                           :rem 0
2130 IF TA(E)>0 THEN BO(E)=TA(E):A1=A1+1
                                          :rem 99
2140 NEXTE                                :rem 75
2150 FORQ=1TO8                            :rem 73
2160 IF XY+OF(Q)>-1THEN PO(XY+OF(Q))=PO(X
     Y+OF(Q))+1                           :rem 213
2170 NEXTQ                                :rem 90
2180 BO(XY)=TU                            :rem 68
2190 NW=QW:REC=1:Y1=XY                    :rem 138
2200 TU=3-TU:GOSUB1940:REC=0              :rem 188
2210 QY=NW-HI:TU=3-TU                     :rem 56
2220 IF QY>HY THEN HY=QY:H2=Y1            :rem 16
2230 IF HY=0 THEN 2250                    :rem 92
2240 IF QY/HY>.85 AND QY/HY<1.15 THEN ZZ=
     INT(RND(1)*2):IFZZ=1THEN HY=QY:H2=Y1
                                          :rem 51
2250 XY=Y1                                :rem 65
2260 FORE=0TO70                           :rem 109
2270 BO(E)=A(E):NEXT                      :rem 127
2280 GOSUB750                             :rem 232
2290 FORQ=1TO8                            :rem 78
2300 IF Y1+OF(Q)<0 THEN 2330              :rem 163
2310 IF PO(Y1+OF(Q))=2 THEN PO(Y1+OF(Q))=
     1:GOTO2330                           :rem 84
2320 PO(Y1+OF(Q))=0                       :rem 16
2330 NEXTQ                                :rem 88
2340 RETURN                               :rem 169
2350 IF XY=7 THEN 2410                    :rem 116
2360 IF XY=63 THEN 2440                   :rem 170
2370 IF XY=70 THEN 2470                   :rem 172
2380 FORI=9TO13:PT(I)=15-I:NEXT           :rem 132
2390 FORI=1TO37STEP9:PT(I)=6-INT(I/9):NEX
     T                                    :rem 108
2400 RETURN                               :rem 166
2410 FORI=6TO42STEP9:PT(I)=6-INT(I/9):NEX
     T                                    :rem 102
2420 FORI=16TO12STEP-1:PT(I)=I-10:NEXT
                                          :rem 65
2430 RETURN                               :rem 169
2440 FORI=54TO58:PT(I)=60-I:NEXT          :rem 186
2450 FORI=64TO28STEP-9:PT(I)=INT(I/9)-1:N
     EXT                                  :rem 202
2460 RETURN                               :rem 172
2470 FORI=61TO58STEP-1:PT(I)=I-55:NEXT
                                          :rem 89
2480 FORI=69TO33STEP-9:PT(I)=INT(I/9)-1:N
     EXT                                  :rem 206
2490 RETURN                               :rem 175
2500 FORI=1TO8                            :rem 64
2510 READ A                               :rem 37
2520 OF(I)=A:NEXT                         :rem 239
2530 FORX=0TO71                           :rem 129
2540 READA:PT(X)=A                        :rem 45
2550 NEXTX                                :rem 99
2560 FORI=8TO71STEP9:BO(I)=5:NEXT         :rem 66
2570 FORI=COTOCO+24:POKEI,0:NEXT          :rem 26
2580 POKECO+5,130:POKECO+6,66:POKECO+24,1
     5                                    :rem 194
2590 RETURN                               :rem 176
2600 DATA -10,-9,-8,-1,1,8,9,10           :rem 208
2610 DATA 16,-8,5,2,2,5,-8,16,0,-8,-12,-2
     ,-2,-2,-2,-12,-8,0                   :rem 251
2620 DATA 5,-2,8,2,2,8,-2,5,0,2,-2,2,1,1,
     2,-2,2,0                             :rem 20
2630 DATA 2,-2,2,1,1,2,-2,2,0,5,-2,8,2,2,
     8,-2,5,0                             :rem 21
```

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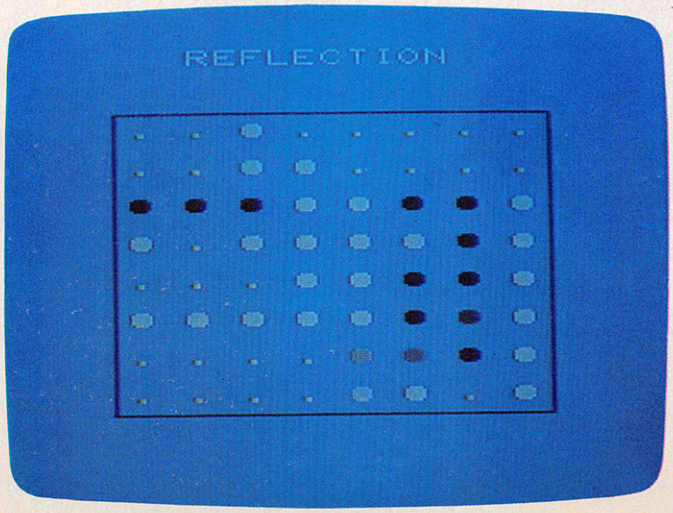
```
2640 DATA -8,-12,-2,-2,-2,-2,-12,-8,0,16,
     -8,5,2,2,5,-8,16,0              :rem 254
2650 DATA0,0,0,0,0,0,0,0             :rem 155
2660 DATA0,0,0,0,15,240,0,15         :rem 110
2670 DATA240,0,12,48,0,12,48,0       :rem 225
2680 DATA12,48,0,12,48,0,15,240       :rem 24
2690 DATA0,15,240,0,0,0,0,0           :rem 59
2700 DATA0,0,0,0,0,0,0,0             :rem 151
2710 DATA0,0,0,0,0,0,0,0             :rem 152
2720 DATA0,0,0,0,0,0,0,235             :rem 3
2730 DATA0,0,0,0,0,0,63,252           :rem 60
2740 DATA0,63,252,0,48,12,0,48       :rem 232
2750 DATA12,0,48,12,0,48,12,0        :rem 173
2760 DATA48,12,0,48,12,0,48,12       :rem 234
2770 DATA0,48,12,0,63,252,0,63       :rem 232
2780 DATA252,0,0,0,0,0,0,0             :rem 8
2790 DATA0,0,0,0,0,0,0,0             :rem 160
2800 DATA0,0,0,0,0,0,0,235             :rem 2
2810 DATA255,255,0,255,255,0,192,3
                                     :rem 184
2820 DATA0,192,3,0,192,3,0,192       :rem 228
2830 DATA3,0,192,3,0,192,3,0         :rem 124
2840 DATA192,3,0,192,3,0,192,3       :rem 233
2850 DATA0,192,3,0,192,3,0,192       :rem 231
2860 DATA3,0,255,255,0,255,255,0      :rem 81
2870 DATA0,0,0,0,0,0,0,0             :rem 159
2880 DATA0,0,0,0,0,0,0,8             :rem 168
2890 DATA63,63,63,63,31,15,7,0,0      :rem 82
2900 DATA252,252,252,248,240,224,0,0
                                      :rem 16
2910 DATA0,0,7,15,31,63,63,63        :rem 182
2920 DATA0,0,224,240,248,252,252,252
                                      :rem 18
2930 DATA 1,1,1,1,1,0,0,1,1,0,0,1,1,1,1,1
                                     :rem 136
```

Program 3: Reflection For VIC-20

Version by John Krause, Assistant Technical Editor

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
10 GOSUB540                          :rem 122
20 IFJ=2ORF=64THEN470                 :rem 2
30 IFC1=1THENC1=2:C2=1:GOTO50        :rem 219
40 C1=1:C2=2                         :rem 100
50 IFC1=1ANDB$="C"THEN270            :rem 155
60 IFC1=2ANDW$="C"THEN270            :rem 178
70 GETA$:IFA$="P"THENJ=J+1:GOTO20    :rem 220
80 POKE37154,127:A=PEEK(37152)AND128:B=(A
   =0)                               :rem 183
90 POKE37154,255:A=PEEK(37151)       :rem 147
100 R=R+((AAND8)=0)-((AAND4)=0)      :rem 124
110 C=C+((AAND16)=0)-B               :rem 121
120 IFR<0THENR=0                     :rem 206
130 IFR>7THENR=7                     :rem 223
140 IFC<0THENC=0                     :rem 178
150 IFC>7THENC=7                     :rem 195
160 B=8079-44*R+C+C                  :rem 219
170 D=PEEK(B):D1=PEEK(B+30720)       :rem 156
180 POKEB+30720,C1-1:POKEB,D+128      :rem 16
190 FORE=0TO99:NEXT                  :rem 193
200 POKEB+30720,D1:POKEB,D           :rem 230
210 FORE=0TO99:NEXT                  :rem 186
220 IF(AAND32)=0THENP=9*(7-R)+C:GOTO240
                                     :rem 247
230 GOTO70                            :rem 53
240 IFB(P)THEN50                     :rem 156
250 GOSUB400:IFNTHENA=P:GOSUB370:POKEL-30
    720,46:POKEL,7:B(P)=0:GOTO50      :rem 1
260 J=0:F=F+1:GOTO20                 :rem 131
270 M=-99:FORE=0TO70:IFB(E)THEN350   :rem 7
280 N=0:FORX=0TO7:A=E:B=0            :rem 251
290 A=A+D(X):IFA<0ORA>70THEN320       :rem 51
300 IFB(A)=C2THENB=B+1:GOTO290         :rem 2
310 IFB(A)=C1THENN=N+B               :rem 29
320 NEXT:IFN=0THEN350                :rem 31
330 N=N+RND(1)*.9:IFF<55THENN=G(E)+G(E)-N
                                     :rem 96
340 IFM<NTHENM=N:P=E                 :rem 16
350 NEXT:IFM=-99THENJ=J+1:GOTO20     :rem 250
360 J=0:F=F+1:GOSUB400:GOTO20        :rem 210
370 POKE36874,230:FORH=0TO99:NEXT:POKE368
    74,0                             :rem 203
380 L=38491+26*INT(A/9)+A+A:POKEL,C1-1
                                     :rem 90
390 B(A)=C1:RETURN                   :rem 59
400 A=P:GOSUB370:POKEL-30720,81      :rem 41
410 N=1:FORX=0TO7:A=P:B=0             :rem 2
420 A=A+D(X):IFA<0ORA>70THEN460       :rem 51
430 IFB(A)=C2THENB=B+1:GOTO420         :rem 1
440 IFB(A)<>C1ORB=0THEN460             :rem 2
450 N=0:A=P:FORE=1TOB:A=A+D(X):GOSUB370:N
    EXT                              :rem 243
460 NEXT:RETURN                      :rem 243
470 FORE=0TO70:IFB(E)=1THENS1=S1+1:rem 29
480 IFB(E)=2THENS2=S2+1               :rem 68
490 NEXT:PRINT"{HOME}{DOWN}{WHT}":IFS1>S2
    THENPRINT" BLACK WINS"S1"TO"S2:GOTO52
    0                                :rem 184
500 IFS1<S2THENPRINT" WHITE WINS"S2"TO"S1
    :GOTO520                         :rem 37
510 PRINT"{4 SPACES}IT'S A DRAW!     :rem 236
520 GETA$:IFA$=""THEN520              :rem 81
530 RUN                              :rem 141
540 FORA=0TO7:READD(A):NEXT          :rem 173
550 DIMB(70),G(70):A=RND(-TI):F=4:POKE368
    78,15                            :rem 76
560 FORA=0TO34:READB:G(A)=B:G(70-A)=B:NEX
    T                                 :rem 3
570 FORA=8TO62STEP9:B(A)=3:NEXT      :rem 176
580 B(30)=2:B(31)=1:B(39)=1:B(40)=2
                                     :rem 232
590 C1=2:C2=1                        :rem 158
600 POKE36879,110:C$="{BLK}BLACK":GOSUB77
    0:B$=A$                          :rem 61
610 C$="{WHT}WHITE":GOSUB770:W$=A$
                                     :rem 180
620 IFZ=0THEN690                     :rem 188
630 PRINT"{CLR}{DOWN}MOVE CURSOR WITH
    {6 SPACES}JOYSTICK."             :rem 125
```



"Reflection," VIC-20 version.

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64K Printer Buffer

- Works with any computer. With standard Centronics parallel interface.
- Works with any printer. Centronics parallel - standard RS 232 Serial - optional

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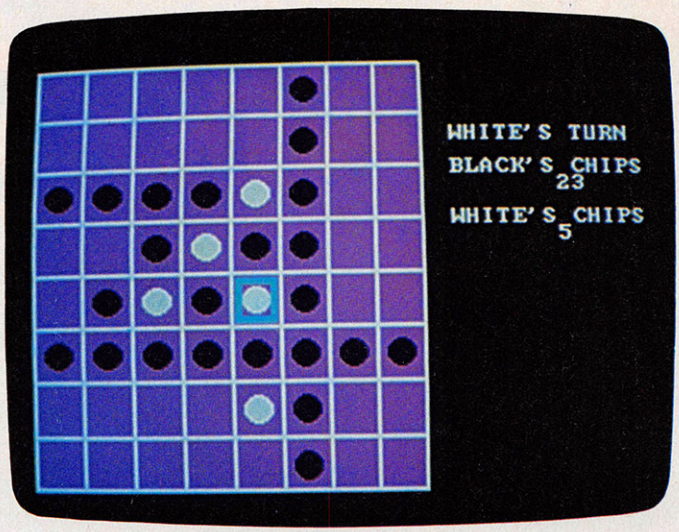
```
640 PRINT"{DOWN}PRESS FIRE BUTTON TO
    {2 SPACES}MAKE YOUR MOVE."     :rem 0
650 PRINT"{DOWN}PRESS P TO PASS."
                                   :rem 226
660 IFZ=2THENPRINT"{DOWN}CURSOR COLOR IND
    ICATESWHOSE TURN."             :rem 115
670 PRINT"{DOWN}PRESS SPACEBAR ..."
                                   :rem 87
680 GETA$:IFA$<>" "THEN680         :rem 156
690 PRINTCHR$(142)"{CLR}{WHT}{5 SPACES}RE
    FLECTION"                      :rem 220
700 PRINT"{2 DOWN}{2 RIGHT}{BLK}{A}******
    *********{S}                  :rem 208
710 FORA=1TO8:PRINT"{BLK}{2 SPACES}-{YEL}
    . . . . . .{BLK}-"             :rem 252
720 PRINT"{2 RIGHT}-"TAB(18)"-":NEXT
                                   :rem 172
730 PRINT"{UP}{2 RIGHT}{Z}**************
    {X}                            :rem 190
740 PRINT"{HOME}{10 DOWN}"TAB(9)"{WHT}Q
    {BLK}Q                         :rem 227
750 PRINTTAB(9)"{DOWN}{BLK}Q {WHT}Q
                                   :rem 244
760 RETURN                         :rem 125
770 PRINTCHR$(14)"{CLR}{WHT}WHO WILL PLAY
     THE"                          :rem 123
780 PRINT"{DOWN}{RVS}"C$"{OFF}{WHT} PIECE
    S?                             :rem 171
790 PRINT"{2 DOWN}{2 RIGHT}{RVS}C{OFF}OMP
    UTER                           :rem 62
800 PRINT"{DOWN}{2 RIGHT}{RVS}H{OFF}UMAN
                                   :rem 47
810 GETA$:IFA$=""THEN810           :rem 85
820 IFA$="H"THENZ=Z+1              :rem 211
830 RETURN                         :rem 123
840 DATA-9,-8,1,10,9,8,-1,-10      :rem 164
850 DATA16,-4,4,2,2,4,-4,16,0,-4,-12,-2,-
    2,-2,-2,-12,-4,0               :rem 189
860 DATA4,-2,4,2,2,4,-2,4,0,2,-2,2,0,0,2,
    -2,2                           :rem 128
```

Program 4: Reflection For IBM PC/PCjr

Version By Chris Poer, Editorial Programmer

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
MJ 5 DEF SEG=0:POKE 1047,64:KEY OFF:WI
     DTH 40:DEFINT A-Z:TU=1:PL=1
NI 10 DIM BO(80),TA(71),PT(71),A(80),P
     O(81),BC(56),WC(56),CU(68)
BI 20 GOSUB 9000
MJ 30 GOSUB 1000
NO 40 GOSUB 3000
MF 50 GOSUB 2000
BC 60 IF DE=1 THEN GOSUB 4000:GOTO 100
LE 70 FOR Y= 2 TO 5:FOR X = 2 TO 5
IL 75 READ A:PO(Y*9+X) = A:NEXT X:NEXT
      Y
NC 80 BO (30)= 2:BO(31)=1:BO(39)=1:BO(
     40)=2:NB=2:NW=2
JN 85 PUT (81,81),WC,XOR:PUT (106,81),
     BC,XOR
OC 90 PUT (81,106),BC,XOR:PUT (106,106
     ),WC,XOR
PF 100 FL=1:X=4:Y=4:NW$=STR$(NW)+"  ":
     NB$=STR$(NB)+"  "
IM 105 IF TU =2 THEN M$="WHITE'S TURN"
     :GOTO 120
EE 110 M$="BLACK'S TURN"
```



"Reflection," IBM PC/PCjr version.

```
MA 120 LOCATE 5,28:PRINT M$
GH 130 LOCATE 7,28:PRINT"BLACK'S CHIPS
     ":LOCATE 8,34:PRINT NB$
GB 140 LOCATE 10,28:PRINT"WHITE'S CHIP
     S":LOCATE 11,34:PRINT NW$
HJ 145 IF PL=1 THEN AL=NB+1:GOTO 150
MO 147 AL=NW+1
NI 150 IF CM=1 AND TU=PL THEN GOSUB 80
     00:GOTO 300
GC 160 PUT (3+X*25,3+Y*25),CU,XOR
GC 170 A$=INKEY$
JN 180 IF A$="I" AND Y>0 THEN Y=Y-1:XX
     =0:YY=1:GOTO 240
LI 190 IF A$="M" AND Y<7 THEN Y=Y+1:XX
     =0:YY=-1:GOTO 240
DD 200 IF A$="J" AND X>0 THEN X=X-1:YY
     =0:XX=1:GOTO 240
DK 210 IF A$="K" AND X<7 THEN X=X+1:YY
     =0:XX=-1:GOTO 240
CN 220 IF A$=" " THEN 270
NN 225 IF A$="E" THEN 800
FA 230 GOTO 170
GP 240 PUT (3+X*25,3+Y*25),CU,XOR
AD 250 PUT (3+(X+XX)*25,3+(YY+Y)*25),C
     U,XOR
FG 260 GOTO 170
II 270 XY=X+Y*9:IF BO(XY)>0 THEN 170
GH 280 PUT (3+X*25,3+Y*25),CU,XOR
OG 300 IF FL=0 THEN 350
FP 305 IF TU=1 THEN PUT (6+X*25,6+Y*25
     ),BC,XOR:GOTO 320
NL 310 PUT (6+X*25,6+Y*25),WC,XOR
MO 320 IF PO(XY)=0 THEN 350
QM 330 GOSUB 5000
MO 340 IF CHIPS>0 THEN GOSUB 6000:BO(X
     Y)=TU:GOTO 420
KH 350 LOCATE 18,27:PRINT"ILLEGAL MOVE
     ":LOCATE 19,27:PRINT"END OF TUR
     N"
QN 360 BEEP:FOR I= 1 TO 2000:NEXT I
MK 370 IF FL=0 THEN 410
FP 380 IF TU=1 THEN PUT (6+X*25,6+Y*25
     ),BC,XOR:GOTO 410
OL 390 PUT (6+X*25,6+Y*25),WC,XOR
KH 410 LOCATE 18,27:PRINT"
```

```
        ":LOCATE 19,27:PRINT"
         ":GOTO 470
NK 420  IF TU=1 THEN NB=NB+CHIPS+1:NW=N
        W-CHIPS:GOTO 440
NM 430  NW=NW+CHIPS+1:NB=NB-CHIPS
KK 440  FOR Q= 1 TO 8
FN 450  IF XY+OF(Q)>-1 THEN PO(XY+OF(Q)
        )=1
CG 460  NEXT Q
DN 470  TU=(TU-2)*-1+1
JD 480  GOSUB 900
GP 490  IF NB=0 OR NW=0 OR NW+NB=64 THE
        N 7000
MG 500  IF XY=0 OR XY=7 OR XY=63 OR XY=
        70 THEN GOSUB 8800
AC 510  GOTO 100
PB 800  LOCATE 18,28:PRINT"DO YOU WANT"
        :LOCATE 19,27:PRINT"TO QUIT (Y/
        N)"
GN 810  A$=INKEY$
OH 820  IF A$="Y" THEN FL=0:GOTO 840
IB 830  IF A$<>"N" THEN 810
LL 840  LOCATE 18,28:PRINT"
        ":LOCATE 19,27:PRINT"
           "
NO 850  IF FL=0 THEN 7000
GM 860  GOTO 170
OL 900  FOR I= 0 TO 70:TA(I)=0:NEXT I:R
        ETURN
PA 1000 CLS:LOCATE 2,14:PRINT"REFLECTI
        ON"
OH 1010 PRINT:PRINT"  USE THE (I-J-K-M
        ) KEYS TO MOVE THE       CURSO
        R  TYPE (E) TO END THE GAME"
CD 1020 LOCATE 7,10:PRINT"(W)HITE MOVE
        S FIRST"
IJ 1030 LOCATE 8,10:PRINT"(B)LACK MOVE
        S FIRST"
ID 1040 A$=INKEY$:IF A$="W" THEN TU=2:
        GOTO 1060
EC 1050 IF A$<>"B" THEN 1040
BA 1060 LOCATE 10,13:PRINT"(N)ORMAL BO
        ARD"
PG 1070 LOCATE 11,8:PRINT"(D)ESIGN YOU
        R OWN BOARD"
DK 1080 A$=INKEY$:Z=INT(RND(1)):IF A$=
        "D" THEN DE=1:GOTO 1100
FG 1090 IF A$<>"N" THEN 1080
KM 1100 LOCATE 13,13:PRINT"(1-2)PLAYER
        S"
DO 1120 A$=INKEY$:Z=INT(RND(1)):IF A$=
        "2" THEN RETURN
DH 1130 IF A$<>"1" THEN 1120
FK 1140 CM=1:LOCATE 16,11:PRINT"WHAT L
        EVEL? (1-2)"
IB 1150 A$=INKEY$:Z=INT(RND(1))
KF 1160 LE = VAL(A$):IF LE <1 OR LE>2
        THEN 1150
CI 1170 LOCATE 18,9:PRINT"COMPUTER PLA
        YS (B)LACK"
OP 1180 LOCATE 19,9:PRINT"COMPUTER PLA
        YS (W)HITE"
EP 1190 A$=INKEY$:IF A$="W" THEN PL=2:
        RETURN
MG 1200 IF A$<>"B" THEN 1190
IC 1210 RETURN
NI 2000 CLS:COLOR 0,1:LINE (0,0)-(199,
        199),2,BF
MO 2010 FOR X = 0 TO 200 STEP 25
EC 2020 LINE (X,1)-(X,200):LINE (X+1,1
        )-(X+1,200)
NA 2030 LINE (0,X)-(200,X):LINE (0,X+1
        )-(200,X+1)
AB 2040 NEXT X
OE 2050 LINE (0,198)-(200,198):LINE (0
        ,199)-(200,199)
JO 2060 RETURN
KM 3000 SCREEN 1:CLS:COLOR 0,1
LB 3005 CLS:LINE (105,105)-(120,120),0
        ,BF
GJ 3010 LINE (105,105)-(121,121),3,B
HA 3020 LINE (104,104)-(122,122),3,B
IH 3030 LINE (103,103)-(123,123),3,B
EC 3040 GET (103,103)-(123,123),CU
NA 3050 CLS
EB 3060 CIRCLE (113,113),7,1
ND 3070 PAINT (113,113),1,1
EM 3080 GET (106,106)-(120,120),WC
MI 3090 CLS:LINE (105,105)-(120,120),0
        ,BF
FK 3100 CIRCLE (113,113),7,2
OB 3110 PAINT (113,113),2,2
LG 3120 GET (106,106)-(120,120),BC
IB 3200 RETURN
BH 4000 LOCATE 4,27:PRINT"TYPE (B) FOR
        ":LOCATE 5,28:PRINT"BLACK CHIP
        S"
IP 4010 LOCATE 8,27:PRINT"TYPE (W) FOR
        ":LOCATE 9,28:PRINT"WHITE CHIP
        S"
HO 4020 LOCATE 12,27:PRINT"TYPE SPACE
        FOR":LOCATE 13,30:PRINT"NO CHI
        P"
GL 4030 FOR Y=0 TO 7:FOR X= 0 TO 7
PH 4050 PUT (X*25+3,Y*25+3),CU,XOR:C=C
        +1
NC 4060 A$=INKEY$:XY=Y*9+X
BJ 4070 IF A$="W" THEN NW=NW+1:BO(XY)=
        2:PUT(6+X*25,6+Y*25),WC,XOR:GO
        TO 4110
FP 4080 IF A$="B" THEN NB=NB+1:BO(XY)=
        1:PUT(6+X*25,6+Y*25),BC,XOR:GO
        TO 4110
EO 4090 IF A$=" " THEN 4130
NN 4100 GOTO 4050
BJ 4110 FOR E = 1 TO 8
DD 4120 IF XY+OF(E) > -1 THEN PO(XY+OF
        (E))=1
EC 4125 NEXT E
NC 4130 IF C/2<>INT(C/2) THEN PUT (X*2
        5+3,Y*25+3),CU,XOR
FP 4140 C=0
EG 4150 NEXT X:NEXT Y
EL 4160 LOCATE 4,27:PRINT"
        ":LOCATE 5,28:PRINT"
         "
CG 4170 LOCATE 8,27:PRINT"
        ":LOCATE 9,28:PRINT"
         "
EB 4180 LOCATE 12,27:PRINT"
           ":LOCATE 13,30:PRINT"
         "
```

```
IC 4200 RETURN
AF 5000 CHIPS=0:FOR I=1 TO 8:L=1:V=0:X
        X=0
JN 5010 V=V+OF(I):IF XY+V>70 OR XY+V<0
         THEN 5040
FN 5015 IF BO(XY+V)=5 THEN 5040
JN 5020 IF BO(XY+V)=3-TU THEN XX=1:L=L
        +1:GOTO 5010
QJ 5030 IF XX=1 AND BO(XY+V)=TU THEN G
        OSUB 5100
GP 5040 NEXT I
JO 5050 RETURN
BJ 5100 W=1:V=0
MC 5110 V=V+OF(I):TA(XY+V)=TU
CH 5120 W=W+1:IF W <=L-1 THEN 5110
KJ 5130 CHIPS=CHIPS+W-1:RETURN
KA 6000 FOR I=0 TO 7:FOR L= 0 TO 7
OC 6010 IF TA(I*9+L)=0 THEN 6050
KO 6020 IF TU=1 THEN PUT (6+L*25,6+I*2
        5),WC,XOR:PUT (6+L*25,6+I*25),
        BC,XOR:GOTO 6040
NL 6030 PUT (6+L*25,6+I*25),BC,XOR:PUT
         (6+L*25,6+I*25),WC,XOR
MF 6040 BC(I*9+L)=TU
KC 6050 NEXT L:NEXT I
JC 6060 RETURN
HF 7000 IF NW>NB THEN A$="WHITE WINS":
        H1=NW:H2=NB:GOTO 7030
LO 7010 IF NB>NW THEN A$="BLACK WINS":
        H1=NB:H2=NW:GOTO 7030
FH 7020 A$=" TIE GAME":H1=NW:H2=NB
FF 7030 LOCATE 18,29:PRINT A$
IJ 7040 LOCATE 19,29:PRINT H1;" TO ";H
        2
CF 7050 LOCATE 21,28:PRINT"PLAY AGAIN
        ?"
JC 7060 A$=INKEY$
KL 7070 IF A$="Y" THEN RUN
MG 7080 IF A$="N" THEN CLS:END
BH 7090 GOTO 7060
KI 8000 HY=-32000
HF 8010 XY=0:HI=-32000:FOR XY=0 TO 70
DC 8020 IF BO(XY)>0 OR PO(XY)=0 THEN G
        OTO 8200
LH 8050 GOSUB 5000:IF CHIPS=0 THEN 820
        0
AE 8060 TT=NB+NW:QW=(TT/8)*CHIPS+PT(XY
        )*(65-TT)/8
LI 8065 IF LE=2 AND CHIPS=A1 THEN QW=1
        0000
AA 8070 IF LE=2 AND REC=0 THEN GOSUB 8
        400:GOTO 8200
EK 8080 IF QW>HI THEN HI=QW:H1=XY:GOTO
         8200
NC 8090 IF HI=0 THEN 8200
CH 8100 IF QW/HI>.85 AND QW/HI<1.15 TH
        EN ZZ=INT(RND(1)*2):IF ZZ=1 TH
        EN HI=QW:H1=XY
PH 8200 NEXT
KI 8210 IF LE=2 AND REC=1 THEN RETURN
KL 8220 IF (HI=-32000 AND LE=1) OR (HY
        =-32000 AND LE=2) THEN FL=0:CH
        IPS=0
HO 8230 XY=H1
OG 8240 IF LE=2 THEN XY=H2
LD 8250 GOSUB 900
KP 8260 Y=INT(XY/9):X=XY-Y*9
KL 8270 RETURN
DM 8400 A1=AL:FOR E=0 TO 71
PL 8410 A(E)=BO(E)
EC 8420 IF TA(E)>0 THEN BO(E)=TA(E):A1
        =A1+1
EL 8430 NEXT E
LM 8440 BO(XY)=TU
MD 8441 FOR Q=1 TO 8
CA 8442 IF XY+OF(Q)>-1 THEN PO(XY+OF(Q
        ))=PO(XY+OF(Q))+1
NO 8443 NEXT Q
AC 8450 NE=QW:REC=1:Y1=XY
MP 8460 TU=3-TU:GOSUB 8010:REC=0
EB 8470 QY=NE-HI:TU=3-TU
GD 8480 IF QY>HY THEN HY=QY:H2=Y1:GOTO
         8550
CP 8490 IF HY=0 THEN 8550
CH 8500 IF QY/HY>.85 AND QY/HY<1.15 TH
        EN ZZ=INT(RND(1)*2):IF ZZ=1 TH
        EN HY=QY:H2=Y1
BD 8550 XY=Y1
JC 8560 FOR E=0 TO 70
NB 8570 BO(E)=A(E):NEXT E
NN 8580 FOR Q=1 TO 8
JA 8590 IF Y1+OF(Q)<0 THEN 8620
OC 8600 IF PO(Y1+OF(Q))=2 THEN PO(Y1+O
        F(Q))=1:GOTO 8620
DL 8610 PO(Y1+OF(Q))=1
MA 8620 NEXT Q
LF 8630 GOSUB 900
KK 8640 RETURN
EB 8800 IF XY=7 THEN 8860
FG 8810 IF XY=63 THEN 8890
MJ 8820 IF XY=70 THEN 8920
PF 8830 FOR I=9 TO 13:PT(I)=15-I:NEXT
        I
GF 8840 FOR I=1 TO 37 STEP 9:PT(I)=6-I
        NT(I/9):NEXT I
KB 8850 RETURN
GO 8860 FOR I=6 TO 42 STEP 9:PT(I)=6-I
        NT(I/9):NEXT I
ML 8870 FOR I=16 TO 12 STEP -1:PT(I)=I
        -10:NEXT I
LK 8880 RETURN
KA 8890 FOR I =54 TO 58:PT(I)=60-I:NEX
        T I
EC 8900 FOR I=64 TO 28 STEP -9:PT(I)=I
        NT(I/9)-1:NEXT I
JH 8910 RETURN
KC 8920 FOR I=61 TO 57 STEP -1:PT(I)=I
        -55:NEXT I
HE 8930 FOR I=69 TO 33 STEP -9:PT(I)=I
        NT(I/9)-1:NEXT
KA 8940 RETURN
GM 9000 FOR I=1 TO 8
NC 9010 READ A
MO 9020 OF(I)=A:NEXT
HL 9040 FOR X =0 TO 71
HL 9050 READ A:PT(X) = A
BO 9060 NEXT X
IL 9070 FOR I= 8 TO 71 STEP 9:BO(I) =
        5:NEXT I
MC 9099 RETURN
OA 9100 DATA -10,-9,-8,-1,1,8,9,10
```

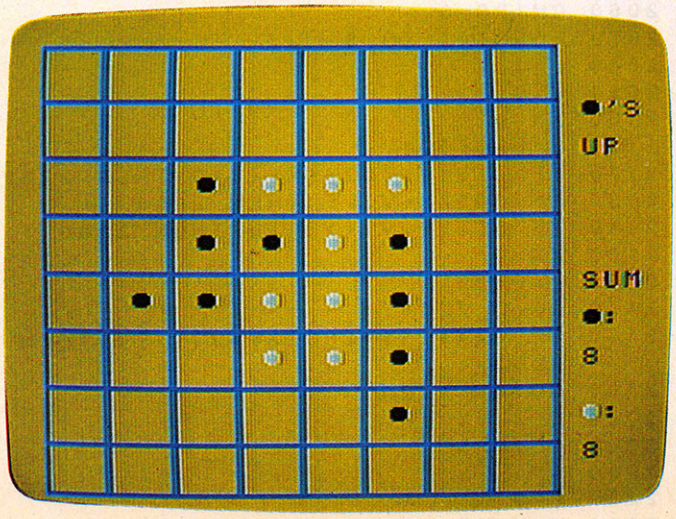
```
QP 9110 DATA 16,-6,6,2,2,6,-6,16,0,-6,
        -12,-2,-2,-2,-2,-12,-6,0
LJ 9120 DATA 6,-2,6,2,2,6,-2,6,0,2,-2,
        2,1,1,2,-2,2,0
BE 9130 DATA 2,-2,2,1,1,2,-2,2,0,6,-2,
        6,2,2,6,-2,6,0
PE 9140 DATA -6,-12,-2,-2,-2,-2,-12,-6
        ,0,16,-6,6,2,2,6,-6,16,0
DF 11000 DATA 1,1,1,1,1,0,0,1,1,0,0,1,
         1,1,1,1
```

Program 5: Reflection For TI-99/4A

Version by Pat Parrish, Programming Supervisor

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
10 DIM BO(80),TA(71),PT(71),A(71),P
   O(80)
20 GOTO 70
30 FOR I=1 TO LEN(A$)
40 CALL HCHAR(R,C+I,ASC(SEG$(A$,I,1
   )))
50 NEXT I
60 RETURN
70 TU=1
80 RANDOMIZE
90 GOSUB 3850
100 GOSUB 1310
110 IF DE=0 THEN 130
120 GOSUB 4090
130 GOSUB 1540
140 IF DE=0 THEN 170
150 GOSUB 1650
160 GOTO 330
170 RESTORE 4080
180 FOR Y=2 TO 5
190 FOR X=2 TO 5
200 READ PO(Y*9+X)
210 NEXT X
220 NEXT Y
230 BO(30)=2
240 BO(31)=1
250 BO(39)=1
260 BO(40)=2
270 BC=2
280 WC=2
290 CALL HCHAR(11,13,128)
300 CALL HCHAR(11,16,120)
310 CALL HCHAR(14,13,120)
320 CALL HCHAR(14,16,128)
330 FL=1
340 X=4
350 Y=4
360 KH=128
370 IF TU<>1 THEN 390
380 KH=120
390 CALL HCHAR(4,28,KH)
400 A$=STR$(BC)&" "
410 R=17
420 C=27
430 GOSUB 30
440 R=22
450 A$=STR$(WC)&" "
460 GOSUB 30
470 IF (CM<>1)+(TU<>1)THEN 500
480 GOSUB 2730
490 GOTO 900
500 KH=1
510 CALL GCHAR(3*Y+2,3*X+4,GG)
520 KH=1-KH
530 CALL HCHAR(3*Y+2,3*X+4,120+8*KH
    )
540 CALL KEY(0,K,S)
550 IF S=0 THEN 520
560 IF (K<>ASC("E"))+(Y<1)THEN 600
570 CALL HCHAR(3*Y+2,3*X+4,GG)
580 Y=Y-1
590 GOTO 510
600 IF (K<>ASC("S"))+(X<1)THEN 640
610 CALL HCHAR(3*Y+2,3*X+4,GG)
620 X=X-1
630 GOTO 510
640 IF (K<>ASC("D"))+(X>6)THEN 680
650 CALL HCHAR(3*Y+2,3*X+4,GG)
660 X=X+1
670 GOTO 510
680 IF (K<>ASC("X"))+(Y>6)THEN 720
690 CALL HCHAR(3*Y+2,3*X+4,GG)
700 Y=Y+1
710 GOTO 510
720 IF K<>ASC("Q")THEN 870
730 A$="SURE YOU WANT TO END (Y/N)?
    "
740 R=24
750 C=2
760 GOSUB 30
770 CALL KEY(0,K,S)
780 IF S=0 THEN 770
790 IF K<>89 THEN 820
800 EE=1
810 GOTO 830
820 IF K<>78 THEN 770
830 A$=C$&"{3 SPACES}"
840 C=2
850 GOSUB 30
860 IF EE=1 THEN 2370
870 IF K<>ASC(" ")THEN 520
880 XY=Y*9+X
890 IF BO(XY)>0 THEN 520
900 IF FL=0 THEN 990
910 CALL HCHAR(Y*3+2,X*3+4,120+(TU-
    1)*8)
920 IF PO(XY)=0 THEN 990
930 CALL SOUND(100,440,2)
940 GOSUB 2060
950 IF CHIPS<1 THEN 990
960 GOSUB 2300
970 BO(XY)=TU
980 GOTO 1110
990 R=24
```

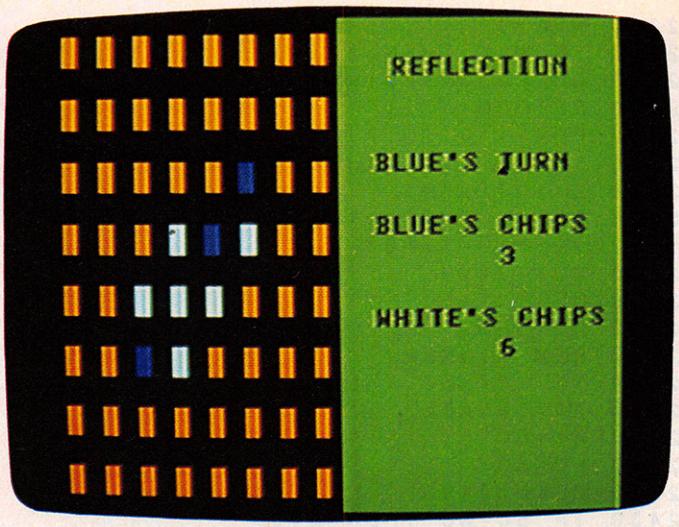


"Reflection," TI-99/4A version.

```
1000 CALL SOUND(100,110,2)
1010 C=2
1020 A$="ILLEGAL MOVE - LOSE TURN"
1030 GOSUB 30
1040 FOR I=1 TO 500
1050 NEXT I
1060 A$=C$
1070 GOSUB 30
1080 IF FL=0 THEN 1100
1090 CALL HCHAR(3*Y+2,3*X+4,32)
1100 GOTO 1210
1110 IF TU<>1 THEN 1150
1120 BC=BC+CHIPS+1
1130 WC=WC-CHIPS
1140 GOTO 1170
1150 WC=WC+CHIPS+1
1160 BC=BC-CHIPS
1170 FOR Q=1 TO 8
1180 IF XY+OF(Q)<0 THEN 1200
1190 PO(XY+OF(Q))=1
1200 NEXT Q
1210 TU=3-TU
1220 IF (WC=0)+(BC=0)+(WC+BC=64)THE
     N 2370
1230 GOSUB 1270
1240 IF (XY<>0)*(XY<>7)*(XY<>63)*(X
     Y<>70)THEN 1260
1250 GOSUB 3540
1260 GOTO 330
1270 FOR I=0 TO 71
1280 TA(I)=0
1290 NEXT I
1300 RETURN
1310 CALL CLEAR
1320 CALL SCREEN(11)
1330 PRINT TAB(10);"REFLECTION": :
     :
1340 PRINT TAB(11);"1ST MOVE"
1350 INPUT "{5 SPACES}(B)LACK/(W)HI
     TE: ":A$
1360 PRINT : :
1370 IF (A$<>"B")*(A$<>"W")THEN 134
     0
1380 IF A$="B" THEN 1400
1390 TU=2
1400 PRINT TAB(10);"GAME BOARD"
1410 INPUT "  (N)ORMAL/(D)ESIGN ONE
     : ":A$
1420 PRINT : :
1430 IF (A$<>"D")*(A$<>"N")THEN 140
     0
1440 IF A$="N" THEN 1460
1450 DE=1
1460 INPUT "{3 SPACES}# OF PLAYERS
     [1/2] ?: ":CM
1470 IF (CM<>1)*(CM<>2)THEN 1460
1480 PRINT : :
1490 CM=(CM=2)*2+CM
1500 IF CM=0 THEN 1530
1510 INPUT "{4 SPACES}SKILL LEVEL [
     1/2] ?: ":LE
1520 IF (LE<>1)*(LE<>2)THEN 1510
1530 RETURN
1540 A$="pqrqqrqqrqqrqqrqqrqqrqqr"
1550 B$="s t  t  t  t  t  t  t  t"
1560 C$="uvwvvwvvwvvwvvwvvwvvwvvw"
1570 CALL SCREEN(2)
1580 CALL COLOR(11,1,1)
1590 CALL COLOR(13,1,1)
1600 PRINT A$,B$,B$,A$&"  'S",B$,B$
     &" UP",A$,B$,B$,A$,B$,B$,A$&"
     SUM",B$,B$&" x:",A$,B$,B$,A$,B
     $&" "&CHR$(128)&":",B$,A$,B$,C
     $;
1610 CALL SCREEN(11)
1620 CALL COLOR(11,5,1)
1630 CALL COLOR(13,16,1)
1640 RETURN
1650 KH=0
1660 FOR Y=0 TO 7
1670 FOR X=0 TO 7
1680 KH=1-KH
1690 CALL HCHAR(3*Y+2,3*X+4,120+8*K
     H)
1700 CALL KEY(0,K,S)
1710 IF S=0 THEN 1680
1720 XY=X+Y*9
1730 IF K<>87 THEN 1770
1740 WC=WC+1
1750 BO(XY)=2
1760 GOTO 1850
1770 IF K<>66 THEN 1810
1780 BC=BC+1
1790 BO(XY)=1
1800 GOTO 1850
1810 IF K<>32 THEN 1680
1820 CALL HCHAR(3*Y+2,3*X+4,32)
1830 BO(XY)=0
1840 GOTO 1900
1850 CALL HCHAR(3*Y+2,3*X+4,120+8*(
     BO(XY)-1))
1860 FOR E=1 TO 8
1870 IF XY+OF(E)<=-1 THEN 1890
1880 PO(XY+OF(E))=1
1890 NEXT E
1900 NEXT X
1910 NEXT Y
1920 A$="OK?"
1930 R=22
1940 C=27
1950 GOSUB 30
1960 CALL KEY(0,K,S)
1970 IF S=0 THEN 1960
1980 IF (K<>78)*(K<>89)THEN 1960
1990 IF K<>89 THEN 2020
2000 CALL HCHAR(22,27,32,4)
2010 RETURN
2020 WC=0
2030 BC=0
2040 GOSUB 1540
2050 GOTO 1650
2060 CHIPS=0
2070 FOR I=1 TO 8
2080 L=1
2090 V=0
2100 XX=0
2110 V=V+OF(I)
2120 IF (XY+V>70)+(XY+V<0)THEN 2200
2130 IF BO(XY+V)=5 THEN 2200
2140 IF BO(XY+V)<>3-TU THEN 2180
2150 XX=1
2160 L=L+1
2170 GOTO 2110
2180 IF (XX<>1)+(BO(XY+V)<>TU)THEN
     2200
2190 GOSUB 2220
2200 NEXT I
2210 RETURN
2220 W=1
2230 V=0
2240 V=V+OF(I)
2250 TA(XY+V)=TU
```

```
2260 W=W+1
2270 IF W<L THEN 2240
2280 CHIPS=CHIPS+W-1
2290 RETURN
2300 FOR I=0 TO 71
2310 IF TA(I)=0 THEN 2350
2320 L=INT(I/9)
2330 CALL HCHAR(L*3+2,(I-9*L)*3+4,1
     20+(TU-1)*8)
2340 BO(I)=TU
2350 NEXT I
2360 RETURN
2370 REM WINNER
2380 IF BC<=WC THEN 2430
2390 A$="BLACK"
2400 HI=BC
2410 LO=WC
2420 GOTO 2490
2430 IF BC=WC THEN 2480
2440 A$="WHITE"
2450 HI=WC
2460 LO=BC
2470 GOTO 2490
2480 A$="TIE GAME."
2490 R=24
2500 C=3
2510 IF SEG$(A$,1,1)="T" THEN 2540
2520 CALL VCHAR(3,27,32,96)
2530 A$=A$&" WINS "&STR$(HI)&" TO "
     &STR$(LO)&" !"
2540 GOSUB 30
2550 BC=0
2560 WC=0
2570 DE=0
2580 TU=1
2590 FOR I=0 TO 71
2600 PO(I)=0
2610 BO(I)=0
2620 TA(I)=0
2630 NEXT I
2640 FOR I=1 TO 750
2650 NEXT I
2660 A$="  PLAY AGAIN (Y/N)?  "
2670 GOSUB 30
2680 CALL KEY(0,K,S)
2690 IF S=0 THEN 2680
2700 IF (K<>78)*(K<>89)THEN 2680
2710 IF K=89 THEN 100
2720 STOP
2730 HY=-32000
2740 HI=-32000
2750 XY=0
2760 IF (BO(XY)>0)+(PO(XY)=0)THEN 2
     960
2770 GOSUB 2060
2780 IF CHIPS=0 THEN 2960
2790 QW=(TT/8)*CHIPS+PT(XY)*(65-(TT
     /8))
2800 IF (LE<>2)+(CHIPS<>A1)THEN 282
     0
2810 QW=10000
2820 IF (LE<>2)+(RE<>0)THEN 2850
2830 GOSUB 3100
2840 GOTO 2960
2850 IF (QW<=HI)THEN 2890
2860 HI=QW
2870 H1=XY
2880 GOTO 2960
2890 IF HI=0 THEN 2960
2900 IF (QW/HI<.86)+(QW/HI>1.14)THE
     N 2960
2910 RANDOMIZE
2920 ZZ=INT(RND*2)+1
2930 IF ZZ<>1 THEN 2960
2940 HI=QW
2950 H1=XY
2960 XY=XY+1
2970 IF XY<71 THEN 2760
2980 IF (LE<>2)+(RE<>1)THEN 3000
2990 RETURN
3000 IF ((HI<>-32000)+(LE<>1))*((HY
     <>-32000)+(LE<>2))THEN 3030
3010 FL=0
3020 CHIPS=0
3030 XY=H1
3040 IF LE<>2 THEN 3060
3050 XY=H2
3060 GOSUB 1270
3070 Y=INT(XY/9)
3080 X=XY-Y*9
3090 RETURN
3100 A1=BC+1
3110 FOR E=0 TO 70
3120 A(E)=BO(E)
3130 IF TA(E)<1 THEN 3160
3140 BO(E)=TA(E)
3150 A1=A1+1
3160 NEXT E
3170 BO(XY)=1
3180 FOR Q=1 TO 8
3190 IF XY+OF(Q)<0 THEN 3210
3200 PO(XY+OF(Q))=PO(XY+OF(Q))+1
3210 NEXT Q
3220 NW=QW
3230 RE=1
3240 Y1=XY
3250 TU=2
3260 GOSUB 2740
3270 RE=0
3280 QY=NW-HI
3290 TU=1
3300 IF QY<=HY THEN 3340
3310 HY=QY
3320 H2=Y1
3330 GOTO 3410
3340 IF HY=0 THEN 3410
3350 IF (QY/HY<.86)+(QW/HY>1.14)THE
     N 3410
3360 RANDOMIZE
3370 ZZ=INT(RND*2)+1
3380 IF ZZ<>1 THEN 3410
3390 HY=QY
3400 H2=Y1
3410 XY=Y1
3420 FOR E=0 TO 70
3430 BO(E)=A(E)
3440 NEXT E
3450 GOSUB 1270
3460 FOR Q=1 TO 8
3470 IF Y1+OF(Q)<0 THEN 3520
3480 IF PO(Y1+OF(Q))<>2 THEN 3510
3490 PO(Y1+OF(Q))=1
3500 GOTO 3520
3510 PO(Y1+OF(Q))=0
3520 NEXT Q
3530 RETURN
3540 IF XY=7 THEN 3640
3550 IF XY=63 THEN 3710
3560 IF XY=70 THEN 3780
3570 FOR I=9 TO 13
3580 PT(I)=15-I
3590 NEXT I
```

```
3600 FOR I=1 TO 37 STEP 9
3610 PT(I)=6-INT(I/9)
3620 NEXT I
3630 RETURN
3640 FOR I=6 TO 42 STEP 9
3650 PT(I)=6-INT(I/9)
3660 NEXT I
3670 FOR I=16 TO 12 STEP -1
3680 PT(I)=I-10
3690 NEXT I
3700 RETURN
3710 FOR I=54 TO 58
3720 PT(I)=60-I
3730 NEXT I
3740 FOR I=64 TO 28 STEP -9
3750 PT(I)=INT(I/9)-1
3760 NEXT I
3770 RETURN
3780 FOR I=61 TO 57 STEP -1
3790 PT(I)=I-55
3800 NEXT I
3810 FOR I=69 TO 33 STEP -9
3820 PT(I)=INT(I/9)-1
3830 NEXT I
3840 RETURN
3850 FOR I=1 TO 8
3860 READ OF(I)
3870 NEXT I
3880 FOR X=0 TO 71
3890 READ PT(X)
3900 NEXT X
3910 FOR I=8 TO 71 STEP 9
3920 BO(I)=5
3930 NEXT I
3940 FOR I=0 TO 7
3950 READ A$
3960 CALL CHAR(I+112,A$)
3970 NEXT I
3980 CALL CHAR(120,"003C7E7E7E7E3C0
     0")
3990 CALL CHAR(128,"003C7E7E7E7E3C0
     0")
4000 RETURN
4010 DATA -10,-9,-8,-1,1,8,9,10
4020 DATA 16,-6,6,2,2,6,-6,16,0,-6,
     -12,-2,-2,-2,-2,-12,-6,0
4030 DATA 6,-2,6,2,2,6,-2,6,0,2,-2,
     2,1,1,2,-2,2,0
4040 DATA 2,-2,2,1,1,2,-2,2,0,6,-2,
     6,2,2,6,-2,6,0
4050 DATA -6,-12,-2,-2,-2,-2,-12,-6
     ,0,16,-6,6,2,2,6,-6,16,0
4060 DATA FFFFC0C0C0C0C0C0,FFFF0000
     00000000,FFFF030303030303,C0C0
     C0C0C0C0C0C0
4070 DATA 0303030303030303,C0C0C0C0
     C0C0FFFF,0000000000000FFFF,0303
     03030303FFFF
4080 DATA 1,1,1,1,1,0,0,1,1,0,0,1,1
     ,1,1,1
4090 CALL CLEAR
4100 CALL SCREEN(13)
4110 PRINT TAB(3);"TYPE (B) FOR BLA
     CK CHIP": : : :
4120 PRINT TAB(3);"TYPE (W) FOR WHI
     TE CHIP": : : :
4130 PRINT TAB(3);"TYPE SPACE FOR N
     O CHIP": : : : : : :
4140 FOR T=1 TO 750
4150 NEXT T
4160 RETURN
```



"Reflection," TRS-80 Color Computer version.

Program 6: Reflection For TRS-80 Color Computer

Version By Chris Poer, Editorial Programmer

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
10 CLEAR:DIM BO(80),TA(71),PT(71),A
   (71),PO(80)
20 BT$=CHR$(161)+CHR$(162):BB$=CHR$
   (164)+CHR$(168):WT$=CHR$(193)+CH
   R$(194):WB$=CHR$(196)+CHR$(200)
30 CT$=CHR$(177)+CHR$(178):CB$=CHR$
   (180)+CHR$(184):ET$=CHR$(241)+CH
   R$(242):EB$=CHR$(244)+CHR$(248)
40 CLS:TU=1:PL=1
50 GOSUB 670
60 GOSUB 590
70 GOSUB 900
80 IF DE=1 THEN GOSUB 1040:GOTO 140
90 FOR Y=2TO5:FORX=2TO5
100 READA:PO(Y*9+X)=A:NEXTX:NEXTY
110 BO(30)=2:BO(31)=1:BO(39)=1:BO(4
    0)=2:BC=2:WC=2
120 PRINT@198,WT$;:PRINT@200,BT$;:P
    RINT@230,WB$;:PRINT@232,BB$;
130 PRINT@262,BT$;:PRINT@264,WT$;:P
    RINT@294,BB$;:PRINT@296,WB$;
140 FL=0:WC$=STR$(WC)+"  ":BC$=STR$
    (BC)
150 IF TU=1 THEN A$="BLUE'S TURN":G
    OTO180
160 A$="WHITE'S TURN"
170 PRINT@51,"REFLECTION"
180 PRINT@146,A$:PRINT@210,"BLUE'S
    CHIPS":PRINT@248,BC$
190 PRINT@306,"WHITE'S CHIPS":PRINT
    @344,WC$
200 IF PL=1 THEN AL=BC+1:GOTO220
210 AL=WC+1
220 IF TU=PL AND CM=1 THEN GOSUB 16
    20:GOTO340
230 A=JOYSTK(0):X=INT(JOYSTK(2)/8):
    Y=INT(JOYSTK(3)/8)
240 SP=Y*64+X*2:XY=X+Y*9
250 PRINT@SP,CT$;:PRINT@SP+32,CB$;
260 FORI=1TO50:NEXTI
270 IF (PEEK(65280)=253 OR PEEK(652
    80)=125) AND BO(X+Y*9)=0 THEN 3
    50
```

```
280 A$=INKEY$:IFA$="E" THEN 540
290 IFBO(XY)=0THENPRINT@SP,ET$;:PRI
    NT@SP+32,EB$;
300 FORI=1TO50:NEXTI
310 IF BO(XY)=1 THEN PRINT@SP,BT$;:
    PRINT@SP+32,BB$;:GOTO330
320 IF BO(XY)=2 THEN PRINT@SP,WT$;:
    PRINT@SP+32,WB$;
330 GOTO 230
340 IF FL=1 THEN 390
350 IF TU=1 THENPRINT@SP,BT$;:PRINT
    @SP+32,BB$;:GOTO370
360 PRINT@SP,WT$;:PRINT@SP+32,WB$;
370 IF PO(XY)=0 THEN 390
380 GOSUB 1330:IFCHIPS>0THENGOSUB14
    40:BO(XY)=TU:GOTO440
390 PRINT@402,"ILLEGAL MOVE"
400 SOUND 15,15
410 PRINT@402,"{11 SPACES}"
420 IF FL=1 THEN 490
430 PRINT@SP,ET$;:PRINT@SP+32,EB$;:
    GOTO490
440 IF TU=1 THEN BC=BC+CHIPS+1:WC=W
    C-CHIPS:GOTO460
450 WC=WC+CHIPS+1:BC=BC-CHIPS
460 FORQ=1TO8:IFXY+OF(Q)>-1 THENPO(
    XY+OF(Q))=1
470 NEXTQ
480 IF XY=0ORXY=7ORXY=63ORXY=70THEN
    GOSUB2040
490 TU=3-TU
500 IF WC=0 OR BC=0 OR BC+WC=64 THE
    N 1500
510 GOSUB 530
520 GOTO140
530 FORI=0TO70:TA(I)=0:NEXT:RETURN
540 PRINT@400,"WANT TO QUIT Y/N";
550 A$=INKEY$:IF A$="Y" THEN 1500
560 IF A$<>"N" THEN 550
570 PRINT@400,"{16 SPACES}";
580 GOTO 290
590 CLS:FORY=0TO7:FORX=0TO7
600 XY=X*2+Y*64:PRINT@XY,ET$;:PRINT
    @XY+32,EB$;
610 NEXTX:NEXTY
620 RETURN
630 SET(I,J,6)
640 NEXTJ:NEXTI
650 REM FORI=1TO56:SET(I,31,3):NEXT
    I
660 RETURN
670 PRINTTAB(11)"REFLECTION"
680 PRINT:PRINT"  USE JOYSTICK2 TO
    MOVE THE{5 SPACES}CURSOR, PRESS
     THE JOYSTICK{6 SPACES}BUTTON T
    O  MAKE YOUR MOVE."
690 PRINT"TYPE (E) TO END THE GAME
    "
700 PRINT:PRINT"(W)HITE MOVES FIRST
    "
710 PRINT"(B)LUE MOVES FIRST"
720 A$=INKEY$:IF A$="W"THENTU=2:GOT
    O 740
730 IF A$<>"B"THEN720
740 PRINT:PRINT"(N)ORMAL BOARD"
750 PRINT"(D)ESIGN YOUR OWN BOARD"
760 A$=INKEY$:IF A$="D" THEN DE=1:G
    OTO 780
770 IF A$<>"N" THEN 760
780 PRINT:PRINT"(1-2) PLAYERS"
790 A$=INKEY$
800 IF A$="2" THEN RETURN
810 IF A$<>"1" THEN 790
820 CLS
830 CM=1:PRINT:PRINT:PRINT"WHAT LEV
    EL (1-2)"
840 A$=INKEY$:LE=VAL(A$):IF LE>2 OR
     LE<1 THEN 840
850 PRINT:PRINT"COMPUTER PLAYS (W)H
    ITE"
860 PRINT"COMPUTER PLAYS (B)LUE
870 A$=INKEY$:IF A$="W" THEN PL=2:G
    OTO 890
880 IF A$<>"B" THEN 870
890 RETURN
900 FORI=1TO8
910 READ A
920 OF(I)=A:NEXT I
930 FORX=0TO71
940 READ A:PT(X)=A
950 NEXT X
960 FOR I=8TO71STEP9:BO(I)=5:NEXTI
970 RETURN
980 DATA -10,-9,-8,-1,1,8,9,10
990 DATA 16,-6,6,2,2,6,-6,16,0,-6,-
    12,-2,-2,-2,-2,-12,-6,0
1000 DATA 6,-2,6,2,2,6,-2,6,0,2,-2,
     2,1,1,2,-2,2,0
1010 DATA 2,-2,2,1,1,2,-2,2,0,6,-2,
     6,2,2,6,-2,6,0
1020 DATA -6,-12,-2,-2,-2,-2,-12,-6
     ,0,16,-6,6,2,2,6,-6,16,0
1030 DATA 1,1,1,1,1,0,0,1,1,0,0,1,1
     ,1,1,1
1040 PRINT@81,"MOVE THE CURSOR";:PR
     INT@113,"WITH JOYSTICK2"
1050 PRINT@178,"TYPE (B) FOR":PRINT
     @211,"BLUE CHIP"
1060 PRINT@274,"TYPE (W) FOR":PRINT
     @307,"WHITE CHIP"
1070 PRINT@370,"HIT SPACE IF":PRINT
     @403,"A MISTAKE"
1080 PRINT@464,"TYPE (E) TO QUIT";
1090 A=JOYSTK(0):X=INT(JOYSTK(2)/8)
     :Y=INT(JOYSTK(3)/8):SP=X*2+Y*6
     4:XY=X+Y*9
1100 PRINT@SP,CT$;:PRINT@SP+32,CB$;
1110 FORI=1TO60:NEXTI
1120 PRINT@SP,ET$;:PRINT@SP+32,EB$;
1130 A$=INKEY$
1140 FORI=1TO50:NEXTI
1150 IF BO(XY)=1 THEN PRINT@SP,BT$;
     :PRINT@SP+32,BB$;:GOTO1170
1160 IF BO(XY)=2 THEN PRINT@SP,WT$;
     :PRINT@SP+32,WB$;
1170 IF A$="E" THEN 1230
1180 IF A$<>"E" AND A$<>" " AND A$<
     >"W" AND A$<>"B" THEN 1090
1190 IF A$="W"THEN BO(XY)=2:PRINT@S
     P,WT$;:PRINT@SP+32,WB$;:GOTO12
     20
1200 IF A$="B" THENBO(XY)=1:PRINT@S
     P,BT$;:PRINT@SP+32,BB$;:GOTO12
     20
1210 BO(XY)=0:PRINT@SP,ET$;:PRINT@S
     P+32,EB$;
1220 GOTO 1090
1230 FORI=0TO71:IFBO(I)=0 OR BO(I)=
     5 THEN 1290
```

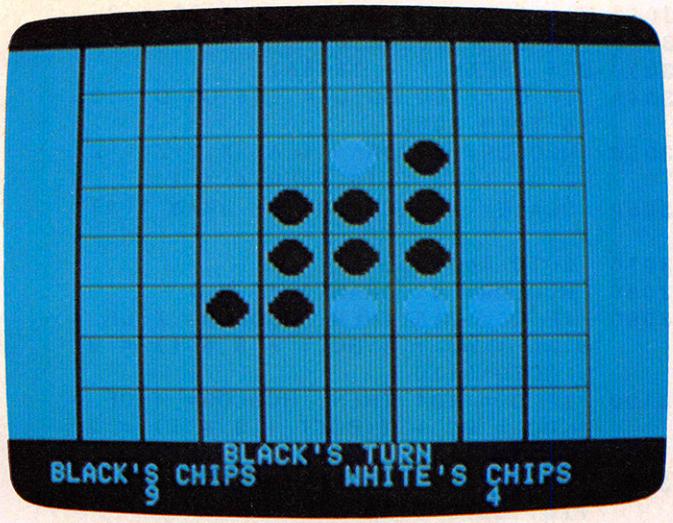
```
1240 FORE=1TO8
1250 IF I+OF(E)>-1 THEN PO(I+OF(E))
     =1
1260 NEXT E
1270 IF BO(I)=1 THEN BC=BC+1:GOTO12
     90
1280 WC=WC+1
1290 NEXT I
1300 FORI=64TO448STEP32:PRINT@I+16,
     "{16 SPACES}";
1310 NEXT I
1320 RETURN
1330 CHIPS=0:FORI=1TO8:L=1:V=0
1340 V=V+OF(I):IFXY+V>70 OR XY+V<0
     THEN 1380
1350 IF BO(XY+V)=5 THEN 1380
1360 IF BO(XY+V)=3-TU THENXX=1:L=L+
     1:GOTO1340
1370 IF XX=1 AND BO(XY+V)=TU THENGO
     SUB1400
1380 XX=0:NEXT
1390 RETURN
1400 W=1:V=0
1410 V=V+OF(I):TA(XY+V)=TU
1420 W=W+1:IF W<L THEN 1410
1430 CHIPS=CHIPS+W-1:RETURN
1440 FORJ=0TO7:FORI=0TO7
1450 IF TA(I+J*9)=0 THEN 1490
1460 SP=I*2+J*64:IF TU=2 THEN PRINT
     @SP,WT$;:PRINT@SP+32,WB$;:GOTO
     1480
1470 PRINT@SP,BT$;:PRINT@SP+32,BB$;
1480 BO(I+J*9)=TU
1490 NEXT:NEXT:RETURN
1500 FORI=128TO384STEP32
1510 PRINT@I+16,"{16 SPACES}";
1520 NEXT I
1530 IF WC>BC THEN A$="WHITE WINS":
     H1=WC:H2=BC:GOTO 1560
1540 IF BC>WC THEN A$="BLUE WINS":H
     1=BC:H2=WC:GOTO 1560
1550 A$=" TIE GAME":H1=BC:H2=WC
1560 PRINT@147,A$
1570 PRINT@212,H1;"TO";H2
1580 PRINT@304,"PLAY AGAIN (Y/N)";
1590 A$=INKEY$:IF A$="Y" THEN 10
1600 IF A$<>"N" THEN 1590
1610 CLS:END
1620 HY=-32000
1630 HI=-32000:FORXY=0TO70
1640 IF BO(XY)>0 OR PO(XY)=0 THEN N
     EXT:GOTO1730
1650 GOSUB 1330:IF CHIPS=0 THEN 172
     0
1660 TT=WC+BC:QW=(TT/8)*CHIPS+PT(XY
     )*(65-TT)/8
1670 IF LE=2 AND CHIPS=A1 THEN QW=1
     0000
1680 IF LE=2 AND REC=0 THEN GOSUB 1
     800:GOTO 1720
1690 IF QW>HI THEN HI=QW:H1=XY:GOTO
     1720
1700 IF HI=0 THEN 1720
1710 IF QW/HI >.85 AND QW/HI<1.15 T
     HEN ZZ=INT(RND(0)*2):IF ZZ=1TH
     ENHI=QW:H1=XY
1720 NEXT
1730 IF LE=2 AND REC=1 THEN RETURN
1740 IF (HI=-32000 AND LE=1) OR (HY
     =-32000 AND LE=2) THEN FL=1
1750 XY=H1
1760 IF LE=2 THEN XY=H2
1770 GOSUB 530
1780 Y=INT(XY/9):X=XY-Y*9:SP=X*2+Y*
     64
1790 RETURN
1800 A1=AL:FOR E=0TO70
1810 A(E)=BO(E)
1820 IF TA(E)>0 THEN BO(E)=TA(E):A1
     =A1+1
1830 NEXT E
1840 BO(XY)=TU
1850 FORQ=1TO8
1860 IF XY+OF(Q)>-1THENPO(XY+OF(Q))
     =PO(XY+OF(Q))+1
1870 NEXT Q
1880 NW=QW:REC=1:Y1=XY
1890 TU=3-TU:GOSUB 1630:REC=0
1900 QY=NW-HI:TU=3-TU
1910 IF QY>HY THEN HY=QY:H2=Y1:GOTO
     1940
1920 IF HY=0 THEN 1940
1930 IF QY/HY>.85 AND QY/HY<1.15 TH
     EN ZZ=INT(RND(0)*2):IFZZ=1THEN
     HY=QY:H2=Y1
1940 XY=Y1
1950 FORE=0TO70
1960 BO(E)=A(E):NEXT
1970 GOSUB 530
1980 FORQ=1TO8
1990 IF Y1+OF(Q) <0 THEN 2020
2000 IF PO(Y1+OF(Q))=2 THEN PO(Y1+O
     F(Q))=1:GOTO 2020
2010 PO(Y1+OF(Q))=0
2020 NEXT Q
2030 RETURN
2040 IF XY=7THEN2100
2050 IF XY=63THEN2130
2060 IF XY=70THEN2160
2070 FORI=9TO13:PT(I)=15-I:NEXT
2080 FORI=1TO37STEP9:PT(I)=6-INT(I/
     9):NEXT
2090 RETURN
2100 FORI=6TO42STEP9:PT(I)=6-INT(I/
     9):NEXT
2110 FORI=16TO12STEP-1:PT(I)=I-10:N
     EXT
2120 RETURN
2130 FORI=54TO58:PT(I)=60-I:NEXT
2140 FORI=64TO28STEP-9:PT(I)=INT(I/
     9)-1:NEXT
2150 RETURN
2160 FORI=61TO57STEP-1:PT(I)=I-55:N
     EXT
2170 FORI=69TO33STEP-9:PT(I)=INT(I/
     9)-1:NEXT
2180 RETURN
```

Program 7: Reflection For Apple

Version By Chris Poer, Editorial Programmer

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
5  CLEAR : DIM BO(80),TA(71),A(71),P
     O(80),PT(71)
10 TU = 1: ROT= 0: POKE 232,28: POKE
     233,3: TEXT : HOME :FL = 1:PL =
     1
12  RESTORE
15  GOSUB 9000
```



"Reflection," Apple version

```
20  GOSUB 1000
30  GOSUB 2000
40  GOSUB 10000
50  IF DE = 1 THEN  GOSUB 3000: GOTO
     100
60  HCOLOR= 4: SCALE= 1: DRAW 2 AT 1
    54,82: DRAW 2 AT 128,62
70  HCOLOR= 7: DRAW 2 AT 127,82: DRAW
    2 AT 153,62
80 BC = 2:WC = 2: FOR Y = 2 TO 5: FOR
    X = 2 TO 5
90  READ A:PO(Y * 9 + X) = A: NEXT :
     NEXT
100 FL = 1: IF TU = 1 THEN M$ = "BLA
    CK'S TURN": GOTO 120
110 M$ = "WHITE'S TURN"
120  VTAB 21: PRINT  TAB( 15)M$: VTAB
    (23): PRINT  TAB( 10);BC; TAB(
    30);WC;"       "
125  VTAB (22): PRINT "   BLACK'S CH
    IPS     WHITE'S CHIPS"
127  IF PL = 1 THEN AL = BC + 1: GOTO
    130
128 AL = WC + 1
130  IF COM = 1 AND TU = PL THEN  GOSUB
    6000: GOTO 250
135 X = 4:Y = 4:Z = 1: POKE  - 16368
    ,0
140 Q =  PEEK ( - 16384):X1 = X:Y1 =
    Y: POKE  - 16368,0
150  IF Q = 201 AND Y > 0 THEN Y = Y
     - 1
160  IF Q = 205 AND Y < 7 THEN Y = Y
     + 1
170  IF Q = 203 AND X < 7 THEN X = X
     + 1
180  IF Q = 202 AND X > 0 THEN X = X
     - 1
183  IF Q <  > 197 THEN 188
184  VTAB (23): PRINT "    ARE YOU S
    URE YOU WANT TO QUIT? ";: GET A
    $: IF A$ = "Y" THEN 7000
185  SCALE= Z: HCOLOR= 6: DRAW 1 AT
    X1 * 26 + 39,Y1 * 20 + 2
186  HOME : GOTO 100
188  IF BO(X1 + 9 * Y1) = 2 THEN OF =
    1: GOTO 190
189 OF = 0
190  SCALE= Z: HCOLOR= 6: DRAW 1 AT
    X1 * 26 + 39,Y1 * 20 + 2
200  IF BO(X1 + 9 * Y1) <  > 0 THEN
     SCALE= 1: HCOLOR= 4 + (BO(X1 +
    9 * Y1) - 2) * 3: DRAW 2 AT X1 *
    26 + 49 + OF + (X1 > 4) * 2,Y1 *
    20 + 2
210 Z = Z + 3: IF Z > 16 THEN Z = 1
215  IF X <  > X1 OR Y <  > Y1 THEN
     POKE 768,1: POKE 769,160: CALL
    770
220  SCALE= Z: HCOLOR= 5: DRAW 1 AT
    X * 26 + 39,Y * 20 + 2
230  IF Q <  > 160 THEN 140
233  IF BO(X + 9 * Y) > 0 THEN 140
235  IF TU = 1 THEN OF = 1: GOTO 240
237 OF = 0
240  SCALE= Z: HCOLOR= 6: DRAW 1 AT
    X * 26 + 39,Y * 20 + 2
250  SCALE= 1: HCOLOR= 4 + (TU - 1) *
    3
253  IF FL = 0 THEN 280
255  POKE 768,2: POKE 769,110: CALL
    770
260  DRAW 2 AT X * 26 + 49 + OF + (X
     > 4) * 2,Y * 20 + 2
265  POKE 768,3: POKE 769,125: CALL
    770
267 XY = Y * 9 + X: IF PO(XY) = 0 THEN
    290
270  GOSUB 4000
280  IF CHIPS > 0 THEN  GOSUB 5000:B
    O(XY) = TU + 1: GOTO 320
290  VTAB (23): PRINT "    FALSE MOV
    E, FORFEITURE OF TURN."
295  POKE 768,50: POKE 769,10: CALL
    770
296  FOR I = 1 TO 500: NEXT I
297  IF FL = 0 THEN 340
299  POKE 768,3: POKE 769,125: CALL
    770
300  HCOLOR= 6: DRAW 2 AT X * 26 + 4
    9 + OF + (X > 4) * 2,Y * 20 + 2
310  POKE 768,2: POKE 769,110: CALL
    770: GOTO 340
320  IF TU = 1 THEN BC = BC + CHIPS +
    1:WC = WC - CHIPS: GOTO 333
330 BC = BC - CHIPS:WC = WC + CHIPS +
    1
333  FOR Q = 1 TO 8
337  IF XY + OF(Q) >  - 1 THEN PO(XY
     + OF(Q)) = 1
338  NEXT Q
340 TU = (TU - 2) *  - 1 + 1
350  IF WC = 0 OR BC = 0 THEN 7000
360  IF WC + BC = 64 THEN 7000
370  GOSUB 500
380  IF XY = 0 OR XY = 7 OR XY = 63 OR
    XY = 70 THEN  GOSUB 6800
400  GOTO 100
500  FOR I = 0 TO 71:TA(I) = 0: NEXT
    : RETURN
1000  HOME : VTAB (2): HTAB (14): INVERSE
    : PRINT "REFLECTION": NORMAL
1001  VTAB (4): PRINT  TAB( 9)"(I-J-
    K-M) MOVES CURSOR."
1002  PRINT  TAB( 8)"PRESS SPACE TO
    MAKE MOVE."
1003  PRINT : PRINT  TAB( 11)"TYPE (
    E) TO QUIT."
```

```
1010  VTAB (10): PRINT  TAB( 11)"(W)
     HITE MOVE FIRST"
1020  PRINT  TAB( 11)"(B)LACK MOVE F
     IRST"
1030  POKE  - 16368,0
1040  IF  PEEK ( - 16384) < 128 THEN
     1030
1050  GET A$: IF A$ = "W" THEN TU =
     2: GOTO 1070
1060  IF A$ <  > "B" THEN 1030
1070  VTAB (13): PRINT  TAB( 10)"(N)
     ORMAL GAME BOARD"
1080  PRINT  TAB( 9)"(D)IFFERENT GAM
     E BOARD"
1090  POKE  - 16368,0
1100  IF  PEEK ( - 16384) < 128 THEN
     1090
1110  GET A$: IF A$ = "D" THEN DE =
     1: GOTO 1140
1120  IF A$ <  > "N" THEN 1090
1130 BO(30) = 2:BO(40) = 2:BO(31) =
     3:BO(39) = 3
1140  VTAB (16): PRINT  TAB( 14)"(O)
     NE PLAYER"
1150  PRINT  TAB( 14)"(T)WO PLAYERS"

1160  POKE  - 16368,0
1170  IF  PEEK ( - 16384) < 128 THEN
     1170
1180  GET A$: IF A$ = "T" THEN  RETURN
1190  IF A$ <  > "O" THEN 1160
1200 COM = 1: VTAB (19): PRINT  TAB(
     13)"WHAT LEVEL (1-2)"
1210  POKE  - 16368,0
1220  IF  PEEK ( - 16384) < 128 THEN
     1210
1230  GET A$:LE =  VAL (A$): IF LE <
     1 OR LE > 3 THEN 1230
1240  VTAB (21): PRINT  TAB( 9)"COMP
     UTER PLAYS (B)LACK"
1250  PRINT  TAB( 9)"COMPUTER PLAYS
     (W)HITE"
1260  POKE  - 16368,0
1270  IF  PEEK ( - 16384) < 128 THEN
     1260
1280  GET A$: IF A$ = "W" THEN PL =
     2: GOTO 1300
1290  IF A$ <  > "B" THEN 1280
1300  HOME : RETURN
2000  HGR
2010  FOR I = 0 TO 159
2020  HCOLOR= 6: HPLOT 36,I TO 244,I
2023  HCOLOR= 2: HPLOT 0,I TO 33,I
2026  HCOLOR= 5: HPLOT 245,I TO 279,
     I
2030  NEXT I
2040  HCOLOR= 4
2050  FOR I = 1 TO 8
2060  HPLOT I * 26 + 36,0 TO I * 26 +
     36,159
2070  HPLOT 36,I * 20 TO 244,I * 20
2080  NEXT I
2130  RETURN
3000  VTAB (22): PRINT "TYPE (W) FOR
      PLACING A WHITE CHIP HERE."
3003  PRINT "TYPE (B) FOR PLACING A
     BLACK CHIP HERE."
3005  PRINT " HIT THE SPACEBAR TO MO
     VE THE CURSOR."
3009  FOR I = 0 TO 7: FOR T = 0 TO 7
3010 X = T * 26 + 38:Y = I * 20 + 2
3020  POKE  - 16368,0
3030 Q =  PEEK ( - 16384)
3040  IF Q = 160 OR Q = 194 OR Q = 2
     15 THEN 3080
3050  HCOLOR= 6: DRAW 1 AT X,Y:Z = Z
      + 2: IF Z > 16 THEN Z = 1
3060  SCALE= Z: HCOLOR= 5: DRAW 1 AT
     X,Y
3070  GOTO 3030
3080  HCOLOR= 6: DRAW 1 AT X,Y
3090  IF Q = 215 THEN  HCOLOR= 7:OF =
     0:WC = WC + 1:BO(T + 9 * I) = 3
     : GOTO 3110
3100  IF Q = 194 THEN  HCOLOR= 4:OF =
     1:BC = BC + 1:BO(T + 9 * I) = 2
     : GOTO 3110
3105  POKE 768,1: POKE 769,160: CALL
     770: GOTO 3120
3110  SCALE= 1: DRAW 2 AT X + 11 + O
     F + (T > 4) * 2,Y
3115  POKE 768,3: POKE 769,125: CALL
     770
3116  IF Q = 160 THEN 3120
3117  FOR E = 1 TO 8
3118  IF T + 9 * I + OF(E) > 0 THEN
     PO(T + 9 * I + OF(E)) = 1
3119  NEXT
3120  NEXT T: NEXT I
3130  HOME : RETURN
4000 CHIPS = 0: FOR I = 1 TO 8:L = 1
     :V = 0
4005 V = V + OF(I): IF XY + V > 70 OR
     XY + V < 0 THEN 4040
4006  IF BO(XY + V) = 5 THEN 4040
4010  IF BO(XY + V) = 4 - TU THEN XX
      = 1:L = L + 1: GOTO 4005
4020  IF XX = 1 AND BO(XY + V) = TU +
     1 THEN  GOSUB 4100
4040 XX = 0: NEXT I
4060  RETURN
4100 W = 1:V = 0
4110 V = V + OF(I):TA(XY + V) = TU +
     1
4120 W = W + 1: IF W < L THEN 4110
4130 CHIPS = CHIPS + W - 1: RETURN
5000  FOR I = 0 TO 7: FOR T = 0 TO 7
5010  IF TA(T + I * 9) = 0 THEN 5080
5020  HCOLOR= 6: DRAW 2 AT T * 26 +
     49 + (T > 4) * 2,I * 20 + 2
5025  POKE 768,2: POKE 769,110: CALL
     770
5030  HCOLOR= 4 + (TU - 1) * 3: DRAW
     2 AT T * 26 + 49 + OF + (T > 4)
      * 2,I * 20 + 2
5040 BO(T + I * 9) = TU + 1
5055  POKE 768,3: POKE 769,125: CALL
     770
5060  FOR Q = 1 TO 8
5070  IF XY + OF(Q) > 0 THEN PO(XY +
     OF(Q)) = 1
5075  NEXT Q
5080  NEXT T: NEXT I
5090  RETURN
6000 HY =  - 32000:OF = (PL - 2) *  -
     1
6010 HI =  - 32000: FOR XY = 0 TO 70
     : IF PO(XY) = 0 OR BO(XY) > 0 THEN
      NEXT XY: GOTO 6203
6030  GOSUB 4000
```

```
6040  IF CHIPS = 0 THEN  NEXT XY: GOTO
      6203
6060 TT = WC + BC:QW = (TT / 8) * CH
      IPS + PT(XY) * (65 - TT) / 8
6065  IF LE = 2 AND CHIPS = A1 THEN
      QW = 10000
6070  IF LE = 2 AND REC = 0 THEN  GOSUB
      6400: NEXT XY: GOTO 6203
6080  IF QW > HI THEN HI = QW:H1 = X
      Y: NEXT : GOTO 6203
6100  IF HI = 0 THEN  NEXT XY: GOTO
      6203
6110  IF QW / HI > .85 AND QW / HI <
      1.15 THEN ZZ =  INT ( RND (1) *
      2): IF ZZ = 1 THEN HI = QW:H1 =
      XY
6200  NEXT
6203  IF LE = 2 AND REC = 1 THEN  RETURN
6205  IF (HI =  - 32000 AND LE = 1) OR
      (HY =  - 32000 AND LE = 2) THEN
      FL = 0:CHIPS = 0
6210 XY = H1
6220  IF LE = 2 THEN XY = H2
6230  GOSUB 500
6250 Y =  INT (XY / 9):X = XY - Y *
      9
6260  RETURN
6400 A1 = AL: FOR E = 0 TO 70
6410 A(E) = BO(E)
6420  IF TA(E) > 0 THEN BO(E) = TA(E
      ):A1 = A1 + 1
6430  NEXT E
6440 BO(XY) = TU + 1
6441  FOR Q = 1 TO 8
6442  IF XY + OF(Q) >  - 1 THEN PO(X
      Y + OF(Q)) = PO(XY + OF(Q)) + 1
6446  NEXT Q
6450 NW = QW:REC = 1:Y1 = XY
6460 TU = 3 - TU: GOSUB 6010:REC = 0
      :TU = 3 - TU:QW = NW - HI
6470  IF QW > HY THEN HY = QW:H2 = Y
      1: GOTO 6550
6490  IF HY = 0 THEN 6550
6500  IF QW / HY > .85 AND QW / HY <
      1.15 THEN ZZ =  INT ( RND (1) *
      2): IF ZZ = 1 THEN HY = QW:H2 =
      Y1
6550 XY = Y1
6560  FOR E = 0 TO 70
6570 BO(E) = A(E)
6580  NEXT
6590  GOSUB 500
6600  FOR Q = 1 TO 8
6610  IF Y1 + OF(Q) < 0 THEN 6630
6615  IF PO(Y1 + OF(Q)) = 2 THEN PO(
      Y1 + OF(Q)) = 1: GOTO 6630
6620 PO(Y1 + OF(Q)) = 0
6630  NEXT Q
6640  RETURN
6800  IF XY = 7 THEN 6860
6810  IF XY = 63 THEN 6890
6820  IF XY = 70 THEN 6920
6830  FOR I = 9 TO 13:PT(I) = 15 - I
      : NEXT
6840  FOR I = 1 TO 37 STEP 9:PT(I) =
      6 -  INT (I / 9): NEXT
6850  RETURN
6860  FOR I = 6 TO 42 STEP 9:PT(I) =
      6 -  INT (I / 9): NEXT
6870  FOR I = 16 TO 12 STEP  - 1:PT(
      I) = I - 19
6880  RETURN
6890  FOR I = 54 TO 59:PT(I) = I - 4
      8: NEXT
6900  FOR I = 64 TO 28 STEP  - 9:PT(
      I) =  INT (I / 9) - 1: NEXT
6910  RETURN
6920  FOR I = 62 TO 58 STEP  - 1:PT(
      I) = I - 57: NEXT
6930  FOR I = 69 TO 33 STEP  - 9:PT(
      I) =  INT (I / 9) - 1: NEXT
6940  RETURN
7000  SCALE= 1:WI = 3: IF WC > BC THEN
      GC = WC:BL = 4:M$ = "WHITE":WH =
      1: GOTO 7020
7010  IF BC > WC THEN GC = BC:WI = 2
      :WH = 3:M$ = "BLACK":BL = 6: GOTO
      7020
7015 TI = 1:GC = WC:WH = 1:BL = 6:WI
      = 0
7020  FOR I = 1 TO GC
7030  IF WC >  = I THEN  HCOLOR= 3: DRAW
      2 AT 15,140 - I * 2
7040  IF BC >  = I THEN  HCOLOR= 4: DRAW
      2 AT 266,140 - I * 2
7045  POKE 768,2: POKE 769,80 + I *
      2: CALL 770
7050  NEXT I
7060  HCOLOR= CO: FOR I = 1 TO GC
7070  IF WC >  = I THEN  HCOLOR= WH:
      DRAW 2 AT 15,140 - I * 2
7075  IF BC >  = I THEN  HCOLOR= BL:
      DRAW 2 AT 266,140 - I * 2
7080  POKE 768,2: POKE 769,80 + I *
      2: CALL 770
7090  NEXT I
7100  HOME : VTAB (21): IF TI THEN  PRINT
      TAB( 10)"THE GAME IS A TIE": GOTO
      7120
7110  PRINT  TAB( 12)M$" IS THE WINN
      ER"
7120  PRINT "  WOULD YOU LIKE TO PLA
      Y AGAIN? (Y/N)";
7130  POKE  - 16368,0
7140  IF  PEEK ( - 16384) < 128 THEN
      7130
7150  GET A$: IF A$ = "N" THEN  TEXT
      : HOME : END
7160  IF A$ <  > "Y" THEN 7150
7170  GOTO 5
7200  END
9000  FOR I = 1 TO 8
9010  READ A
9020 OF(I) = A
9030  NEXT I
9040  FOR X = 0 TO 71
9050  READ A:PT(X) = A
9060  NEXT
9070  FOR I = 770 TO 795: READ M: POKE
      I,M: NEXT I
9080  FOR I = 8 TO 71 STEP 9:BO(I) =
      5: NEXT
9099  RETURN
9100  DATA  -10,-9,-8,-1,1,8,9,10
9120  DATA  16,-8,5,2,2,5,-8,16,0,-8
      ,-12,-2,-2,-2,-2,-12,-8,0
9130  DATA  5,-2,8,2,2,8,-2,5,0,2,-2
      ,2,1,1,2,-2,2,0
9140  DATA  2,-2,2,1,1,2,-2,2,0,5,-2
      ,8,2,2,8,-2,5,0
```

```
9150  DATA  -8,-12,-2,-2,-2,-2,-12,-
      8,0,16,-8,5,2,2,5,-8,16,0
9160  DATA    172,01,03,174,01,03,16
      9,04,32,168,252,173,48,192,232,
      208,253,136,208,239,206,0,03,20
      8,231,96
10000 X = 795: IF  PEEK (796) = 2 THEN
      RETURN
10010  READ A: IF A =  - 1 THEN  RETURN
10020 X = X + 1: POKE X,A
10030  GOTO 10010
10040  DATA  2,0,6,0,9,0
10050  DATA  46,60,0
10055  DATA  7,63,63,19,45,45,45,45
10060  DATA  45,19,63,63,63,63,63,17
      ,27,45,45,45,45,45,45,19
10070  DATA  63,63,63,63,63,63,63,63
10080  DATA  19,45,45,45,45,45,45,45
      ,45,45,19,63,63,63
10090  DATA  63,63,63,63,63,63,21,45
      ,45,45,45,45,45,45,45
10100  DATA   45,19,63,63,63,63,63,6
      3,63,63
10110  DATA  63,17,13,45,45,45,45,45
      ,45,45,45
10120  DATA  19,31,63,63,63,63,63,63
      ,63
10130  DATA  10,45,45,45,45,45,45,45
      ,19
10140  DATA  31,63,63,63,63,63,10,45
      ,45,45,45,45,19
10150  DATA  31,63,63,63
10999  DATA  0,-1
11000  DATA  1,1,1,1,1,0,0,1,1,0,0,1
      ,1,1,1,1
```


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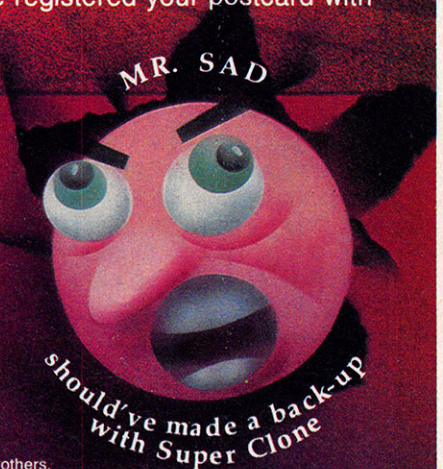
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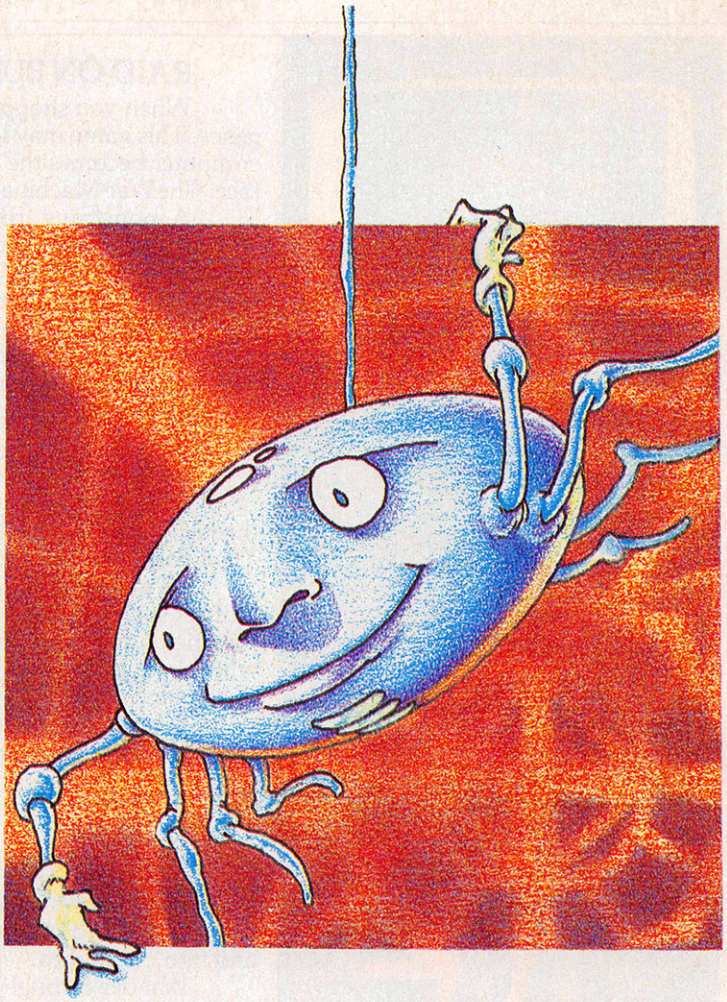


Illustration by Lee Noel

Spiders

Joe Rocke

A furiously fast and frenzied game, "Spiders" will keep your fire-button finger in top physical condition. It takes sharp reflexes and lots of stamina to resist the waves of alien spiders bent on attacking your solar system. Originally written for the unexpanded VIC-20, Spiders has been adapted for the Commodore 64 with joystick; Apple; IBM PC with 128K, color/graphics adapter, game port adapter, joystick, and Advanced BASIC (BASICA); and PCjr with 128K, joystick, and Cartridge BASIC.

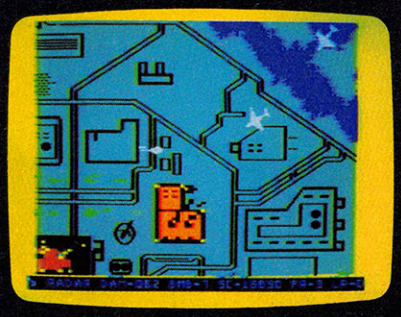
The Arachnid Empire is invading, and it's up to you to stop them. These venomous spiders have left their home web-world to seek fresh prey, and are attracted to the blue sphere of Earth.

As you sip coffee in your comfy chair, you're suddenly interrupted by screaming klaxons and flashing lights which alert you that a large Arachnid armada is speeding toward Earth. It's too late to send up manned fighters, so you activate the planetary defense system—radio-controlled robot fighters. No longer comfortable, you poise before your video screen, thumb on the launcher button, awaiting the onslaught.

Your video screen shows the spider formation. Three rows of fighting spiders jockey for position, hoping to receive the signal that will dispatch them toward glorious conquest. The whole armada sways back and forth hypnotically. Individual fighters get the signal and careen away, dropping missiles. You must position your robot fighter beneath each spider, then squeeze off a shot. Down they come, firing missiles as they whirl toward seeming victory. If you miss, the spider will rejoin its comrades. Their orders are to eliminate the planetary defense system (you), then attack *en masse*.

Two Arachnidan generals radio orders from their safe positions at the top of the formations. A lieutenant waits beneath each general. The generals and lieutenants won't attack until you've eliminated all the fighters, but then will fight with surprising speed and fury. Until you've destroyed the fighters, these officers are impervious to your attack.

You get 10 points for shooting a fighter in formation, and 100 points for an attacking spider. You have three robot ships available, one at a time. You lose a ship when a spider hits it with a missile or crashes into it. When (not *if*) you lose a ship, the invaders victoriously swarm to the ground.

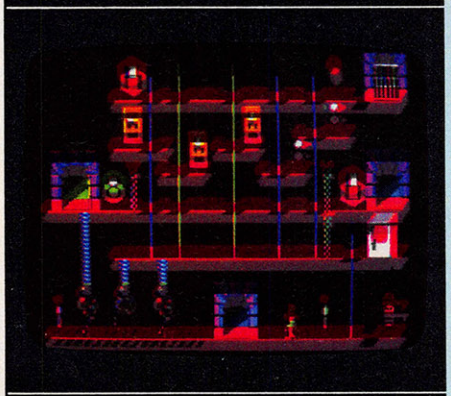


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A monstrous artificial intelligence directs an endless army of self-replicating robot weapons and a complex of factories hidden on six heavily defended islands. Even as you strike at one island, robots beyond your field of vision continue to multiply...to repair the damage you've done...to attack and destroy.

Before all of Humankind is crushed beneath the Bungeling Empire's iron heel, one faint hope remains: you in your helicraft.

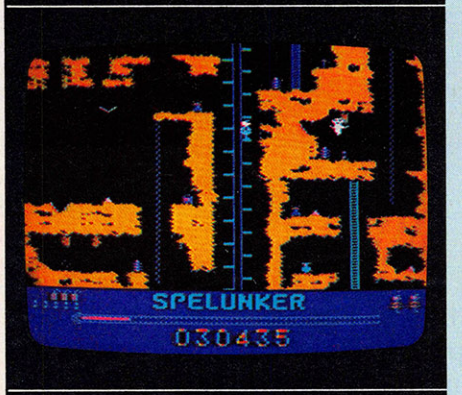


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Ever dream that you were locked in a haunted castle, wandering blindly through darkened corridors, never knowing what ghastly demons await you? Then you'll feel right at home in *The Castles of Doctor Creep*.

It's a maddening maze of 13 separate castles, more than 200 rooms in all. Sinister surprises await you behind every door: mummies and monsters, forcefields and death rays, trap doors and dead—*very* dead—ends. Remember where you've been and watch where you're going...there's got to be a way out *somewhere*!

Better hurry, or you'll wind up playing a rather unpleasant role in one of Doctor Creep's experiments.

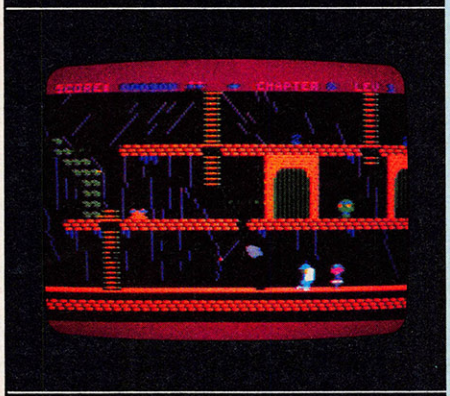


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Who knows what fabulous treasures—and unspeakable dangers—await you in the world's deepest cave? This is one game you can really get into... and into...and into.

Wander through miles of uncharted passageways, swinging on ropes and ladders, tumbling over subterranean falls and plunging to the very depths of the earth on an abandoned mine railroad. Deadly steam vents and boiling lava pits threaten you at every turn. Chattering bats and the Spirits of dead Spelunkers beg you to join them, permanently.

Let's face it: you're in deep, deep trouble.

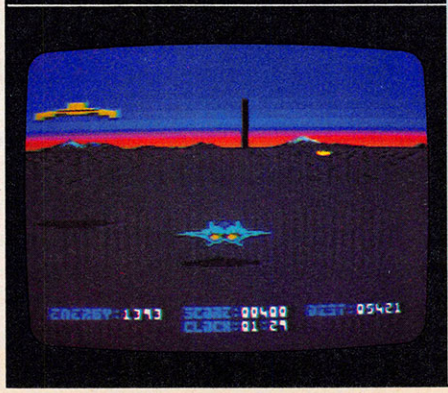


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You're the star of a full-fledged arcade adventure—and the big question is whether it'll turn out to be a comedy or a tragedy. That's because your co-star and beloved brother, Archaeologist Fenton Q. Fogbank, is rather absent-minded and extremely accident-prone.

As you search for priceless treasures in steaming tropical jungles, ancient cliff villages, musty old tombs and glittering crystal caverns, you control both your character and your brother. The only way to keep him on track and out of trouble is to whistle and pray that he follows you to safety.

Poison arrows, runaway boulders, fearsome frogs and mysterious mummies are only a few of the hazards that'll make you wish you weren't your brother's keeper.



STEALTH™

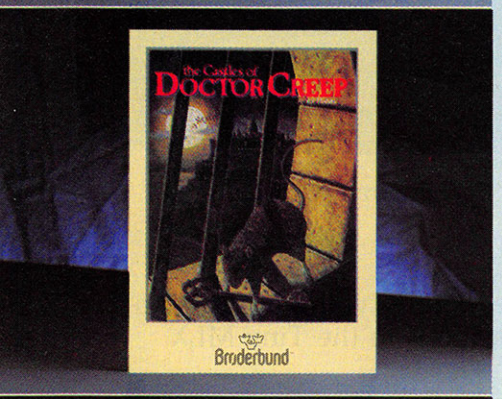
You're all alone on a strange and forbidding planet. On the distant horizon, looming thousands of meters above the blasted landscape, lies your destination: The Dark Tower, home of the mysterious Council of Nine, cruel overlords of a conquered world.

You must maneuver your Stealth Starfighter through an unending assault by the Council's automated arsenal—jets and heat-seeking missiles, photon tanks and anti-aircraft batteries, vaporizing volcanoes and deadly energy fields. Outgunned and outmanned, you must press ever onward, with only your stealth to rely on.

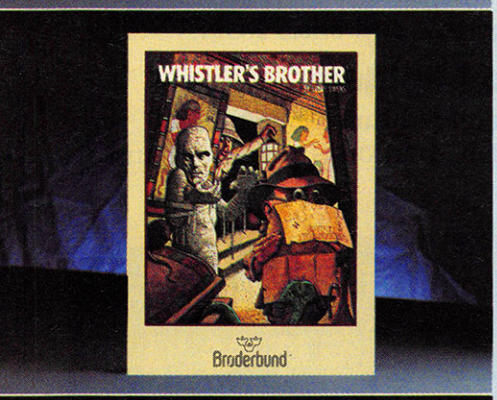
You must reach the Tower. You must destroy it. There's no turning back.

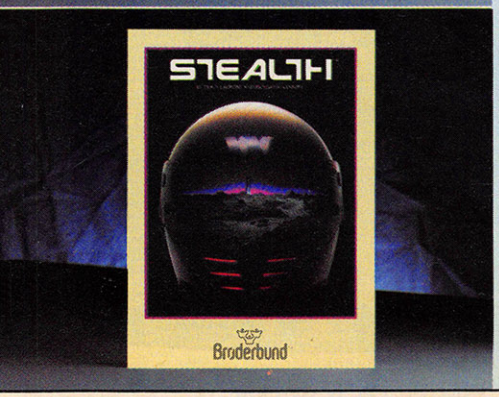
All titles available on Commodore 64. Championship Lode Runner *also available on Apple II+, IIe, IIc.* Whistler's Brother, Spelunker *and* Stealth *also available for Atari Home Computers. Commodore 64 is a trademark of Commodore Electronics, Ltd. Apple is a trademark of Apple Computer, Inc. Atari is a trademark of Atari Corporation.*





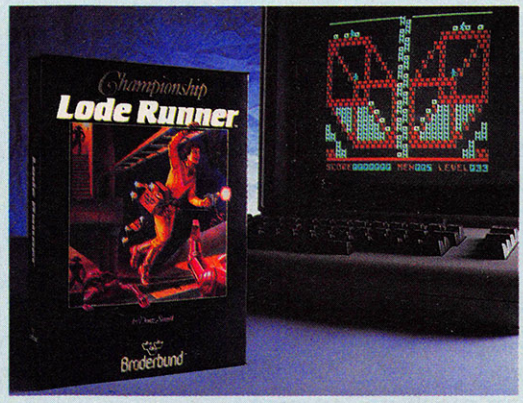






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CHAMPIONSHIP LODE RUNNER™

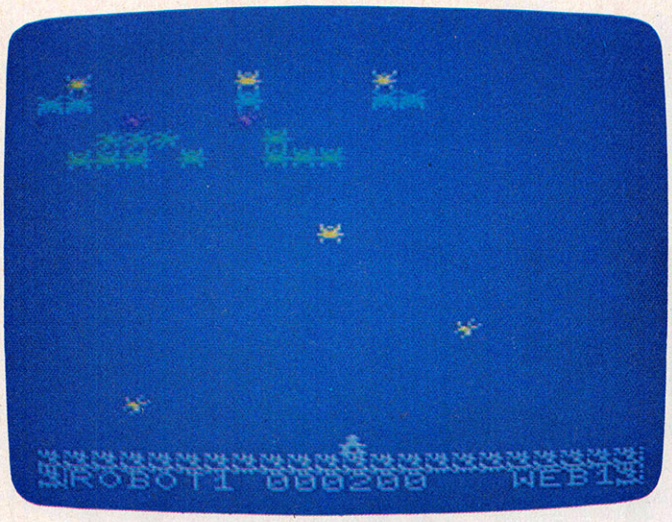
It has come to our attention that some of you out there think you're pretty good at *Lode Runner,* 1983's best computer game. For those foolhardy few, we offer a challenge of a higher order: *Championship Lode Runner.*

With fifty fiendish Treasury Chambers: more intricate, more elaborate, more insidious than anything you've seen before. You'll need lots of skill, lots of smarts, and every ounce of your lode-running experience to have any hope at all of survival.

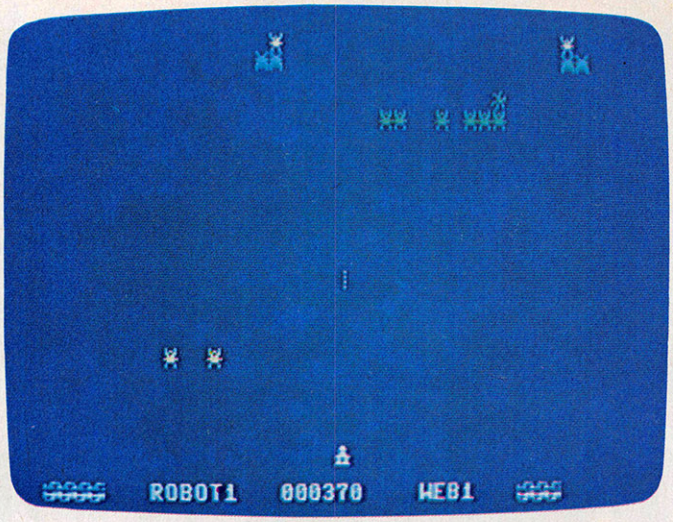
And if you haven't yet paid your dues on the original *Lode Runner,* don't even think of attempting this championship round.

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"Spiders," VIC-20 version.



"Spiders," Commodore 64 version.

The bonus round begins once you've eliminated all the fighters. Two at a time, the lieutenants and then the generals launch their attack. The bonus round scores ten times as much as normal play. Shooting an officer in formation gets you 100 points, and hitting an officer in flight is worth 1000 points. The bonus round ends when your ship is hit or when you've finished off the officers. You don't lose your ship if hit during the bonus round. After the round, a new (more difficult) formation appears.

VIC-20 Spiders

The VIC, 64, and Apple versions of "Spiders" each consist of two programs, one written in BASIC, the other in machine language.

Program 1 is the BASIC portion of Spiders for the unexpanded VIC-20. Program 2 must be typed in with "Tiny MLX," the machine language editor for the unexpanded VIC found elsewhere in this issue. Before typing in Program 2, make these modifications to the Tiny MLX program:

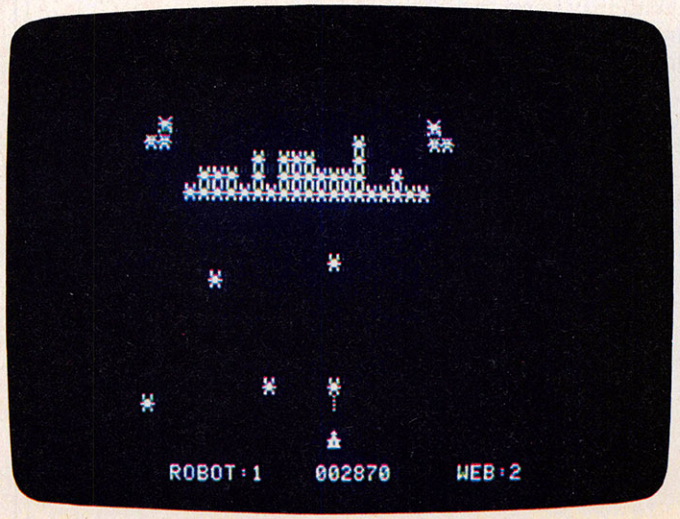
```
100 POKE55,0:POKE56,25:CLR          :rem 8
210 S=6405:E=7676                   :rem 136
```

After you have typed in and saved both programs, follow these steps to load and run Spiders on the unexpanded VIC:

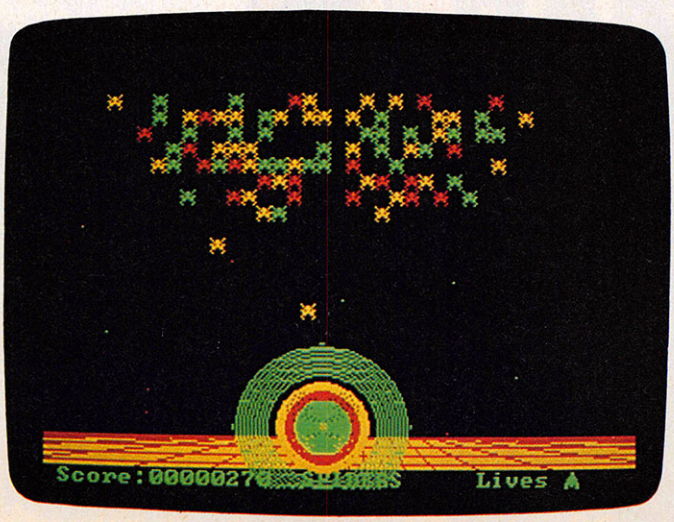
1. Load the BASIC program (LOAD *"filename"*,8 for disk or LOAD *"filename"* for tape).
2. Load the machine language program (LOAD *"filename"*,8,1 for disk or LOAD *"filename"*,1,1 for tape).
3. Plug in a joystick and enter RUN.

Commodore 64 Spiders

The 64 version is entered much like the VIC version. Enter the BASIC portion (Program 3) and



"Spiders," Apple version.



"Spiders," IBM PC/PCjr version.

FOR COMMODORE AND COMING SOON FOR APPLE AND ATARI

"... facts attest to its

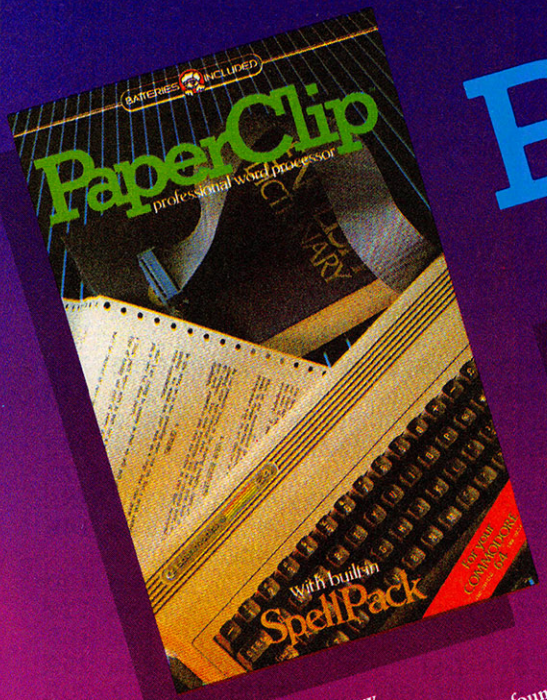
EXCELLENCE!"

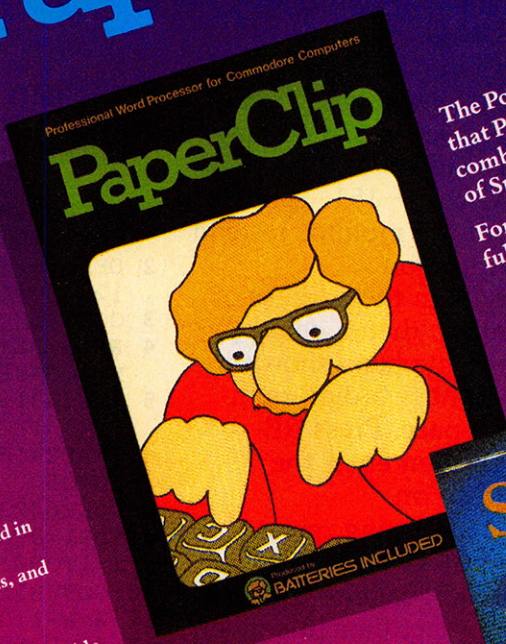
FAMILY COMPUTING

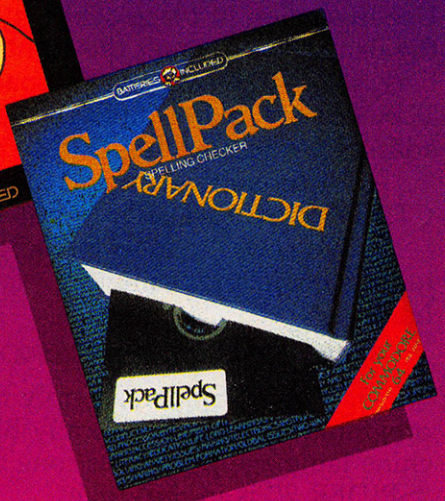
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save it to tape or disk. Then use the 64 MLX machine language editor to enter Program 4. Use a starting address of 7911 and an ending address of 9182. To load and run Spiders on the 64, follow these steps:

1. Load the machine language program (LOAD *"filename"*,8,1 for disk or LOAD *"filename"*,1,1 for tape).

2. Enter NEW.

3. Load the BASIC program (LOAD *"filename"*,8 for disk or LOAD *"filename"* for tape).

4. Plug a joystick into port 2, enter RUN.

Apple Spiders

The Apple version works on the Apple II Plus, Apple IIe, or Apple IIc with DOS 3.3. The keyboard is used instead of the joystick. Press the space bar to fire shots and the left- and right-arrow keys to position your ship.

Type in the BASIC portion (Program 5) and save it to disk. Enter the machine language portion (Program 6) with the Apple's machine language monitor. Follow these steps:

1. From BASIC, enter CALL −151. You'll see the asterisk (*) prompt of the monitor instead of the bracket (]) used by Applesoft.

2. To enter each line, type in the address of the line (the four-digit number), then a colon (:). Use this colon in place of the hyphens shown in the listing. Next, enter the eight two-digit numbers, separating each with a space. Press RETURN at the end of the line, then enter the address of the next line, and so on.

3. After you've entered the listing, press CTRL-C, then RETURN to exit to BASIC.

4. To save the machine language to disk, enter this command, using the exact filename given here:

```
BSAVE "SPIDER 2",A$9000,L$4C6
```

5. To play Spiders, simply run the BASIC program. It will automatically BLOAD the machine language portion as long as the disk with "SPIDER 2" is in the drive.

PC/PCjr Spiders

Due to programming considerations, the IBM PC/PCjr version of Spiders plays differently than the VIC, 64, and Apple versions.

Despite gallant efforts, the VIC, 64, and Apple players have let some of the invading spiders escape. Now the spiders are heading for the final battle, which takes place on your IBM. As mankind's last hope, you must thwart the ruthless aims of the Arachnid Empire. The evil Empire sends wave after wave of Spider ships with only one purpose in mind—get past your defenses and conquer. As the lone defender, you must not let these ships escape. Line up your craft beneath the oncoming horde and press the fire button on your joystick to send a pulse of energy flashing skyward. The alien ships will not fire, nor will they attempt to dodge your shots. They depend on their strength in numbers to defeat you. The dreaded arachnids do not fear death and will happily fall upon you, detonating both of you in a flash.

You get more points for shooting the aliens when they're closer to your ship. Therefore, shooting a spider can be worth anything from 10 points to 200 points. After all the spiders have either fallen or been destroyed, you get a 10,000-point bonus, but watch out—you lose 1000 points for every spider you let escape. If your score falls to zero, you lose one of your three ships, as if you had been hit by a falling spider.

Program 1: VIC-20 Spiders (BASIC Portion)

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering these listings.

```
1 POKE45,88:POKE46,24:POKE55,5:POKE56,25:
  CLR:SYS7651                          :rem 140
2 DEF FNR(X)=INT(6*RND(1)+2):R$="{RVS}
  {22 SPACES}":H$="000000"             :rem 182
3 GOSUB12                               :rem 22
4 RESTORE:FORI=0TO6:READA:POKEI+6412,A:NE
  XT:GOSUB23:GOSUB36:GOSUB27           :rem 148
5 SYS6431:IFPEEK(6423)=0THENGOSUB28
                                       :rem 150
6 IFPEEK(6422)THEN8                    :rem 112
7 GOTO5                                :rem 165
8 POKE6422,0:L=L+1                     :rem 252
9 FORI=0TO6:POKEI+6412,1:NEXT:GOSUB52:FOR
  I=1TO50:SYS6437:NEXT                 :rem 182
10 GOSUB51:IFL=4THENGOSUB54:GOTO3:rem 139
11 W=W-1:GOTO4                          :rem 82
12 POKE36869,242:PRINT"{CLR}{3 DOWN}{BLK}
   {7 SPACES}{RVS}SPIDERS{2 DOWN}"
                                       :rem 149
13 PRINT"{DOWN}{3 SPACES}{RVS}POINTS:
   {DOWN}":PRINT"{3 SPACES}FORMATION = 10
   {DOWN}":PRINT"{3 SPACES}ATTACKER
   {2 SPACES}= 100{DOWN}"              :rem 162
14 PRINT"{3 SPACES}PUSH {RED}FIRE BUTTON"
   :PRINT"{4 SPACES}{BLK}{DOWN}{2 SPACES}
   TO START"                           :rem 241
15 IFH$<>"000000"THENPRINT"{DOWN}
   {3 SPACES}HIGH:{2 SPACES}"H$;       :rem 209
16 D=250:B=102:S=36879:T=7680:C=38400:A=0
   :S$="000000"                        :rem 57
17 POKES,D:F=FNR(0):POKET+A,B:POKET+22*22
   +A,B:POKET+22*A,B:POKET+21+22*A,B
                                       :rem 161
18 POKEC+A,F:POKEC+22*22+A,F:POKEC+22*A,F
   :POKEC+21+22*A,F                     :rem 30
19 IF(PEEK(37137)AND32)=0THEN22        :rem 253
20 A=A+1:IFA<22THEN17                  :rem 190
21 A=0:D=D+1+5*(D=255):B=B+3+6*(B=105):GO
   TO17                                :rem 137
22 W=1:L=1:RETURN                       :rem 55
```

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•Disk: Commodore 64, Atari 48K



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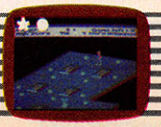
Neutral Zone



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The Scrolls of Abadon



Spell Now

```
23 PØKE36879,11Ø:POKE36878,15:PRINT"{CLR}
   ":FORI=1TO2:PRINT"{YEL}"R$;:NEXT:PRINT
   "{CYN}"R$;                          :rem 231
24 PRINT"{PUR}"R$;:FORI=1TO2:PRINT"{GRN}"
   R$;:NEXT:FORI=1TO14:PRINT"{YEL}"R$;:NE
   XT                                  :rem 55
25 PRINT"{WHT}"R$:PRINT" {RVS}ROBOT
   {2 SPACES}"S$"{3 SPACES}WEB ";:POKE818
   5,32                                :rem 250
26 R=PEEK(6424):POKE8120+R,Ø:POKE8121+R,1
   :RETURN                             :rem 115
27 FORJ=1TO4:FORI=ØTO5Ø:POKE36874,2Ø5+I:N
   EXT:NEXT:POKE6421,Ø:RETURN           :rem 8
28 GOSUB51:GOSUB52:BS=VAL(S$)          :rem 40
29 FORI=1TO3ØØ:NEXT:SYS6453:IFPEEK(6423)=
   ØTHEN33                             :rem 211
3Ø SYS6527:IFPEEK(6422)THENPOKE6422,Ø:FOR
   I=1TO3ØØ:NEXT:GOTO33                :rem 43
31 IFPEEK(6423)THEN3Ø                  :rem 202
32 GOTO29                               :rem 9
33 GOSUB52:GOSUB51:BS=(VAL(S$)-BS)*9:S$=S
   TR$(BS+VAL(S$))                     :rem 97
34 S$=LEFT$("ØØØØØØ",7-LEN(S$))+RIGHT$(S$
   ,LEN(S$)-1)                         :rem 28
35 FORI=1TO6:POKEI+8171,ASC(MID$(S$,I,1))
   +128:NEXT:GOSUB26                   :rem 218
36 GOSUB52:PRINT"{HOME}{DOWN}{YEL}"R$"
   {CYN}"R$                            :rem 236
37 ONWGOSUB39,42,45:IFW>3THENGOSUB48
                                       :rem 29
38 POKE36869,255:POKE8184,W+176:POKE8170,
   L+176:W=W+1:RETURN                  :rem 17
39 PRINT"{HOME}{DOWN}{3 RIGHT}{YEL}G
   {10 RIGHT}G{9 RIGHT}{CYN}HH{10 RIGHT}H
   H"                                  :rem 236
4Ø PRINT"{UP}{6 RIGHT}{PUR}DDDDDD{GRN}
   {14 RIGHT}DDDDDDDDDD{10 RIGHT}DDDDDDDD
   DDDDDD"                             :rem 222
41 RETURN                              :rem 69
42 PRINT"{HOME}{DOWN}{3 RIGHT}{YEL}G
   {11 RIGHT}G{8 RIGHT}{CYN}HHH{9 RIGHT}H
   HH"                                 :rem 89
43 PRINT"{UP}{4 RIGHT}{PUR}DDD{5 RIGHT}DD
   D{GRN}{10 RIGHT}DDDDD{3 RIGHT}DDDDD
   {8 RIGHT}DDDDDDD{RIGHT}DDDDDDD"
                                       :rem 254
44 RETURN                              :rem 72
45 PRINT"{HOME}{DOWN}{3 RIGHT}{YEL}G
   {12 RIGHT}G{7 RIGHT}{CYN}HHH{1Ø RIGHT}
   HHH"                                :rem 121
46 PRINT"{UP}{5 RIGHT}{PUR}DDDDDDDDDD
   {GRN}{11 RIGHT}DDDDDDDDDDD{9 RIGHT}DD
   DDDDDDDDDDD"                        :rem 235
47 RETURN                              :rem 75
48 PRINT"{HOME}{DOWN}{3 RIGHT}{YEL}GG
   {1Ø RIGHT}GG{7 RIGHT}{CYN}HHHH
   {2 RIGHT}DDDD{2 RIGHT}HHHH"    :rem 194
49 PRINT"{UP}{6 RIGHT}{PUR}DDDDDDDD{GRN}
   {12 RIGHT}DDDDDDDDDDD{9 RIGHT}DDDDDDD
   DDDDDD"                             :rem 16Ø
5Ø RETURN                              :rem 69
51 S$="":FORI=ØTO5:S$=S$+CHR$(PEEK(8172+I
   )-128):NEXT:RETURN                   :rem 6
52 IFPEEK(255)THENPOKEPEEK(254)+256*PEEK(
   255),16Ø:POKE255,Ø                  :rem 159
53 RETURN                              :rem 72
54 GOSUB52:IFVAL(S$)>VAL(H$)THENH$=S$
                                       :rem 241
55 PRINT"{HOME}{RVS}{3 SPACES}PLAY AGAIN?
    Y<N":FORI=ØTO2:POKE6419+I,Ø:NEXT
                                       :rem 74
56 IFPEEK(6419)THENPOKE7696,188:POKE6419,
   Ø                                   :rem 228
57 IFPEEK(6420)THENPOKE7696,19Ø:POKE6420,
   Ø                                   :rem 2Ø6
58 IFPEEK(6421)=ØTHEN56                 :rem 7Ø
59 IFPEEK(7696)=19ØTHENSYS65234         :rem 88
6Ø RETURN                               :rem 7Ø
61 DATA1,1,16,4,3Ø,2Ø,6Ø               :rem 177
```

Program 2: VIC-20 Spiders (ML Portion, Enter With Tiny MLX)

```
6405 :ØØØ,ØØØ,ØØØ,ØØØ,ØØØ,ØØØ,ØØ5
6411 :ØØØ,ØØØ,ØØØ,ØØØ,ØØØ,ØØØ,Ø11
6417 :ØØØ,ØØØ,ØØØ,ØØØ,ØØØ,ØØØ,Ø17
6423 :ØØØ,ØØØ,ØØØ,Ø21,Ø22,Ø23,Ø89
6429 :ØØØ,ØØØ,Ø32,23Ø,Ø28,Ø32,Ø95
6435 :Ø93,Ø26,Ø32,148,Ø25,Ø32,135
6441 :166,Ø27,Ø32,Ø72,Ø28,Ø32,142
6447 :214,Ø26,Ø32,1Ø3,Ø27,Ø96,Ø33
6453 :162,255,232,224,Ø22,176,1ØØ
6459 :Ø31,189,Ø44,Ø3Ø,2Ø1,ØØ8,Ø5Ø
6465 :2ØØ,244,169,ØØ5,157,Ø44,124
6471 :Ø3Ø,162,Ø22,2Ø2,Ø48,Ø14,Ø37
6477 :189,Ø44,Ø3Ø,2Ø1,ØØ8,2ØØ,245
6483 :246,169,ØØ3,157,Ø44,Ø3Ø,22Ø
6489 :2ØØ,Ø36,162,255,232,224,182
6495 :Ø22,176,Ø29,189,Ø22,Ø3Ø,Ø51
6501 :2Ø1,ØØ7,2ØØ,244,169,ØØ5,167
6507 :157,Ø22,Ø3Ø,162,Ø22,2Ø2,19Ø
6513 :Ø48,Ø12,189,Ø22,Ø3Ø,2Ø1,1Ø3
6519 :ØØ7,2ØØ,246,169,ØØ3,157,141
6525 :Ø22,Ø3Ø,Ø32,Ø72,Ø28,169,222
6531 :16Ø,141,Ø1Ø,Ø3Ø,Ø32,214,2Ø6
6537 :Ø26,Ø32,1Ø3,Ø27,Ø32,23Ø,Ø75
6543 :Ø28,Ø32,Ø93,Ø26,Ø96,173,Ø79
6549 :ØØ9,Ø25,24Ø,ØØ1,Ø96,173,181
6555 :Ø16,Ø25,141,ØØ9,Ø25,173,Ø32
6561 :Ø25,Ø25,2ØØ,Ø34,173,Ø44,158
6567 :Ø3Ø,2Ø1,16Ø,2ØØ,Ø59,16Ø,217
6573 :ØØØ,132,252,2ØØ,132,25Ø,115
6579 :16Ø,Ø3Ø,132,251,132,253,113
6585 :Ø32,241,Ø25,23Ø,252,23Ø,171
6591 :25Ø,165,252,2Ø1,132,2ØØ,119
6597 :243,Ø96,173,Ø65,Ø3Ø,2Ø1,237
6603 :16Ø,2ØØ,Ø25,16Ø,131,132,251
6609 :252,136,132,25Ø,16Ø,Ø3Ø,145
6615 :132,253,132,251,Ø32,241,232
6621 :Ø25,198,252,198,25Ø,165,Ø29
6627 :252,2ØØ,245,Ø96,169,ØØ1,174
6633 :Ø56,237,Ø25,Ø25,141,Ø25,23Ø
6639 :Ø25,Ø96,16Ø,ØØØ,177,25Ø,179
6645 :17Ø,2Ø1,ØØ2,24Ø,Ø88,2Ø1,123
6651 :ØØ6,24Ø,Ø84,2Ø1,ØØ9,176,199
6657 :Ø8Ø,177,252,2Ø1,161,144,248
6663 :ØØ1,Ø96,2Ø1,ØØ2,2ØØ,Ø16,Ø19
6669 :132,255,138,2Ø1,ØØ6,176,153
6675 :Ø57,169,255,141,Ø13,144,Ø3Ø
6681 :169,ØØ6,2ØØ,Ø48,138,2Ø1,Ø27
6687 :ØØ4,2ØØ,Ø43,166,25Ø,224,158
6693 :11Ø,176,Ø37,174,Ø25,Ø25,Ø72
6699 :2ØØ,ØØ4,16Ø,Ø23,2ØØ,ØØ2,136
6705 :16Ø,Ø22,Ø72,177,252,2Ø1,165
6711 :16Ø,24Ø,ØØ3,1Ø4,2ØØ,Ø16,Ø18
6717 :173,Ø25,Ø25,2ØØ,ØØ4,16Ø,144
6723 :Ø23,2ØØ,ØØ2,16Ø,Ø22,1Ø4,Ø74
6729 :145,252,169,16Ø,16Ø,ØØØ,191
6735 :145,252,Ø96,177,252,2Ø1,178
6741 :ØØ3,144,ØØ4,2Ø1,ØØ9,144,Ø78
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6747 :239,096,173,006,025,240,102
6753 :001,096,173,013,025,141,034
6759 :006,025,165,255,208,001,251
6765 :096,032,050,027,160,000,218
6771 :177,254,201,002,208,004,193
6777 :169,160,145,254,056,165,046
6783 :254,233,022,133,254,165,164
6789 :255,233,000,133,255,201,186
6795 :031,240,000,177,254,201,018
6801 :006,144,009,201,160,208,105
6807 :054,169,002,145,254,096,103
6813 :201,004,208,016,165,255,238
6819 :201,031,240,010,165,254,040
6825 :201,132,176,004,162,005,081
6831 :208,002,162,004,254,235,016
6837 :031,189,235,031,201,186,030
6843 :208,008,169,176,157,235,116
6849 :031,202,016,238,169,006,087
6855 :145,254,169,255,141,013,152
6861 :144,169,000,133,255,141,023
6867 :021,025,096,173,008,025,047
6873 :240,001,096,173,015,025,255
6879 :141,008,025,032,050,027,250
6885 :165,255,240,006,169,160,200
6891 :160,000,145,254,169,205,144
6897 :133,250,169,031,133,251,184
6903 :160,000,177,250,201,002,013
6909 :208,038,160,022,177,250,084
6915 :201,160,208,006,169,002,237
6921 :145,250,208,018,201,002,065
6927 :176,014,174,024,025,169,085
6933 :006,157,184,031,157,185,229
6939 :031,238,022,025,160,000,247
6945 :169,160,145,250,198,250,181
6951 :208,208,165,255,240,004,095
6957 :169,002,145,254,096,169,112
6963 :000,141,023,025,168,169,065
6969 :205,133,250,169,031,133,210
6975 :251,177,250,201,006,208,132
6981 :006,169,160,145,250,208,239
6987 :009,176,007,201,003,144,103
6993 :003,238,023,025,165,250,017
6999 :208,009,198,251,165,251,145
7005 :201,029,208,001,096,198,058
7011 :250,076,064,027,173,010,187
7017 :025,240,001,096,173,017,145
7023 :025,141,010,025,169,031,000
7029 :133,251,160,000,032,148,073
7035 :224,165,141,133,250,177,189
7041 :250,201,003,144,026,201,186
7047 :006,176,022,152,024,105,108
7053 :022,168,177,250,201,160,095
7059 :240,001,096,169,002,145,032
7065 :250,169,255,141,012,144,100
7071 :096,200,192,022,208,219,072
7077 :096,173,011,025,240,001,199
7083 :096,173,018,025,141,011,123
7089 :025,032,148,224,165,141,144
7095 :056,233,003,176,252,105,240
7101 :003,170,169,030,133,251,177
7107 :169,042,133,250,024,165,210
7113 :250,105,022,133,250,165,102
7119 :251,105,000,133,251,202,125
7125 :016,240,173,025,025,208,132
7131 :017,160,021,177,250,201,021
7137 :004,240,004,136,016,247,104
7143 :096,169,005,145,250,096,224
7149 :169,000,177,250,201,004,014
7155 :240,006,200,192,022,208,087
7161 :245,096,169,003,145,250,133
7167 :096,003,007,003,007,031,146
7173 :012,012,031,000,128,000,188
7179 :128,224,128,192,224,000,139
7185 :008,000,008,000,008,000,041
7191 :008,004,104,025,031,108,047
7197 :146,018,032,066,090,102,227
7203 :060,255,060,066,066,004,034
7209 :072,073,054,120,152,024,024
7215 :032,042,149,042,149,110,059
7221 :153,082,042,130,146,108,202
7227 :056,254,056,068,068,130,179
7233 :068,056,254,124,214,170,183
7239 :130,173,007,025,240,001,135
7245 :096,173,014,025,141,007,021
7251 :025,169,031,133,251,169,093
7257 :205,133,250,160,000,177,246
7263 :250,201,006,176,074,201,235
7269 :003,144,070,072,032,148,058
7275 :224,104,168,185,023,025,068
7281 :168,177,250,201,032,208,125
7287 :013,169,160,160,000,145,254
7293 :250,169,004,141,010,030,217
7299 :208,041,201,160,240,020,233
7305 :201,002,176,033,174,024,235
7311 :025,169,006,157,184,031,203
7317 :157,185,031,238,022,025,039
7323 :208,017,165,142,056,233,208
7329 :003,176,252,105,006,145,080
7335 :250,169,160,160,000,145,027
7341 :250,165,250,208,002,198,222
7347 :251,198,250,201,132,208,139
7353 :162,165,251,201,030,208,178
7359 :156,160,000,177,250,201,111
7365 :003,240,004,201,005,208,090
7371 :021,170,168,185,023,025,027
7377 :168,177,250,201,160,208,093
7383 :009,138,145,250,169,160,062
7389 :160,000,145,250,198,250,200
7395 :208,219,096,173,005,025,185
7401 :240,001,096,173,012,025,012
7407 :141,005,025,165,255,208,014
7413 :026,173,021,025,240,021,239
7419 :169,016,205,007,028,169,077
7425 :184,109,024,025,133,254,218
7431 :169,031,133,255,169,255,251
7437 :141,011,144,173,019,025,014
7443 :240,008,169,000,141,019,084
7449 :025,032,044,029,173,020,092
7455 :025,208,001,096,169,000,018
7461 :141,020,025,032,084,029,112
7467 :096,173,015,028,208,023,074
7473 :173,024,025,208,001,096,064
7479 :174,024,025,169,160,157,252
7485 :184,031,157,185,031,206,087
7491 :024,025,032,126,029,162,209
7497 :008,030,007,028,062,255,207
7503 :027,202,208,247,096,173,008
7509 :007,028,208,025,173,024,038
7515 :025,201,020,208,001,096,130
7521 :174,024,025,169,160,157,038
7527 :184,031,157,185,031,238,161
7533 :024,025,032,126,029,162,251
7539 :008,094,255,027,126,007,120
7545 :028,202,208,247,096,162,040
7551 :008,189,255,027,072,189,099
7557 :007,028,157,255,027,104,199
7563 :157,007,028,202,208,239,212
7569 :174,024,025,169,000,157,182
7575 :184,031,169,001,157,185,110
7581 :031,096,162,007,189,004,134
7587 :025,240,003,222,004,025,170
7593 :202,208,245,169,127,141,237
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7599 :034,145,173,032,145,041,233
7605 :128,208,003,238,020,025,035
7611 :169,255,141,034,145,169,076
7617 :016,044,017,145,208,003,114
7623 :238,019,025,010,044,017,040
7629 :145,208,003,238,021,025,077
7635 :162,003,189,010,144,240,191
7641 :003,222,010,144,202,016,046
7647 :245,108,029,025,120,173,155
7653 :020,003,141,029,025,173,108
7659 :021,003,141,030,025,169,112
7665 :159,141,020,003,169,029,250
7671 :141,021,003,088,096,013,097
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Program 3: 64 Spiders (BASIC Portion)

Version By Tim Victor, Editorial Programmer
Refer to "COMPUTE!'s Guide To Typing In Programs" before entering these listings.

```
100 POKE55,200:POKE56,30:CLR:H$="000000":
    SYS8299                          :rem 194
110 FORI=9472TOI+7:POKEI,0:NEXT      :rem 170
120 FORI=36874TOI+3:POKEI,0:NEXT     :rem 221
130 DEF FNR(X)=INT(15*RND(1)):R$="{RVS}
    {40 SPACES}"                     :rem 164
140 FORI=0TO6:READDF(I):NEXT         :rem 254
150 POKE255,0:POKE8280,0:W=1:L=1:S$="0000
    00"                              :rem 153
160 RESTORE:FORI=2TO6:POKEI+8271,DF(I):NE
    XT:GOSUB310:GOSUB500             :rem 130
170 SYS8290:IFPEEK(8282)=0THENGOSUB390
                                     :rem 53
180 IFPEEK(8281)THEN200              :rem 50
190 GOTO170                          :rem 107
200 POKE8281,0:L=L+1:GOSUB770        :rem 179
210 FORI=2TO6:POKEI+8271,1:NEXT:GOSUB780
                                     :rem 233
220 FORI=1TO50:POKE36875,255:SYS8293:NEXT
    :IFL<>4THENW=W-1:GOTO160         :rem 69
230 GOSUB780:IFVAL(S$)>VAL(H$)THENH$=S$
                                     :rem 85
240 PRINT"{HOME}{RVS}{WHT} HIGH SCORE:"H$
    "{RIGHT}- PLAY AGAIN? Y<-N"      :rem 70
250 FORI=8278TO8280:POKEI,0:NEXT     :rem 217
260 IFPEEK(8278)THENPOKE8278,0:POKE1058,1
    88:POKE1059,173                  :rem 12
270 IFPEEK(8279)THENPOKE8279,0:POKE1058,1
    73:POKE1059,190                  :rem 8
280 IFPEEK(8280)=0THEN260            :rem 165
290 IFPEEK(1058)=188THENPOKE8280,0:GOTO14
    0                                :rem 224
300 SYS65126                         :rem 150
310 POKE53280,6:POKE53281,6:PRINT"{CLR}":
    FORI=1TO2:PRINT"{YEL}"R$;:NEXT:PRINT"
    {CYN}"R$;                        :rem 110
320 PRINT"{3}"R$;:FORI=1TO2:PRINT"{GRN}"R
    $;:NEXT:FORI=1TO16:PRINT"{YEL}"R$;:NE
    XT                               :rem 98
330 PRINT"{WHT}"R$:PRINT"{4 SPACES}{RVS}
    {3 SPACES}ROBOT{4 SPACES}"S$"
    {4 SPACES}WEB{SHIFT-SPACE}{3 SPACES}
    {OFF}{3 SPACES}";:POKE2023,32 :rem 76
340 R=PEEK(8283):POKE1904+R,0:GOSUB780
                                     :rem 218
350 RETURN                           :rem 120
360 BA=984+VR*40:FORI=BATOBA+19:IFPEEK(I)
    =160THENNEXT:RETURN              :rem 40
370 P1=I:FORI=BA+39TOBA+20STEP-1:IFPEEK(I
    )=160THENNEXT:RETURN             :rem 147
380 P2=I:RETURN                      :rem 189
390 GOSUB770:BS=VAL(S$)              :rem 113
400 FORI=2TO6:POKEI+8271,DF(I)/2:DF(I)=DF
    (I)*.9:IFDF(I)<1THENDF(I)=1      :rem 215
410 NEXT                             :rem 212
420 VR=3:GOSUB360:IFI=BA+20THENVR=2:GOSUB
    360:IFI=BA+20THEN480             :rem 35
430 FORI=VRTO6:POKEP1,160:POKEP2,160:P1=P
    1+40:P2=P2+40:POKEP1,4:POKEP2,4
                                     :rem 135
440 FORJ=1TO20:NEXT:NEXT:POKE8282,2
                                     :rem 201
450 SYS8296:IFPEEK(8282)=0THEN420:rem 213
460 IFPEEK(8281)THENPOKE8281,0:FORI=1TO30
    0:NEXT:GOTO480                   :rem 149
470 POKE1044,160:GOTO450             :rem 98
480 GOSUB780:GOSUB770:BS=(VAL(S$)-BS)*9:S
    $=STR$(BS+VAL(S$))               :rem 7
490 S$=LEFT$("000000",7-LEN(S$))+RIGHT$(S
    $,LEN(S$)-1):GOSUB310            :rem 160
500 PRINT"{HOME}{DOWN}{YEL}"R$"{CYN}"R$
                                     :rem 247
510 ONWGOSUB530,590,650:IFW>3THENGOSUB710
                                     :rem 11
520 POKE53272,24:POKE2013,W+176:POKE1996,
    L+176:W=W+1:RETURN               :rem 244
530 PRINT"{HOME}{DOWN}{7 RIGHT}{YEL}G
    {20 RIGHT}G"                     :rem 200
540 PRINT"{CYN}{6 RIGHT}HH{20 RIGHT}HH"
                                     :rem 27
550 PRINT"{UP}{14 RIGHT}{3}D{7 RIGHT}D"
                                     :rem 123
560 PRINT"{12 RIGHT}{GRN}DDDDD{3 RIGHT}DD
    DDD"                             :rem 229
570 PRINT"{UP}{10 RIGHT}DDDDDDDDDDDDDDDDD
    "                                :rem 164
580 RETURN                           :rem 125
590 PRINT"{HOME}{DOWN}{7 RIGHT}{YEL}G
    {20 RIGHT}G"                     :rem 206
600 PRINT"{CYN}{6 RIGHT}HH{20 RIGHT}HH"
                                     :rem 24
610 PRINT"{UP}{14 RIGHT}{3}DDDDDDDDD"
                                     :rem 137
620 PRINT"{12 RIGHT}{GRN}DDDDDDDDDDDDD"
                                     :rem 87
630 PRINT"{UP}{10 RIGHT}DDDDDDDDDDDDDDDDD
    "                                :rem 161
640 RETURN                           :rem 122
650 PRINT"{HOME}{DOWN}{6 RIGHT}{YEL}G
    {22 RIGHT}G"                     :rem 232
660 PRINT"{CYN}{5 RIGHT}HHH{20 RIGHT}HHH"
                                     :rem 145
670 PRINT"{UP}{12 RIGHT}{3}DDDDDDDDDD"
                                     :rem 221
680 PRINT"{10 RIGHT}{GRN}DDDDDDDDDDDDDD"
                                     :rem 171
690 PRINT"{UP}{8 RIGHT}DDDDDDDDDDDDDDDDD
    D"                               :rem 245
700 RETURN                           :rem 119
710 PRINT"{HOME}{DOWN}{5 RIGHT}{YEL}GG
    {22 RIGHT}GG"                    :rem 86
720 PRINT"{CYN}{4 RIGHT}HHHH{20 RIGHT}HHH
    H"                               :rem 1
730 PRINT"{UP}{11 RIGHT}{3}DDDDDDDDDDDDDD
    "                                :rem 137
740 PRINT"{9 RIGHT}{GRN}DDDDDDDDDDDDDDDDD
    D"                               :rem 87
750 PRINT"{UP}{7 RIGHT}DDDDDDDDDDDDDDDDD
    DDDD"                            :rem 161
760 RETURN                           :rem 125
```

```
770 S$="":FORI=0TO5:S$=S$+CHR$(PEEK(2000+
    I)-128):NEXT:RETURN              :rem 46
780 POKE255,0:POKE8280,0:RETURN   :rem 119
790 DATA8,0,16,4,30,20,60         :rem 240
```

Program 4: 64 Spiders (ML Portion, Enter With 64 MLX)

```
7911 :120,173,020,003,141,096,016
7917 :032,173,021,003,141,097,192
7923 :032,169,082,141,020,003,178
7929 :169,035,141,021,003,165,015
7935 :001,041,251,133,001,162,076
7941 :000,189,000,208,157,000,047
7947 :036,189,000,209,157,000,090
7953 :037,232,208,241,165,001,133
7959 :009,004,133,001,088,162,164
7965 :024,169,000,157,000,212,079
7971 :202,016,250,169,014,141,059
7977 :005,212,141,012,212,141,252
7983 :019,212,165,015,141,024,111
7989 :212,096,173,076,032,240,114
7995 :001,096,173,083,032,141,073
8001 :076,032,173,092,032,208,166
8007 :034,173,080,004,201,160,211
8013 :208,059,160,000,132,252,120
8019 :200,132,250,160,004,132,193
8025 :251,132,253,032,148,031,168
8031 :230,252,230,250,165,252,194
8037 :201,240,208,243,096,173,238
8043 :119,004,201,160,208,025,056
8049 :160,239,132,252,136,132,140
8055 :250,160,004,132,253,132,026
8061 :251,032,148,031,198,252,013
8067 :198,250,165,252,208,245,169
8073 :096,169,001,056,237,092,020
8079 :032,141,092,032,096,160,184
8085 :000,177,250,170,201,002,181
8091 :240,088,201,006,240,084,246
8097 :201,009,176,080,177,252,032
8103 :201,161,144,001,096,201,203
8109 :002,208,016,132,255,138,156
8115 :201,006,176,057,169,255,019
8121 :141,013,144,169,006,208,098
8127 :048,138,201,004,208,043,065
8133 :166,250,224,200,176,037,226
8139 :174,092,032,208,004,160,105
8145 :041,208,002,160,040,072,220
8151 :177,252,201,160,240,003,224
8157 :104,208,016,173,092,032,078
8163 :208,004,160,041,208,002,082
8169 :160,040,104,145,252,169,079
8175 :160,160,000,145,252,096,028
8181 :177,252,201,003,144,004,002
8187 :201,009,144,239,096,024,196
8193 :060,024,060,255,102,102,092
8199 :255,000,000,000,000,000,006
8205 :000,000,000,000,008,000,021
8211 :008,000,008,000,008,004,047
8217 :104,025,031,108,146,018,201
8223 :032,066,090,102,060,255,124
8229 :060,066,066,004,072,073,122
8235 :054,120,152,024,032,042,211
8241 :149,042,149,110,153,082,222
8247 :042,130,146,108,056,254,023
8253 :056,068,068,130,068,056,251
8259 :254,124,214,170,130,000,191
8265 :000,000,000,000,000,000,073
8271 :000,000,000,000,000,000,079
8277 :000,000,000,000,000,000,085
8283 :000,000,039,040,041,000,211
8289 :000,076,110,032,076,113,248
8295 :032,076,132,032,076,231,170
8301 :030,032,220,034,032,148,093
8307 :032,032,055,031,032,064,105
8313 :034,032,235,033,032,164,139
8319 :033,032,010,033,096,032,107
8325 :220,034,032,148,032,032,119
8331 :064,034,032,010,033,032,088
8337 :164,033,096,173,073,032,204
8343 :240,001,096,173,080,032,005
8349 :141,073,032,165,255,208,007
8355 :001,096,160,000,177,254,083
8361 :201,002,208,004,169,160,145
8367 :145,254,056,165,254,233,002
8373 :040,133,254,165,255,233,237
8379 :000,133,255,201,004,144,156
8385 :064,177,254,201,006,144,015
8391 :009,201,160,208,054,169,232
8397 :002,145,254,096,201,004,139
8403 :208,016,165,255,201,004,036
8409 :208,010,165,254,201,240,015
8415 :176,004,162,005,208,002,012
8421 :162,004,254,207,007,189,028
8427 :207,007,201,186,208,008,028
8433 :169,176,157,207,007,202,135
8439 :016,238,169,006,145,254,051
8445 :169,255,141,013,144,169,120
8451 :000,133,255,141,088,032,140
8457 :096,173,075,032,240,001,114
8463 :096,173,082,032,141,075,102
8469 :032,032,112,033,165,255,138
8475 :240,006,169,160,160,000,250
8481 :145,254,169,151,133,250,111
8487 :169,007,133,251,160,000,247
8493 :177,250,201,002,208,035,150
8499 :160,040,177,250,201,160,015
8505 :208,006,169,002,145,250,069
8511 :208,015,201,002,176,011,164
8517 :174,091,032,169,006,157,186
8523 :112,007,238,089,032,160,201
8529 :000,169,160,145,250,165,202
8535 :250,208,008,198,251,169,147
8541 :004,197,251,240,005,198,220
8547 :250,076,045,033,165,255,155
8553 :240,004,169,002,145,254,151
8559 :096,169,000,141,090,032,127
8565 :168,169,151,133,250,169,133
8571 :007,133,251,177,250,201,118
8577 :160,240,019,201,006,208,195
8583 :006,169,160,145,250,208,049
8589 :009,176,007,201,003,144,169
8595 :003,238,090,032,198,250,190
8601 :208,227,198,251,165,251,173
8607 :201,003,208,219,096,173,035
8613 :077,032,240,001,096,173,016
8619 :084,032,141,077,032,032,057
8625 :151,224,169,003,037,140,133
8631 :208,001,096,024,105,004,109
8637 :133,251,165,141,133,250,238
8643 :160,000,177,250,201,003,218
8649 :144,026,201,006,176,022,008
8655 :152,024,105,040,168,177,105
8661 :250,201,160,240,001,096,137
8667 :169,002,145,250,169,255,185
8673 :141,012,144,096,200,192,242
8679 :040,208,219,096,173,078,021
8685 :032,240,001,096,173,085,096
8691 :032,141,078,032,032,151,197
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```
8697 :224,169,003,037,141,170,225
8703 :169,004,133,251,169,080,037
8709 :133,250,024,165,250,105,164
8715 :040,133,250,165,251,105,187
8721 :000,133,251,202,016,240,091
8727 :173,092,032,208,017,160,193
8733 :039,177,250,201,004,240,172
8739 :004,136,016,247,096,169,191
8745 :005,145,250,096,169,000,194
8751 :177,250,201,004,240,006,157
8757 :200,192,040,208,245,096,010
8763 :169,003,145,250,096,173,127
8769 :074,032,240,001,096,173,169
8775 :081,032,141,074,032,169,088
8781 :007,133,251,169,151,133,153
8787 :250,160,000,177,250,201,097
8793 :006,176,072,201,003,144,179
8799 :068,072,032,151,224,104,234
8805 :168,185,090,032,168,177,153
8811 :250,201,032,208,013,169,212
8817 :160,160,000,145,250,169,229
8823 :004,141,020,004,208,039,023
8829 :201,160,240,017,201,002,178
8835 :176,031,174,091,032,169,036
8841 :006,157,112,007,238,089,234
8847 :032,208,018,169,003,037,098
8853 :142,208,002,169,002,105,009
8859 :001,145,250,169,160,160,016
8865 :000,145,250,165,250,208,155
8871 :002,198,251,198,250,201,243
8877 :239,208,164,165,251,201,121
8883 :004,208,158,160,000,177,118
8889 :250,201,003,240,004,201,060
8895 :005,208,021,170,168,185,180
8901 :090,032,168,177,250,201,091
8907 :160,208,009,138,145,250,089
8913 :169,160,160,000,145,250,069
8919 :198,250,208,219,096,173,079
8925 :072,032,240,001,096,173,067
8931 :079,032,141,072,032,165,236
8937 :255,208,026,173,088,032,247
8943 :240,021,169,016,205,007,129
8949 :032,169,072,109,091,032,238
8955 :133,254,169,007,133,255,178
8961 :169,255,141,011,144,173,126
8967 :086,032,240,008,169,000,030
8973 :141,086,032,032,034,035,117
8979 :173,087,032,208,001,096,104
8985 :169,000,141,087,032,032,230
8991 :057,035,096,173,091,032,003
8997 :208,001,096,174,091,032,127
9003 :169,160,157,112,007,169,049
9009 :000,157,111,007,206,091,109
9015 :032,096,173,091,032,201,168
9021 :039,208,001,096,174,091,158
9027 :032,169,160,157,112,007,192
9033 :169,000,157,113,007,238,245
9039 :091,032,096,162,007,189,144
9045 :071,032,240,003,222,071,212
9051 :032,202,208,245,169,004,183
9057 :044,000,220,208,003,238,042
9063 :086,032,010,044,000,220,239
9069 :208,003,238,087,032,010,175
9075 :044,000,220,208,003,238,060
9081 :088,032,173,011,144,240,041
9087 :024,201,255,208,014,169,230
9093 :032,141,011,144,160,128,237
9099 :140,004,212,200,140,004,071
9105 :212,141,001,212,206,011,160
9111 :144,173,012,144,240,023,119
9117 :197,255,208,013,169,032,007
9123 :141,012,144,168,140,011,011
9129 :212,200,140,011,212,141,061
9135 :008,212,206,012,144,173,162
9141 :013,144,240,030,201,255,040
9147 :208,014,169,013,141,013,233
9153 :144,160,128,140,018,212,227
9159 :200,140,018,212,169,013,183
9165 :056,237,013,144,141,015,043
9171 :212,206,013,144,108,096,222
9177 :032,013,013,013,013,013,058
```

Program 5: Apple Spiders (BASIC Portion)

Version By Tim Victor, Editorial Programmer
Refer to "COMPUTE!'s Guide To Typing In Programs" before entering these listings.

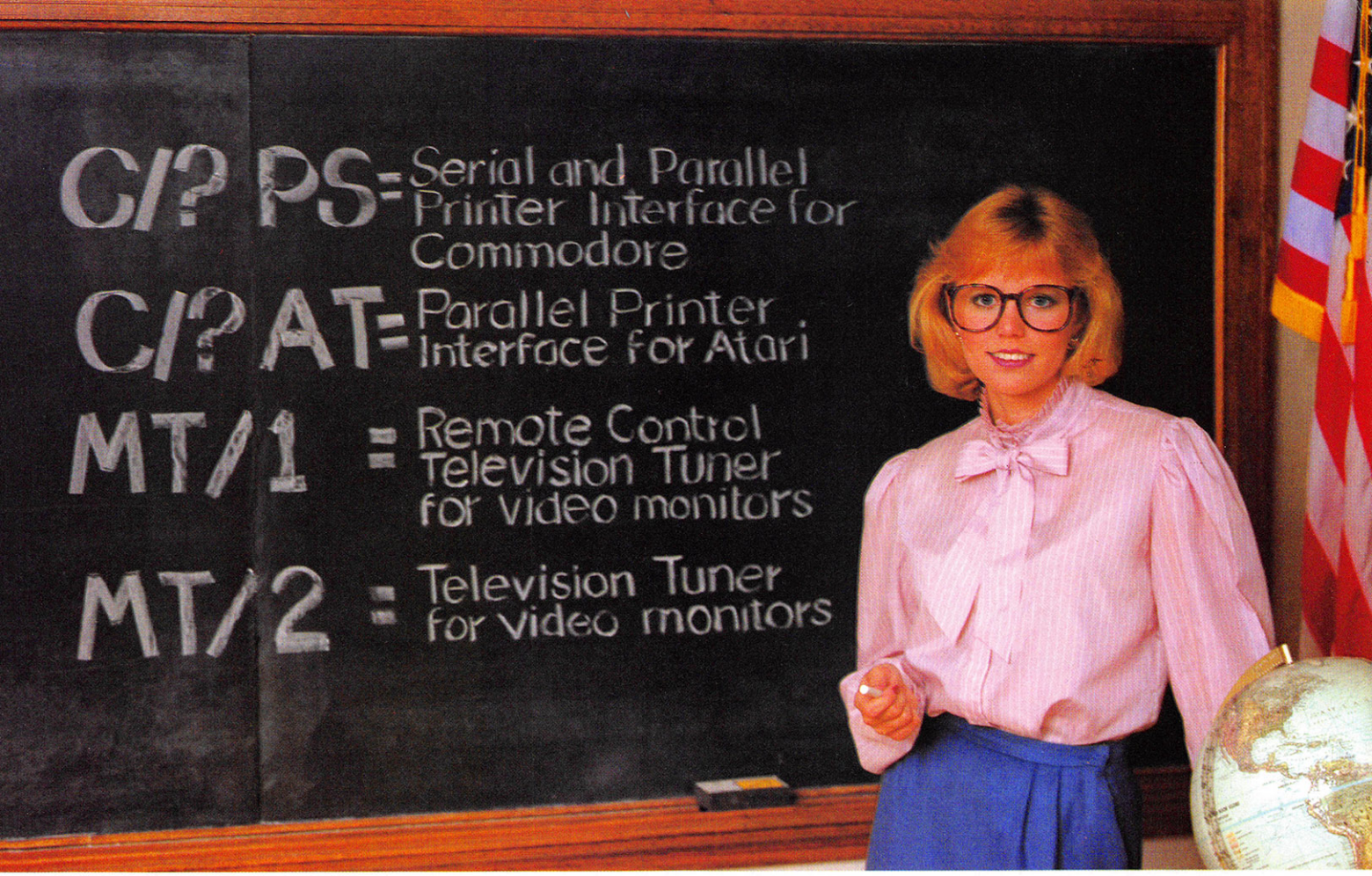
```
100  HIMEM: 128 * 256
110  LOMEM: 80 * 256
120  CLEAR
130  PRINT  CHR$ (4);"BLOAD SPIDER 2"
140  FOR I = 36096 TO 36096 + 7: POKE I
     ,0: NEXT
150  POKE 6,0: POKE 7,141
160  CALL 36884: POKE 54,0: POKE 55,3: CALL
     1002
170 HS$ = "000000"
180 W = 1:L = 1:SC$ = "000000":D = 30
200  GOSUB 1000
210  HTAB 1: VTAB 22: PRINT "       ROBO
     T:"L"     "SC$"      WEB:"W
300  FOR I = 1 TO D
310  IF I = 12 THEN  CALL 36881
320  CALL 36872
330  IF I <  > 1 THEN 370
340  IF  PEEK (1280) <  > 160 THEN  POKE
     36868,1
350  IF  PEEK (1319) <  > 160 THEN  POKE
     36868,0
360  CALL 36875
370  IF I <  > 8 *  INT (I / 8) THEN 41
     0
380  CALL 36878
390  IF  PEEK (36865) THEN 500
400  IF  PEEK (36866) = 0 THEN 2000
410  NEXT : GOTO 300
500  GOSUB 1800:L = L + 1:RP =  PEEK (3
     6867): POKE 36865,0
510  FOR I = 1 TO 20: POKE 36870,1: POKE
     36869,255: VTAB 20: HTAB RP + 1: PRINT
     "F";: CALL 36881: CALL 36878: NEXT

520  IF L < 4 THEN 200
530  GOSUB 1800: IF  VAL (SC$) >  VAL (
     HS$) THEN HS$ = SC$
540  VTAB 23: HTAB 11: PRINT "HIGH SCOR
     E:"HS$
550  HTAB 10: PRINT "PLAY AGAIN? Y <- N
     ";
555  POKE 49168,0
560 A =  PEEK (49152): IF A < 128 THEN
     560
570  POKE 49168,0: IF A = 149 THEN A$ =
     "N": HTAB 24: PRINT "->";
580  IF A = 136 THEN A$ = "Y": HTAB 24:
      PRINT "<-";
590  IF A <  > 160 THEN  GOTO 560
600  IF A$ = "N" THEN  END
610  GOTO 180
1000  HOME : HGR : VTAB 20: HTAB  PEEK
```

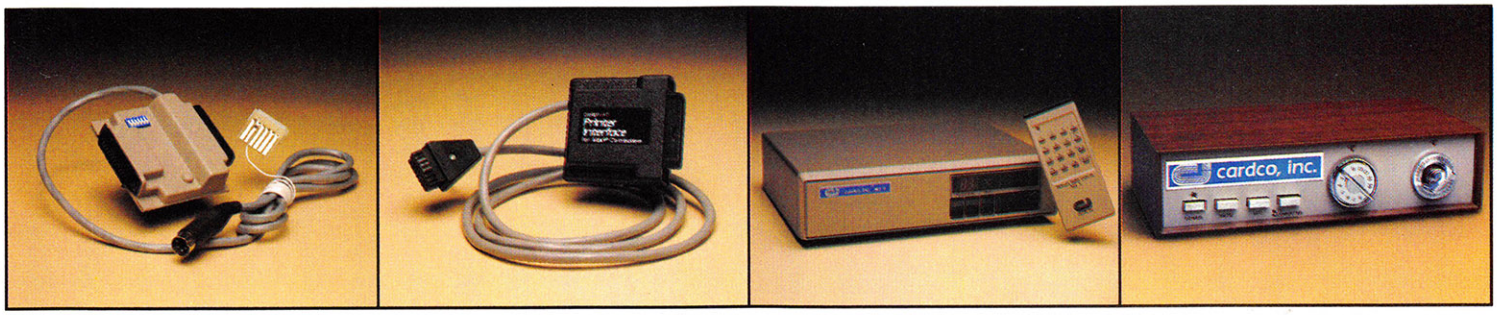
```
(36867) + 1: PRINT "@";: POKE 255,
255: POKE 49168,0
1005  ON W GOTO 1010,1080,1143,1200: GOTO
1200
1010  VTAB 2: HTAB 9: PRINT "G";: HTAB
30: PRINT "G";
1020  VTAB 3: HTAB 9: PRINT "H";: HTAB
30: PRINT "H";
1030  VTAB 4: HTAB 16: PRINT "DDDDDDDD"
;
1040  VTAB 5: HTAB 14: PRINT "DDDDDDDDD
DDD";
1050  VTAB 6: HTAB 12: PRINT "DDDDDDDDD
DDDDDDD";
1070  RETURN
1080  VTAB 2: HTAB 9: PRINT "G";: HTAB
30: PRINT "G";
1090  VTAB 3: HTAB 8: PRINT "HH";: HTAB
30: PRINT "HH";
1100  VTAB 4: HTAB 14: PRINT "DDDDDDDDD
DDD";
1110  VTAB 5: HTAB 12: PRINT "DDDDDDDDD
DDDDDDD";
1120  VTAB 6: HTAB 10: PRINT "DDDDDDDDD
DDDDDDDDDDD";
1140  RETURN
1143  VTAB 2: HTAB 8: PRINT "G";: HTAB
31: PRINT "G";
1146  VTAB 3: HTAB 7: PRINT "HHH";: HTAB
30: PRINT "HHH";
1150  VTAB 4: HTAB 13: PRINT "DDDDDDDDD
DDDDD";
1160  VTAB 5: HTAB 11: PRINT "DDDDDDDDD
DDDDDDDDD";
1170  VTAB 6: HTAB 9: PRINT "DDDDDDDDDD
DDDDDDDDDDDD";
1190  RETURN
1200  VTAB 2: HTAB 6: PRINT "GG";: HTAB
32: PRINT "GG";
1210  VTAB 3: HTAB 5: PRINT "HHHH";: HTAB
31: PRINT "HHHH";
1220  VTAB 4: HTAB 12: PRINT "DDDDDDDDD
DDDDDDD";
1230  VTAB 5: HTAB 10: PRINT "DDDDDDDDD
DDDDDDDDDDD";
1240  VTAB 6: HTAB 8: PRINT "DDDDDDDDDD
DDDDDDDDDDDDDD";
1250  RETURN
1800 SC$ = "": FOR S = 1761 TO 1766:SC$
 = SC$ +  CHR$ ( PEEK (S) - 128): NEXT
: RETURN
2000  GOSUB 1800
2010 VR = 3: GOSUB 2040: IF I = BA + 20
 THEN VR = 2: GOSUB 2040: IF I = B
A + 20 THEN 2120
2020  FOR I = VR TO 6: VTAB I: HTAB P1:
 PRINT " ";: HTAB P2: PRINT " ";
2030  VTAB I + 1: HTAB P1: PRINT "D";: HTAB
P2: PRINT "D";: NEXT : GOTO 2070
2040  VTAB VR:BA =  PEEK (40) + 256 *  PEEK
(41): FOR I = BA TO BA + 19: IF  PEEK
(I) = 160 THEN  NEXT : RETURN
2050 P1 = I - BA + 1: FOR I = BA + 39 TO
BA + 20 STEP  - 1: IF  PEEK (I) =
160 THEN  NEXT : RETURN
2060 P2 = I - BA + 1: RETURN
2070  FOR I = 1 TO D / 2: CALL 36872: IF
I <  > 4 THEN 2100
2080  CALL 36878: VTAB 2: HTAB 21: PRINT
" ";: IF  PEEK (36866) = 0 THEN 20
10
2090  IF  PEEK (36865) THEN  POKE 36865
,0: GOTO 2120
2100  IF I = 6 THEN  CALL 36881
2110  NEXT : GOTO 2070
2120 S1$ = SC$: GOSUB 1800:SC$ =  STR$
( VAL (SC$) + 9 * ( VAL (SC$) -  VAL
(S1$)))
2130 SC$ =  LEFT$ ("00000",6 -  LEN (SC
$)) + SC$:W = W + 1:D =  INT (.85 *
D): IF D < 12 THEN D = 12
2140  GOTO 200
```

Program 6: Apple Spiders (ML Portion, Enter With Apple Monitor)

```
9000- 00 00 00 00 00 00 00 00
9008- 4C 17 90 4C 83 90 4C 81
9010- 91 4C 78 93 4C E4 93 20
9018- 0E 91 A9 13 20 5B FB AD
9020- 00 C0 10 0F 2C 10 C0 C9
9028- 95 F0 09 C9 88 F0 1C C9
9030- A0 F0 32 60 AD 03 90 C9
9038- 27 F0 F8 85 24 A9 A0 20
9040- 00 03 A9 C0 20 00 03 EE
9048- 03 90 60 AC 03 90 C0 00
9050- F0 E1 CE 03 90 AD 03 90
9058- 85 24 A9 C0 20 00 03 A9
9060- A0 20 00 03 60 A5 FF 30
9068- 01 60 A9 13 85 FF 20 5B
9070- FB AC 03 90 84 FE A9 40
9078- 8D 05 90 A9 FC 8D 06 90
9080- 60 00 00 A5 FF C9 06 B0
9088- 0C 20 5B FB A4 FE 84 24
9090- A9 A0 20 00 03 A9 00 20
9098- 5B FB A0 27 B1 28 C9 A0
90A0- D0 05 88 10 F7 30 43 8C
90A8- 81 90 8C 82 90 99 00 02
90B0- 88 30 08 B1 28 C9 A0 F0
90B8- F4 D0 EF AC 82 90 84 24
90C0- AD 04 90 F0 07 A9 A0 20
90C8- 00 03 E6 24 C6 24 B9 00
90D0- 02 20 00 03 CC 81 90 F0
90D8- 03 C8 D0 F2 AC 04 90 D0
90E0- 05 A9 A0 20 00 03 A5 24
90E8- F0 02 E6 25 A5 25 C9 06
90F0- D0 A5 A5 FF C9 06 B0 15
90F8- 20 5B FB A4 FE B1 28 C9
9100- A0 F0 03 4C 3C 91 A9 C2
9108- 84 24 20 00 03 60 A5 FF
9110- 10 01 60 20 5B FB A4 FE
9118- B1 28 C9 C2 D0 07 A9 A0
9120- 84 24 20 00 03 C6 FF 10
9128- 01 60 A5 FF 20 5B FB B1
9130- 28 C9 A0 D0 07 A9 C2 84
9138- 24 4C 00 03 C9 C6 90 05
9140- A9 FF 85 FF 60 C9 C2 F0
9148- 22 C9 C4 D0 0A A5 FF C9
9150- 06 B0 04 A2 05 D0 02 A2
9158- 04 FE E0 06 BD E0 06 C9
9160- BA D0 08 A9 B0 9D E0 06
9168- CA 10 EE A9 C6 84 24 20
9170- 00 03 A9 FF 85 FF A9 40
9178- 8D 05 90 A9 FF 8D 06 90
9180- 60 A9 00 8D 02 90 AC 03
9188- 90 8C 82 90 8C 81 90 A9
9190- 13 20 5B FB A0 00 A2 00
9198- B1 28 C9 A0 F0 1D CC 82
91A0- 90 B0 03 8C 82 90 CC 81
91A8- 90 90 03 8C 81 90 C9 C2
```



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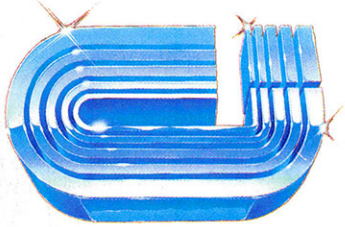
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```
91B0- 90 09 F0 05 A9 C4 8D 14
91B8- 04 A9 A0 9D 00 02 E8 C8
91C0- C0 28 D0 D4 A0 00 A2 00
91C8- C6 25 A5 25 20 5B FB B1
91D0- 28 C9 A0 D0 03 4C 9F 92
91D8- C9 C3 B0 4C A5 25 C5 FF
91E0- D0 08 98 C5 FE D0 03 4C
91E8- 9F 92 BD 00 02 C9 A0 F0
91F0- 1B C9 C2 90 03 4C 9F 92
91F8- A9 A0 91 28 A9 C6 AE 03
9200- 90 9D 00 02 EE 01 90 90
9208- 03 4C 9F 92 84 24 20 00
9210- 03 A9 C2 9D 00 02 CC 82
9218- 90 B0 03 8C 82 90 CC 81
9220- 90 90 7C 8C 81 90 B0 77
9228- C9 C6 D0 0A A9 A0 84 24
9230- 20 00 03 4C 9F 92 B0 67
9238- EE 02 90 A5 4E 0A 0A 38
9240- 65 4E 85 4E 30 48 B1 28
9248- C9 C4 F0 12 90 09 E8 E0
9250- 28 D0 0B A2 00 F0 07 CA
9258- E0 FF D0 02 A2 27 BD 00
9260- 02 C9 A0 F0 0B C9 C2 B0
9268- 36 EE 01 90 A9 C6 D0 02
9270- B1 28 9D 00 02 A9 A0 84
9278- 24 20 00 03 EC 82 90 B0
9280- 03 8E 82 90 EC 81 90 90
9288- 16 8E 81 90 B0 11 A5 4E
9290- 29 03 C9 03 18 F0 04 29
9298- 01 69 04 69 C0 91 28 C8
92A0- 98 AA C0 28 F0 03 4C CF
92A8- 91 AC 82 90 88 CC 81 90
92B0- F0 22 AC 82 90 84 24 E6
92B8- 25 A5 25 20 5B FB B9 00
92C0- 02 20 00 03 CC 81 90 F0
92C8- 03 C8 D0 F2 C0 27 D0 02
92D0- C6 25 C6 25 A5 25 C9 06
92D8- F0 28 A0 00 8C 81 90 C8
92E0- 8C 82 90 20 5B FB A0 27
92E8- B1 28 99 00 02 C9 A0 F0
92F0- 0B CC 81 90 90 03 8C 81
92F8- 90 CC 82 90 88 10 E9 4C
9300- C4 91 A9 14 20 5B FB A0
9308- 00 84 24 A9 A0 91 28 C8
9310- C0 28 90 F9 A9 05 A0 00
9318- 20 5B FB B1 28 C9 C4 D0
9320- 05 EE 02 90 D0 46 C9 A0
9328- D0 37 C6 25 10 04 E6 25
9330- F0 3A A5 25 20 5B FB B1
9338- 28 C9 C4 D0 1A A9 A0 84
9340- 24 20 00 03 E6 25 A5 25
9348- 20 5B FB A9 C4 84 24 20
9350- 00 03 EE 02 90 D0 15 E6
9358- 25 A5 25 20 5B FB 4C 6C
9360- 93 C9 C6 D0 07 A9 A0 84
9368- 24 20 00 03 C8 C0 28 D0
9370- AA C6 25 A5 25 10 9F 60
9378- A9 05 20 5B FB A5 4E 0A
9380- 0A 38 65 4E 85 4E 38 E9
9388- 28 B0 FC 69 28 A8 B1 28
9390- C9 C4 D0 13 A9 A0 84 24
9398- 20 00 03 A9 06 20 5B FB
93A0- A9 C4 84 24 20 00 03 A9
93A8- 11 20 5B FB AC 03 90 B1
93B0- 28 C9 C3 90 04 C9 C6 90
93B8- 09 C6 25 A5 25 C9 05 D0
93C0- E8 60 E6 25 A5 25 20 5B
93C8- FB AC 03 90 B1 28 C9 A0
93D0- D0 11 A9 C2 84 24 20 00
93D8- 03 A9 40 8D 05 90 A9 FF
93E0- 8D 06 90 60 A9 4C 85 B1
93E8- A9 F3 85 B2 A9 93 85 B3
93F0- 4C 0E 94 2C 06 90 F0 0D
93F8- 2C 30 C0 CE 05 90 D0 05
9400- A9 00 8D 06 90 E6 B8 D0
9408- 02 E6 B9 4C B7 00 A0 00
9410- B9 29 94 99 00 03 C8 C0
9418- 55 D0 F5 A0 00 B9 7E 94
9420- 99 00 8E C8 C0 48 D0 F5
9428- 60 85 45 86 46 84 47 A6
9430- 07 0A 0A B0 04 10 3E 30
9438- 04 10 01 E8 E8 0A 86 1B
9440- 18 65 06 85 1A 90 02 E6
9448- 1B A5 28 85 08 A5 29 29
9450- 03 05 E6 85 09 A2 08 A0
9458- 00 B1 1A 24 32 30 02 49
9460- 7F A4 24 91 08 E6 1A D0
9468- 02 E6 1B A5 09 18 69 04
9470- 85 09 CA D0 E2 A5 45 A6
9478- 46 A4 47 4C F0 FD 08 1C
9480- 08 1C 7F 36 36 7F 00 00
9488- 00 00 00 00 00 00 08 00
9490- 08 00 08 00 08 00 10 56
9498- 58 38 36 49 48 04 22 22
94A0- 2A 1C 7F 1C 22 22 08 49
94A8- 2A 1C 3C 54 52 10 22 54
94B0- 2D 36 5D 14 4A 24 41 22
94B8- 1C 7F 1C 64 55 41 00 2A
94C0- 14 3E 55 1C 22 22
```

Program 7: IBM Spiders

Version By Charles Brannon, Program Editor
Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
EP 110 CLEAR ,32768!:DEFINT A-Z:KEY OF
       F:STRIG ON:SCREEN 1:COLOR 0,2:G
       OSUB 600:GOSUB 660
EC 120 LR=3:A=RND(-TIMER)
AA 130 FOR I=1 TO 9:READ FM$(I):NEXT
GO 140 CLS:FOR I=1 TO 50:PSET (320*RND
       ,80+110*RND),3*RND+1:NEXT:AL=0:
       WAVEOVER=0:HITS=0:WV=0
JP 150 FOR I=1 TO 9:PRINT TAB(5);:AX$(
       I)="":FOR J=1 TO LEN(FM$(I)):A=
       ASC(MID$(FM$(I),J,1)):IF A<>32
       THEN AL=AL+1:AX$(I)=AX$(I)+CHR$
       (POS(0)):POKE &H4E,A-48:PRINT C
       HR$(128); ELSE PRINT CHR$(32);
MK 160 NEXT:PRINT:NEXT
IE 170 POKE &H4E,1:LOCATE 25,1.PRINT"
       Score:";STRING$(9-LEN(STR$(SCR!
       )),48);MID$(STR$(SCR!),2);TAB(1
       8);"SPIDERS";TAB(30);"Lives ";S
       TRING$(LR,129);
CI 180 LINE (0,176)-(319,190),3,BF
BE 190 S!=1:FOR X=0 TO 104 STEP 8:LINE
        (160-X,176)-(160-X-S!,190),2:L
       INE (160+X,176)-(160+X+S!,190),
       2:S!=S!*2:NEXT
IN 200 FOR Y=176 TO 190 STEP 4:LINE (0
       ,Y)-(319,Y),2:NEXT
FL 210 PLAY "t255o2f!4gg!8bccfe
L' 220 IF WAVEOVER THEN WV=WV+1:IF WV=
       15 THEN 410 ELSE 230
MK 230 IF SCREEN(22,BX)<>128 THEN 270
EJ 240 Z=1:FOR C=0 TO 15:COLOR 15-C,Z:
       Z=3-Z:FOR W=1 TO 5:NEXT:NEXT
```

```
NO 250 LR=LR-1:FOR C=1 TO 3:FOR W=1 TO
       30-C*5:SOUND 37+W,.1:CIRCLE (B
       X*8-5,171),W,4-C:NEXT:NEXT
DP 260 FOR W=30 TO 60 STEP 2:SOUND W+1
       0,.1:CIRCLE(BX*8-5,171),W:NEXT:
       IF LR THEN 140 ELSE 510
EB 270 BX=STICK(0)/3:IF BX<1 THEN BX=1
        ELSE IF BX>40 THEN BX=40
HO 280 LOCATE 22,BX:PRINT CHR$(129):IF
        STRIG(1)=0 THEN LATCH=0:GOTO 3
       40
NO 290 IF LATCH THEN 340
FP 300 LATCH=1:FOR Y=21 TO 1 STEP-1:IF
        SCREEN(Y,BX)=0 THEN NEXT
EJ 310 RX=BX*8-5:LINE (RX,167)-(RX,Y*8
       ),2:SOUND 5000,1:LINE (RX,167)-
       (RX,Y*8),0
EM 320 IF Y THEN LOCATE Y,BX:PRINT CHR
       $(32):HITS=HITS+1:SOUND 37,2:SC
       R!=SCR!+Y*10:Z$=STRING$(8,48):A
       $=MID$(STR$(SCR!),2):MID$(Z$,9-
       LEN(A$))=A$:LOCATE 25,8:PRINT Z
       $;
KN 330 IF Y>0 AND Y<10 THEN R=INSTR(AX
       $(Y),CHR$(BX)):AX$(Y)=LEFT$(AX$
       (Y),R-1)+MID$(AX$(Y),R+1)
GJ 340 IF WAVEOVER THEN 400
LI 350 Z=0:FOR I=1 TO 9:Z=Z+LEN(AX$(I)
       ):NEXT:IF Z=0 THEN WAVEOVER=1:G
       OTO 400
GI 360 Y=INT(9*RND+1):A$=AX$(Y):R=LEN(
       A$):IF R=0 THEN 360
NO 370 R=INT(R*RND+1):X=ASC(MID$(A$,R)
       ):IF SCREEN(Y+1,X)=128 THEN 400
JJ 380 AX$(Y)=LEFT$(A$,R-1)+MID$(A$,R+
       1) ELSE 400
MJ 390 POKE &H4E,POINT(X*8-7,Y*8-7):LO
       CATE Y,X:PRINT CHR$(32):LOCATE
       Y+1,X:PRINT CHR$(128):POKE &H4E
       ,1:IF Y<9 THEN AX$(Y+1)=AX$(Y+1
       )+CHR$(X)
ME 400 Z!=FNML!(0):CALL Z!:PSET (319*R
       ND,72+8*RND),3*RND:GOTO 220
BI 410 LINE (64,72)-(240,104),0,BF:LIN
       E (64,72)-(240,104),1,B
DK 420 WAVENUM=WAVENUM+1:LOCATE 11,11:
       POKE &H4E,2:PRINT"Wave";WAVENUM
       ;"Completed.":POKE &H4E,1
IG 430 FOR I!=0 TO SCR! STEP 10^(LEN(S
       TR$(SCR!))-3):GOSUB 490::SOUND
       37,.1:NEXT:I!=SCR!:GOSUB 490
JP 440 LOCATE 11,10:POKE &H4E,1:PRINT
       SPACE$(20):LOCATE 11,17:PRINT"B
       ONUS":POKE &H4E,3
LN 450 Z=0:FOR I!=SCR! TO SCR!+10000 S
       TEP 250:GOSUB 490:SOUND 100+Z,.
       1:Z=Z+1:NEXT:SCR!=SCR!+10000:I!
       =SCR!:GOSUB 490:IF AL-HITS=0 TH
       EN 480
DE 460 LOCATE 11,13:PRINT"Penalty for"
       ;AL-HITS;:LOCATE 12,13:PRINT"sp
       iders escaped":POKE &H4E,2:Z=AL
       *10
MJ 470 S!=SCR!:SCR!=SCR!-(AL-HITS)*100
       0:SCR!=-SCR!*(SCR!>0):FOR I!=S!
        TO SCR! STEP -100:GOSUB 490:SO
       UND 100+Z,.1:Z=Z-1:NEXT:I!=SCR!
       :GOSUB 490
DH 474 IF SCR!=0 THEN LOCATE 13,10:PRI
       NT"   One life lost   ":LR=LR-1
       :IF LR=0 THEN 510
KK 480 FOR W=1 TO 3000:NEXT:FOR I=1 TO
        15:Z!=FNML!(0):CALL Z!:NEXT:GO
       TO 140
MA 490 Y=13
EF 500 Z$=STRING$(8,48):A$=MID$(STR$(I
       !),2):MID$(Z$,9-LEN(A$))=A$:LOC
       ATE Y,13:PRINT"Score:";Z$:RETUR
       N
NI 510 CLS:FOR I=1 TO 150:PSET (320*RN
       D,199*RND),3*RND+1:NEXT:LINE (6
       4,0)-(240,40),1,B
PB 520 LINE (0,176)-(319,199),3,BF
JI 530 S!=1:FOR X=0 TO 104 STEP 8:LINE
        (160-X,176)-(160-X-S!,199),2:L
       INE (160+X,176)-(160+X+S!,199),
       2:S!=S!*2:NEXT
EM 540 FOR Y=176 TO 199 STEP 4:LINE (0
       ,Y)-(319,Y),2:NEXT
HO 550 LOCATE 2,15:POKE &H4E,1:PRINT"G
       ame Over":POKE &H4E,3:LOCATE 3,
       11:PRINT"Play Again? (Y/N)":I!=
       SCR!:POKE &H4E,2:Y=4:GOSUB 500
KH 560 A$=INKEY$:IF A$<>"" THEN IF A$=
       "y" OR A$="Y" THEN RUN ELSE SCR
       EEN 0,0,0,0:END
JF 570 LOCATE 10,38*RND+1:POKE &H4E,3*
       RND+1:PRINT CHR$(128):Z!=FNML!(
       0):CALL Z!:PSET (319*RND,72+8*R
       ND),3*RND:GOTO 560
JA 580 GOTO 580
ON 590 'Redefine the character set
II 600 DEF SEG=0
HP 610 POKE 124,0:POKE 125,0:POKE 126,
       0:POKE 127,&H17
IH 620 DEF SEG=&H1700:FOR I=0 TO 15:RE
       AD A:POKE I,A:NEXT
MG 630 RETURN
MH 640 DATA 129,90,60,219,126,102,129,
       66
HM 650 DATA 24,24,60,126,126,255,219,1
       95
LD 660 DEF SEG:FOR I=1 TO 21:READ Z:ML
       $=ML$+CHR$(Z):NEXT:V!=VARPTR(ML
       $):DEF FNML!(Z)=PEEK(V!+1)+256*
       PEEK(V!+2):RETURN
GE 670 DATA &H55,&H1E,&HB8,1,7,&HB9,0,
       9,&HBA,39,21,&HBB,0,0,&HCD,16,&
       H1F,&H5D,&HCA,0,0
OE 680 DATA "3  1  2     2  2     2
       1  3
DJ 690 DATA "  2  3 313 3 3 3 313  3
        2
MM 700 DATA "   11  33 1  3333  1  33
       11
KG 710 DATA "     1 11 11 11  11 11 1
AB 720 DATA "   3 2  3 1 3 1 3 1 3  2
        3
IN 730 DATA "    1123232323232323211
PO 740 DATA "    2 3 2 3 2 3 2 3 2 3
KP 750 DATA "      2 3 1 2 3 1 2 3
LD 760 DATA "     2  3  11   11  3  2
```

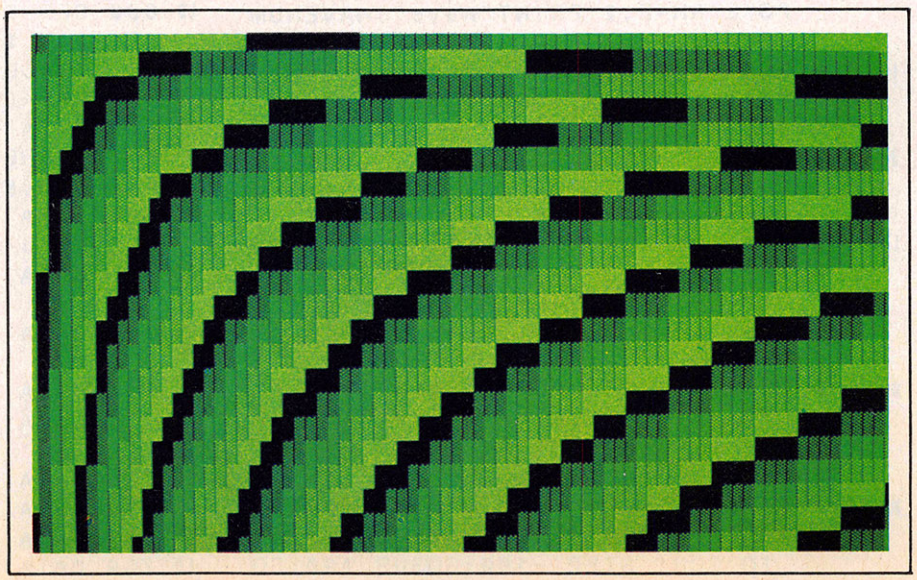
PC Monochrome Graphics

Michael A. Covington

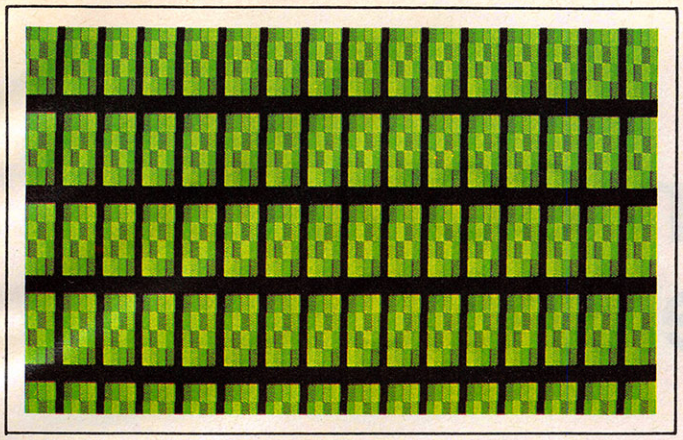
Here are some graphics screens which don't require a color/graphics adapter—they'll work on any IBM PC (or PCjr), even those equipped only with the monochrome display board.

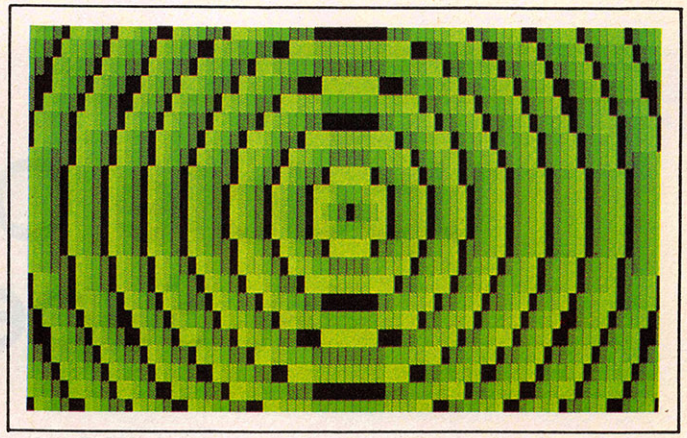
Owners of the IBM monochrome display often feel a bit left out because their systems do not support point-by-point graphics. The monochrome display adapter can produce a variety of special characters that could be used to construct drawings, but most programs never employ more than a few of them.

The brief program accompanying this article takes advantage of these special characters to create dramatic-looking patterns—actually contour maps of three-dimensional mathematical functions. Some of the displays look rather like Scottish tartans. The program runs on a PC or PCjr with any display, but the IBM monochrome display yields the best results.



Line 160 in the program defines the variable W as a function of ROW and COL. The function can be anything you wish. Here are some functions that result in attractive patterns:





W = ROW+COL
W = ROW*COL
W = LOG(ROW)−LOG(COL)
W = LOG(ROW²+COL²)
W = 5*SIN((ROW+COL)/10)

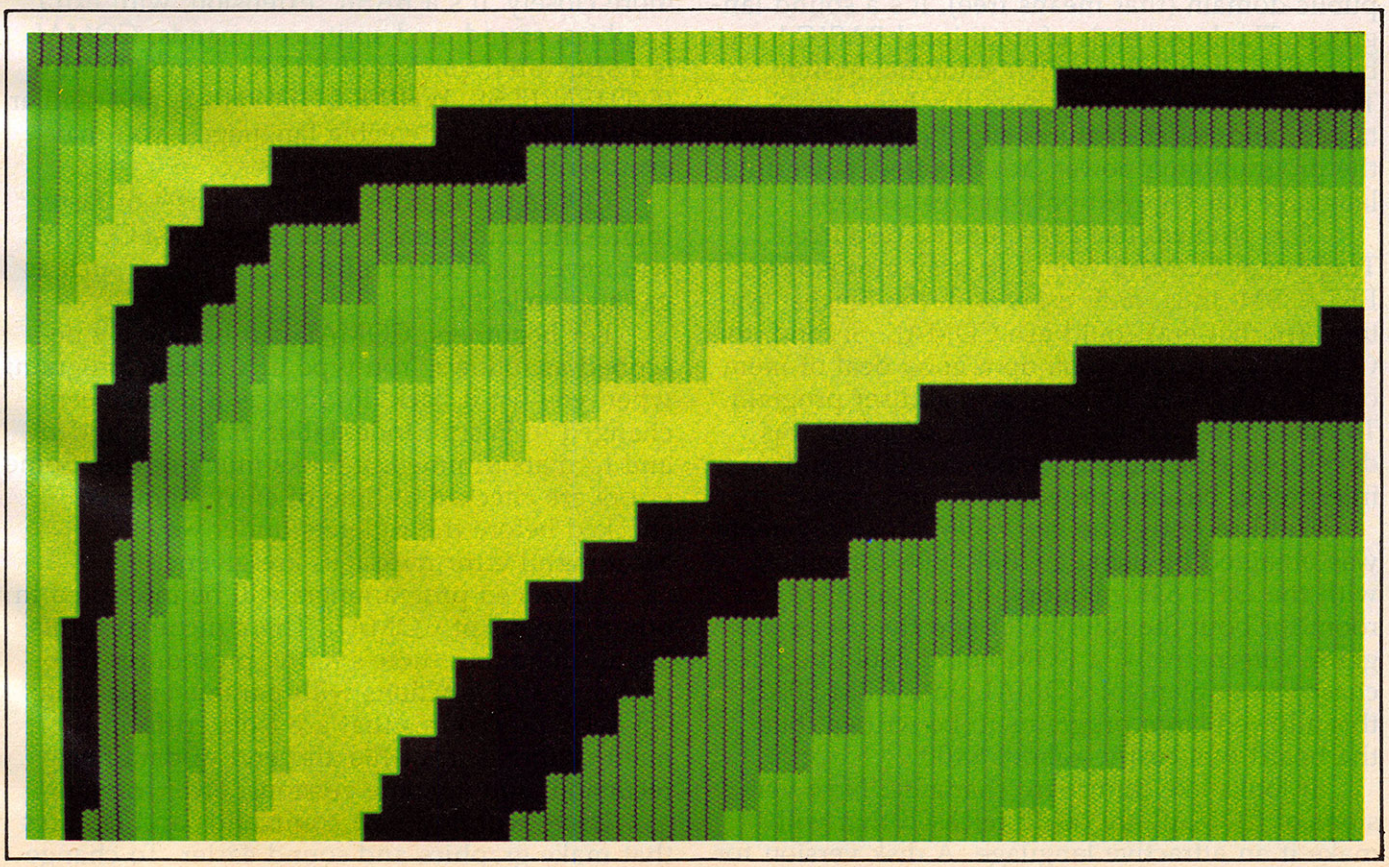
An almost infinite variety of other functions are possible. Just substitute your function for line 160, save, and then run the program. Exit with Ctrl-Break.

PC Monochrome Graphics

Refer to "COMPUTE!'s Guide For Typing In Programs" article before typing this program in.

```
BP 30 SCRNWIDTH = 80
CE 50 DIM A$(4)
KH 60 A$(0)=" "
NM 70 A$(1)=CHR$(176)
NF 80 A$(2)=CHR$(177)
PO 90 A$(3)=CHR$(178)
HC 100 A$(4)=CHR$(219)
HI 110 CLS:KEY OFF
CP 120 FOR ROW=1 TO 22
JM 130 FOR COL=1 TO SCRNWIDTH-1
NP 140 ' Change the following line
EK 150 ' to get different patterns
OH 160 W = SQR((2*(ROW-11))^2 + (COL-4
       0)^2)
AF 170 PRINT A$(ABS(W) MOD 5);
ON 180 NEXT
JC 190 PRINT
NO 200 NEXT
PP 210 BEEP
```

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Update On COMAL: A SuperBASIC

Jim Butterfield, Associate Editor

COMAL is a computer language which was developed in Denmark as an offshoot of BASIC. Some programmers prefer it and think of it as a streamlined, extended, and systematized BASIC.

COMAL has been available for some time, mostly for Commodore 32K PET/CBM machines. Previous versions have had some success despite a few drawbacks and implementation problems. Now, new versions of COMAL are being released, and the new packages look promising.

The New Generation

COMAL has traditionally been available in the public domain (that means free). It's a sound language: The loose ends of traditional BASIC have been tightened into a much smoother system. The ease of use for beginners has been maintained, and added features significantly enhance the programming power. Yet this free, powerful language has enjoyed only modest success.

The problem has been limited resources. Traditional COMAL would fit only into a 32K PET/CBM; thus, only users with the biggest systems (of that era) could use COMAL. Second, the COMAL interpreter took up a good deal of memory, leaving room for only a small user program. To offset this difficulty, a "split" COMAL was developed which used a separate editor and interpreter; but this proved awkward to use.

Until recently, the best COMAL arrangement was obtained by using a CBM 8096 computer; with the extra 64K memory, there was plenty of room for both the interpreter and the user's program. Alternatively, a ROM board could be purchased to implement COMAL on a CBM 8032; this allowed large programs to be written, but the board was costly—about $400.

It looks like things are changing. New versions of COMAL are being released that will make it an attractive language. A disk version for the Commodore 64 is now in the public domain; a cartridge version is soon to be made available for sale; and even the ROM board for the PET/CBM 8032 is being redesigned to incorporate interesting new features.

What Is COMAL?

COMAL may be described in a number of ways. It's as easy as BASIC for beginners, but has the power of Pascal when advanced features are needed. It's a tightly defined superversion of BASIC, with much more precisely defined keywords and with statements that interrelate more closely. It's a BASIC extension, with extra graphics, sound, and sprite commands. COMAL is a structured version of BASIC, complete with IF-THEN-ELSE, WHILE-ENDWHILE, and similar features. It's an extensible language—you may even write your own keywords.

COMAL programs run as fast as—or faster than—the equivalent BASIC programs. COMAL will never have certain BASIC problems such as garbage collection.

For beginners, COMAL can be crudely described as follows: You type in a BASIC program; when you list it back, it looks as if it has been changed to Pascal. Indentation has been added and formats trimmed; it looks much neater. Some errors are checked at time of entry; some are checked before the run gets under way. Meaningful error messages are given.

Advanced programmers will be interested in other features of COMAL. The structured forms are all there, but there's more: procedures (subroutines) and functions with parameter passing; "closed" procedures that are isolated from the main coding; end-of-file and end-of-data flags; recursion; and in some versions, error trapping.

Users will find new commands and features that make graphics and sound easier. To change

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the background color to black, type BACKGROUND 0. On the high-power end, COMAL 64 comes complete with turtle graphics commands: FORWARD 40 and RIGHT 45 have the same meaning as they would have in Logo.

Versions Of COMAL

Disk-based COMAL for the Commodore 64 is named COMAL 0.14. It's free in North America, but it's not public domain. The package prints a copyright statement, but permits unrestricted distribution and copying. COMAL 0.14 is available from clubs, user groups, and the COMAL user group in Madison, Wisconsin. It's a good language implementation, complete with graphics and a complete set of error messages drawn from disk as needed.

COMAL 2.0 is a plug-in cartridge for the 64 which is expected to be available from Commodore in 1985 for less than $100. It's significantly more powerful than COMAL 0.14—it offers much more program memory and includes extra features such as error trapping and program chaining or overlaying.

The COMAL board has been redesigned for the 8032 computer. The price of the revised board is expected to be similar to the previous version—that is, around $400—but there are some new features. First, if you don't want to use COMAL immediately, you can use BASIC, and the computer becomes an 8096 with 64K extra memory supplied by the COMAL board. Second, a video board can be added to the assembly to perform high-resolution graphics, including turtle geometry. Third, the board contains a time-of-day and date clock which is battery-powered and keeps good time even when the unit is off. I installed a board and checked the clock; before I reset it, it gave the correct time for Copenhagen, where it was manufactured.

Documentation

The *COMAL Handbook*, by Len Lindsay (published by Reston Publishing), is a reference manual for the language. It's just that: a reference manual, and not a tutorial. You can look things up, but it's not for learning the language.

Fortunately, most COMAL versions come with a disk of sample programs that illustrate the features of the language well. And to be fair to Lindsay's book, it contains a considerable quantity of sample programming.

If you're interested in the new 64 versions of COMAL, look specifically for the second edition of the *COMAL Handbook*. The publication date for this new edition hasn't yet been set. The original handbook gives a great deal of information on COMAL, but doesn't show the new color and graphics commands or other new features such as error trapping.

Most users will benefit from the fact that COMAL is derived from BASIC. Their BASIC experience will generally carry over to the new language.

Beginning Characteristics

Users may start COMAL programming as they did BASIC. Direct commands are allowed so that statements such as PRINT 5+7 can be executed.

Spaces must be used after keywords. FORK=1TO5 must be written as FOR K=1 TO 5. There are two reasons for this: COMAL encourages legibility, and COMAL allows long variable names. FORK could be a variable; it won't be confused with FOR K because of the space. By the way, the whole variable name is used, so that FORK is distinct from FORM, and both are different from the variable called FOR'LOVE'OF'IVY.

Even though COMAL has a full set of structured statements available, it allows the use of a GOTO statement. However, you can't GOTO a line number; you must GOTO a labeled statement in your program. COMAL is quite insistent that line numbers should be used only for editing purposes. The use of GOTO is strongly discouraged; there are usually plenty of alternative ways of programming what you need.

Subroutines are called, not with GOSUB, but with EXEC for execute. COMAL uses the term *procedure* rather than subroutine; a procedure is given a name. So instead of GOSUB 500 we might code EXEC SUMMARY. Since procedures have names, we don't need the keyword EXEC. Instead of EXEC SUMMARY we may just write SUMMARY, and the interpreter will call the procedure when it reaches that point. In this way, the language is extensible. We might code a program starting as follows:

```
100 START
110 CONTINUE
120 FINISH
130 ....
```

What this sequence means is: Call procedure START, then call procedure CONTINUE, then call procedure FINISH. Each of these will need to be defined as a procedure (a type of subroutine) somewhere in the program, but here's the point: The above coding is quite readable; and we have essentially defined new program commands.

It's impossible in this short article to deal with the whole spectrum of commands. Perhaps the above will give a flavor of how COMAL extends the capabilities of BASIC.

A Mix Of Features

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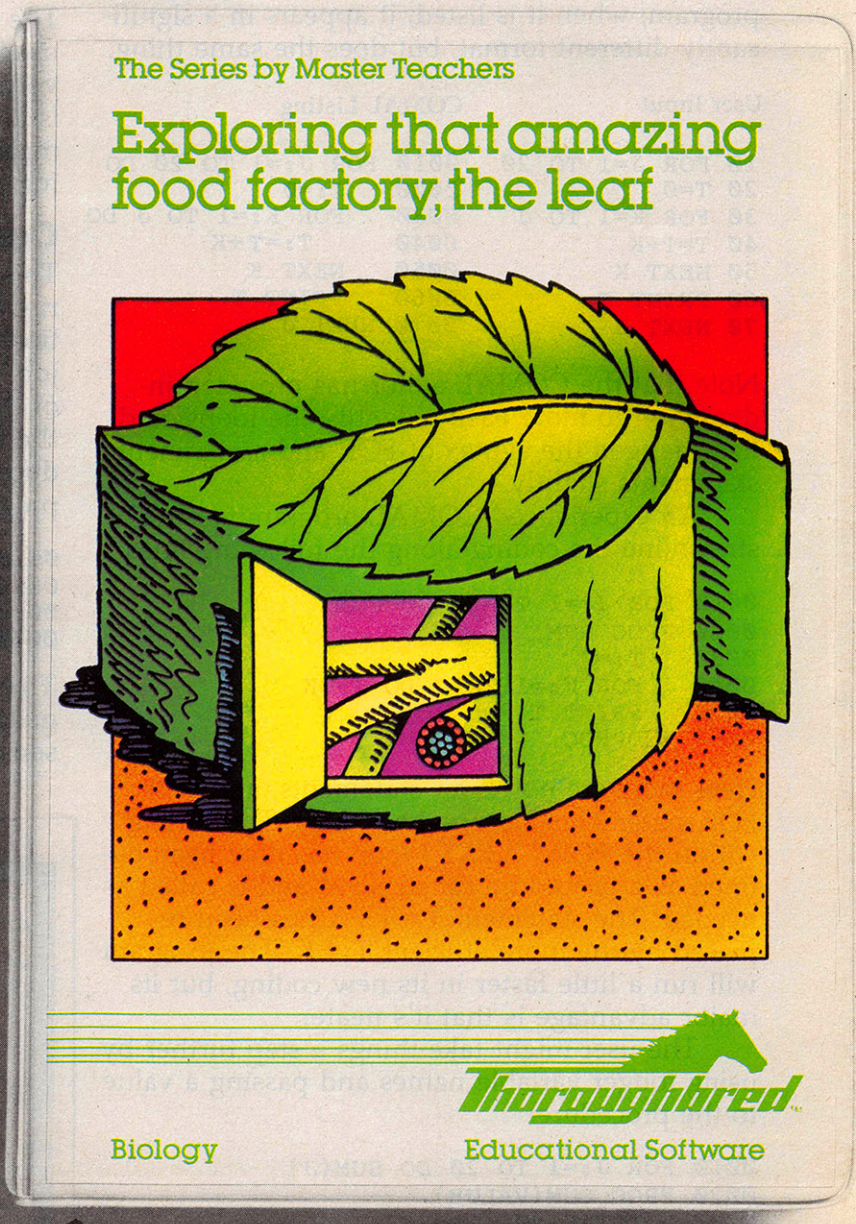
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look. It's easy on the beginner, yet it's not limiting to the expert programmer. It's more than BASIC, not exactly a Pascal, and different from Logo—but it has some of the characteristics of all three languages.

It's inexpensive to try. You may find that it's just what you have been looking for.

Further information on COMAL may be obtained from:

COMAL User's Group
5501 Groveland Terrace
Madison, WI 53716

Reston Publishing
11480 Sunset Hills Road
Reston, VA 22090

COMAL Examples

The user may input what appears to be a BASIC program; when it is listed, it appears in a significantly different format, but does the same thing.

User Input

```
10 FOR J=1 TO 20
20 T=0
30 FOR K=1 TO J
40 T=T+K
50 NEXT K
60 PRINT T
70 NEXT J
```

COMAL Listing

```
0010 FOR J:=1 TO 20 DO
0020    T:=0
0030    FOR K:=1 TO J DO
0040       T:=T+K
0050    NEXT K
0060    PRINT T
0070 NEXT J
```

Note that the COMAL editor has provided indentation to more easily identify the loops, and has changed the syntax of FOR and assignment statements slightly.

An experienced COMAL programmer might streamline the coding along the following lines:

```
0010 FOR J:=1 TO 20 DO SUM
0020 PROC SUM
0030    T:=0
0040    FOR K:=1 TO J DO T:+K
0050    PRINT T
0060 ENDPROC
```

Here there are no NEXT statements, and both FOR statements are one-line loops. The coding within the FOR J-NEXT J loop has now been defined as a procedure called SUM and is called as needed. The statement T=T+K has been replaced by the more efficient T:+K. The program will run a little faster in its new coding, but its major advantage is that it's neater.

The user might take things a step further by using longer variable names and passing a value to the procedure:

```
0010 FOR J:=1 TO 20 DO SUM(J)
0020 PROC SUM(VALUE)
0030    TOTAL:=0
0040    FOR INDEX:=1 TO VALUE DO TOTAL:+IN
        DEX
0050    PRINT TOTAL
0060 ENDPROC
```

Labels such as TOTAL and VALUE would be forbidden in BASIC (the keywords TO and VAL are there), but not in COMAL. The new program takes slightly more space than before and runs at the same speed. Procedure SUM could now be completely disconnected from the main routine (via PROC SUM(VALUE) CLOSED) since it is passed all the required data; it doesn't need to "raid" the main program variables.

We can go a step further by using a defined function in this case:

```
0010 FOR J:=1 TO 20 PRINT SUM(J)
0020 FUNC SUM(VALUE)
0030    TOTAL:=0
0040    FOR INDEX:=1 TO VALUE DO TOTAL:+IN
        DEX
0050    RETURN TOTAL
0060 ENDFUNC
```

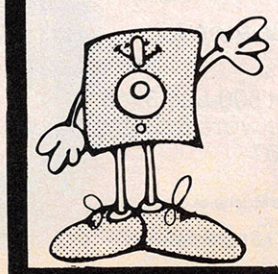
The value of SUM is calculated each time it is used. Using a defined function can generate a very readable program. The statement RETURN is different from a BASIC subroutine RETURN. It means, "give back a value of TOTAL to the calling program."

Common Sense And COMAL

This program generates the sums of various series of numbers. It's meant to show COMAL options; it's certainly not the best way to do the job. As any math teacher will tell you, the sum of the numbers from 1 to J can be calculated by the formula (J+1)*J/2. We could therefore reduce the function to a single line and write the program as follows:

```
0010 FOR J:=1 TO 20 PRINT SUM(J)
0020 FUNC SUM(VALUE)
0030    RETURN (VALUE+1)*VALUE/2
0040 ENDFUNC
```

That's not an advantage caused by the language—that's just a little math and common sense. ©



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THE BEGINNER'S PAGE

Tom R. Halfhill, Staff Editor

Starting this month, "The Beginner's Page" will be written by Tom R. Halfhill, editor of COMPUTE!. *Halfhill's former column in* COMPUTE!, *"Questions Beginners Ask," will be incorporated into "The Beginner's Page."*

A Column For Everybody

Welcome to the new Beginner's Page. A popular column in COMPUTE! since March 1981, "The Beginner's Page" was conceived as a way to introduce the main concepts of personal computing to beginners. But it's also a way to unite the users of the many different computers covered in COMPUTE!.

That's why "The Beginner's Page" will continue to involve every computer brand covered by COMPUTE!. It doesn't matter if you have a $79 Commodore VIC-20 or a $4000 IBM PC. If you have an interest in learning more about personal computing, that's enough. As always, we look forward to your questions, comments, and suggestions. We'll devote most of each month's column to a specific topic, and then conclude with an answer to a general-interest question, much like "Questions Beginners Ask." Sometimes the question will come from one reader's letter, and other times it will be culled from a number of letters asking pretty much the same thing. So keep the mail coming.

Emulators: An Impossible Dream?

Certain types of questions consistently recur in the mail we receive from readers. One such question has to do with *emulators.*

An emulator is an add-on accessory or adapter that lets a computer run programs designed for another computer which is normally incompatible. The concept of an emulator is fascinating, almost mesmerizing, especially for beginners. Imagine having access to the hundreds and even thousands of programs available for other computers. It seems that your software problems would be solved overnight.

Unfortunately, it's not that simple. True emulators are very rare indeed. If ever there was reason to observe the warning "Let the buyer beware," you should heed it when encountering a sales pitch for an emulator.

For instance, when the Commodore 64 first hit the market, there were all kinds of rumors about forthcoming Apple emulators. Several companies, supposedly, were preparing plug-in modules that would let Commodore 64 owners simply load an Apple program off a disk and type RUN. Some companies even advertised their Apple emulators in magazines. But they never materialized.

Elusive Emulators

We received scores of letters from readers asking about these emulators, and we followed every lead. But each time we contacted the company involved, we got pretty much the same answer: "Available soon." Of course, "soon" stretched into "never."

At the time, the idea of an Apple emulator held great appeal for Commodore 64 owners because there wasn't much software for their brand-new computer. Now, two years later, there's a virtual glut of Commodore 64 software and the idea has lost some of its attraction. Even though the Apple has acquired a huge software library (estimated at 10,000 programs) after more than seven years on the market, the Commodore 64 software has all been written within the past two years and is generally more up to date. In fact, there are probably some Apple owners today who'd like to get their hands on a Commodore 64 emulator.

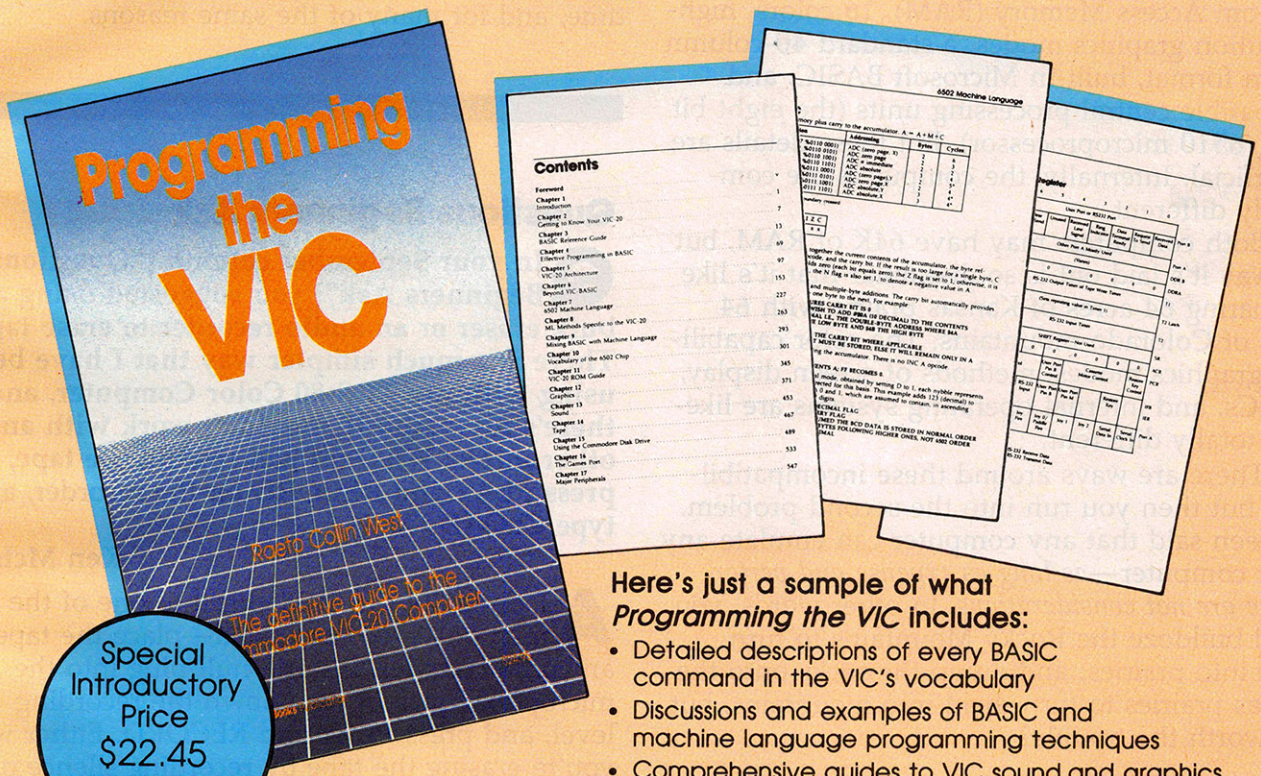
Over the years we've heard wishes, rumors, and announcements of other emulators, too: adapters to make Atari game machine cartridges compatible with Atari computers, or vice versa; a Commodore 64 emulator for the VIC-20; and even an IBM PC emulator for the Coleco Adam (actually announced by Coleco for tentative release in late 1984). But chances are you'll never

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see any of them. Or if you do, they'll scarcely be cost-effective.

Turning Mountains Into Prairies

There are two problems to overcome when designing an emulator: First, you have to exactly duplicate every hardware function of the computer you're trying to emulate (while avoiding patent- and copyright-infringement suits); and second, you have to match or exceed the performance and cost-effectiveness of the computer you're trying to emulate.

Let's tackle the first problem. It might seem that a Commodore 64 and an Apple IIe, for instance, have a lot in common: Both have 64K of Random Access Memory (RAM), 16 colors, high-resolution graphics modes, a standard 40-column screen format, built-in Microsoft BASIC, and compatible central processing units (the eight-bit 6502/6510 microprocessor). But these details are superficial. Internally, the computers are completely different.

Both computers may have 64K of RAM, but the way it's laid out is so dissimilar that it's like comparing 64 acres of Kansas prairie with 64 acres of Colorado mountains. The color capabilities, graphics modes, methods of screen display, BASICs, and internal operating systems are likewise totally different.

There are ways around these incompatibilities, but then you run into the second problem. It's been said that any computer can emulate any other computer—*as long as expense and performance are not considerations.* In other words, you could bulldoze the Rocky Mountains to turn them into prairies, and dump the rocks onto the Kansas prairies to turn them into mountains, but is it worth the trouble?

Emulator=Computer

The only practical way to build an emulator is to shrink the first computer down to a box or module that plugs into the second computer. Usually it's not worth it, because you could simply buy the first computer for not much more than the emulator would cost. For instance, once at a computer show we saw an Atari VCS game machine emulator for the VIC-20. It really worked, because essentially it was an Atari VCS in a plug-in module. However, it cost $89.95, and Atari game machines at that time were selling for $99.95. So the emulator cost $10 less, but didn't come with a pair of joysticks, paddle controllers, or a free game cartridge as the VCS does.

Similarly, one Apple emulator that was announced for the Commodore 64 was to be priced at about $800. But at some discount dealers, you can buy an Apple IIe and a disk drive for not much more. Why buy the emulator?

For an emulator to be worthwhile, it should provide at least 90 percent compatibility at a price significantly less than what the other computer would cost. Even then you should balance the cost of the emulator against the benefits of running the other computer's software.

Admittedly, it would be nice if we could buy inexpensive emulators that would let us run software written for everybody else's computers, because then our choice of which computer to buy wouldn't be so difficult. It would also be nice if we could buy a Datsun or Renault and repair it with Chevrolet or Ford parts, and vice versa. But realistically, neither is likely to happen for a long time, and for many of the same reasons.

Questions Beginners Ask

Q In your September column ["Questions Beginners Ask"] you suggested using a bulk eraser or an audio recorder to erase tapes. There is a much simpler way that I have been using with my TRS-80 Color Computer, and there's no reason it shouldn't work with any other micro. Why not just rewind the tape, press PLAY and RECORD on the recorder, and type CLOAD "X" ?

Ken McIsaac

A Essentially this is identical to one of the methods I recommended—place the tape in an audio recorder, insert a null plug into the microphone jack or turn down the recording level, and press PLAY and RECORD. Either way, you're erasing the tape by recording silence over the previous material.

However, your method works only on TRS-80 computers; Commodore, Apple, TI, and IBM computers don't have a CLOAD command. Atari BASIC uses CLOAD, but if you try typing CLOAD and pressing RECORD and PLAY, the tape stops after a short while and the computer reports ERROR 138—device timeout. When the Atari detects no program on the tape, it stops the recorder motor. As mentioned in September's column, you can get around this by pressing RECORD and PLAY and entering POKE 54018,52 to start the motor, and POKE 54018,60 to stop the motor.

In any event, these methods are inefficient ways to erase a cassette. It takes a half-hour to erase a C-30, an hour to erase a C-60, etc. A bulk tape eraser does the same thing in a few seconds, and saves wear and tear on your recorder. ©

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More Ways Computers Made Me Smarter After Only Thirteen Years Of Daily Use

Last month, on the occasion of my third anniversary as a COMPUTE! columnist, I recounted some of the blessings computers have brought me: *Cuisinart-brain thinking* (the ability to process facts by slicing them, dicing them, and mixing them together); an *algorithmic lifestyle* (applying patterned thinking to problems of everyday life, such as how to turn off an unfamiliar shower faucet in a hotel bathroom); *lightning-fast logic* (like the time it took me only 24 hours to realize I was wearing a name badge upside-down); and new-found *mechanical aptitude* (as evidenced by my futile attempts to open up a new portable computer until rescued by my seven-year-old daughter).

But the blessings don't end there. No, 13 years of working with computers have enhanced my life in other ways as well. For example...

Blessing 5: I've Become A Whiz With Robots

My family and I live an "Erma Bombeck lifestyle." That means our house is a mess, our lives are chaotic, and we struggle through each day doing our best just to cope.

But last week was even worse.

Last week a film crew from the PBS program *The New Tech Times* descended on our house to shoot a profile of me and my family (and our 14 robots and 23 computers), and a robot product review.

The film crew arrived Thursday morning and spent the entire day taping program segments all over the house. They filmed in my study, in the dining room, the rec room, the hallways, and in our bedrooms.

At one point, late in the day, my wife Janet came into the house and gasped. She had absolutely forbidden us to shoot in the living room, yet there we were, complete with a dozen robots, giant, aluminum umbrella reflectors for the camera lights, and thick, snakelike cables draped over our new couch.

In total despair, Janet dashed into the room, and swiped up the Christmas cards that had been sitting over the mantelpiece for at least seven months. "I can see there are no wives and mothers on this film crew," she muttered as she stalked out of the room.

Earlier in the week, to get ready for the program, I had panicked and gone "over the top" (as the English say), and tried to get everyone in my life into the show. I had my mother fly in from Pennsylvania to show how she and Catie have become computer pen pals on The Source. I had helped my five-year-old son Eric set up cubbyhole "offices" under his bed and underneath my desk in my study so he could show

The Bear facts:

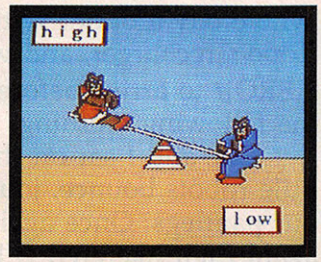
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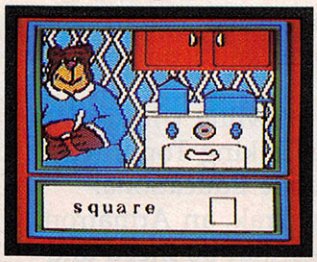


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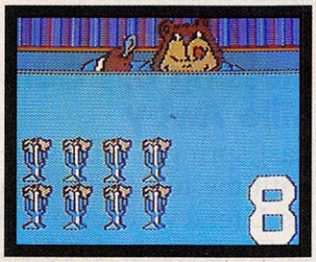


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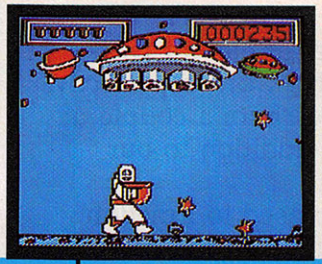




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how he uses a portable computer to do "gobbledygook processing."

I had organized two dozen neighborhood kids to try to teach one of our robots how to skateboard. We had bought Topo the robot a black cape and programmed him to breakdance with Eric, to the tune of Michael Jackson's "Beat It." We had enlisted the teachers and students in a preschool and two high schools to show how they were programming computers and robots and playing with them. And I had even managed to persuade Olga Pagenhardt, the 70-year-old director of Roanoke's "Programs for Retired People," to be present to show my concern for senior citizens and computers.

To get to all the schools and other sites for filming, we formed a caravan of vans and cars, loaded with people, cameras, computers, and robots, and we wound our way, in a big hurry, around the streets of Roanoke. Robots sat on car seats and on the floors of the vans, and peeked out of every window at fellow motorists and passersby. And each time we turned a sharp corner, a robot would tumble over and lose an arm or bend an antenna.

The house was literally crawling with robots. We had a HEROjr, we had a Talking Topo, we had a F.R.E.D. (Friendly Robotic Educational Device), a Maxx Steele, a Big Trak, an Armatron, and eight little crablike robots that bounced and hobbled their way across our kitchen floor.

The robots were the center of the show, but they were so *finicky* they almost caused me to have a nervous breakdown.

We had a HEROjr, for example, for two weeks before the program. He worked perfectly, he visited the kids at the preschool a couple of times, and he was a lovable addition to our family.

Then, inexplicably, he ceased to function.

To bring him back to life, we tried human-to-robot resuscitation. We tried pulling off his head, taking off his clothes, and everything else we could think of. But no luck. He was in the Robot Happy Hunting Ground, and we couldn't bring him back.

That's just when Topo the robot decided to become a problem. Topo, too, had been A-OK for over a month. Then, in quick succession, he suffered memory lapses, his infrared "eye" stopped working, and, worst of all, his recharger disappeared. Anybody who has ever hung around with robots knows how serious it is when a robot can't find his recharger.

Wednesday afternoon, the day before the TV film crew came, was the worst. Topo wasn't working. HEROjr wasn't working. And we had just gotten a shipment of little robots in the mail, and the most important little robot was broken.

"I give up!" I cried. "I hate robots! I never want to see another robot! Get them out of my sight. I'm going back to bed."

Then Eric came to the rescue.

Eric had just come home from school and walked in on my tirade. In his own breezy, take-charge manner, five-year-old Eric barged into a kitchen filled with computers, robots, and adults, sat down at the table, and began fooling with the broken robot.

A moment later it beeped!

Then its lights came on. And it beeped again.

Then it began jerkily moving around the kitchen table. It crawled. It stopped. It lurched. It stopped. It looked like a tipsy turtle ambling across a fishing boat in high seas.

When I saw the robot work I grabbed Eric and gave him a big kiss and a hug. "I don't believe it," I said. "You fixed it. How did you do it?"

"I just pushed the buttons," Eric said. "Do you have any more robots I can fix?"

Eric's dramatic rescue of the robot turned the whole day around. Within minutes we had found Topo's recharger, and we had lined up a new HEROjr to arrive before the TV crew showed up the following morning.

Eric and I sat on the kitchen floor having little robots bounce, jounce, and try to run up our pantlegs. Once again I was happy. Once again I felt like Fred D'Ignazio, Robot Tamer Extraordinaire.

Blessing 6: I Can Spot A Shortcut A Mile Away

Last spring, I took several computers and robots with me to London, England, to teach a "Robotics Literacy" course. I described my adventures in the October 1983 issue of COMPUTE!, in my column "There's A Robot In My Room."

In that column, I told how I tried to make a HERO robot I had taken with me into a robotic alarm clock that would wake me at 5:30 a.m. each morning so I could prepare the lectures for my students before class.

I went to extreme lengths to get HERO to become an alarm clock. I positioned him perfectly, right beneath my bedroom window. I wrote a program in hexadecimal and loaded it into HERO by punching the buttons on top of his head. I activated his light sensor, so he could look out the window and watch the sun coming up, then wake me just after dawn. The sunlight was supposed to trigger his light sensor, which in turn would trigger HERO to start talking. "Good morning, Fred. Time to wake up. Get out of bed, you sleepyhead," he was supposed to say. "It's 5:30 a.m."

And he did say it. But he didn't say it at 5:30 the next morning. He said it at 11:00 p.m.



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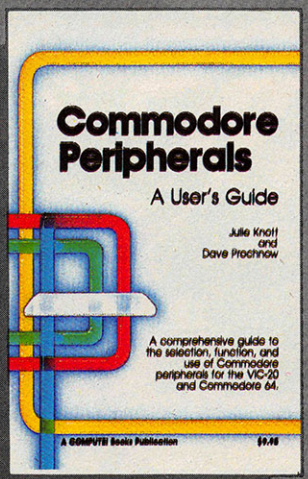
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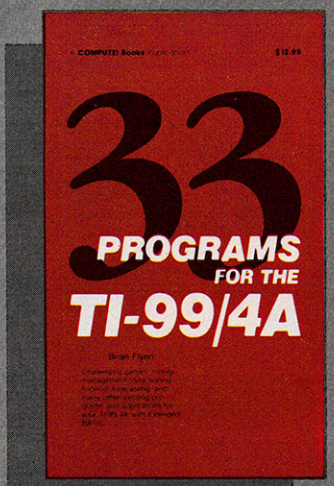


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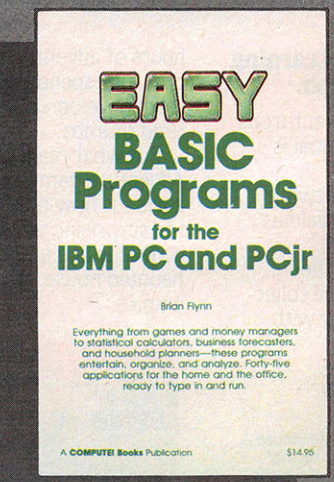


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and again at 11:45 p.m. The second time he said it, I was sound asleep. And I was not happy to be wakened—especially by a robot.

Of course it was not his fault. I had programmed his sensor to be so sensitive to light that even the tiniest amount of light would set off his robotic alarm clock. The first time he went off, his sensor had detected my bedside reading lamp. The second time, it responded to the headlight of a passing truck.

After these two experiences, I lowered the sensitivity of the sensor, went back to bed, and happily slept through the night.

The next morning I heard banging on my door. It was my colleague at the robotics course, and it was 8:30 in the morning. I had overslept by *three hours*.

Why hadn't HERO awakened me? Later in the day, when I had had time to get dressed, teach a course, and grab a late breakfast, I calmed down enough to realize that I had now erred in the opposite direction. This time I had set HERO's sensor *too low*. It was now so low that only a supernova would turn him on.

When my article appeared in COMPUTE!, I received dozens of nice letters. The readers loved my stories about living with robots, and they wanted to know more about the robotics literacy course.

Then, one day, I received a letter from a nine-year-old boy. He had enjoyed my article, too, he said. But he had one small question. Why, he asked, if HERO had a clock built inside him, couldn't I have written a little program to have HERO check his clock, and at 5:30 a.m. start talking and wake me up?

I wrote the boy a letter and answered his question simply and truthfully. "I didn't think of it," I said.

I showed my wife the boy's letter. That's when she christened me "Do It the Hard Way, Fred."

I wince when I admit it, but it is a perfect nickname. After all, I have spent thirteen years programming and working with computers and robots. I have been on intimate terms with machines of all sizes and personalities. But am I any smarter? Have computers made me a quicker, more logical thinker?

Judging from my experience with HERO in London and from all my other experiences, the answer is no. And it took a letter from a sharp little nine-year-old boy to make me realize it.

"Put your heart and soul into computing," I advised him in my letter, "and, one day, you may be smart just like me." ©

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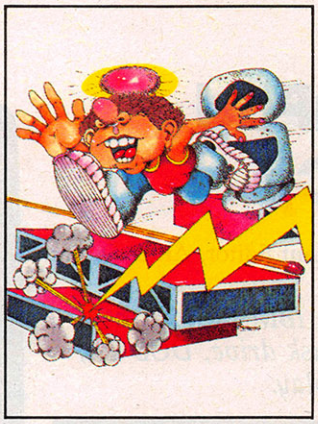
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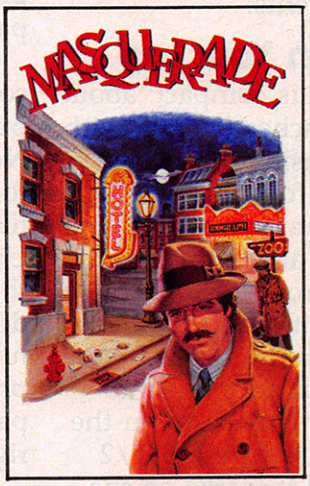
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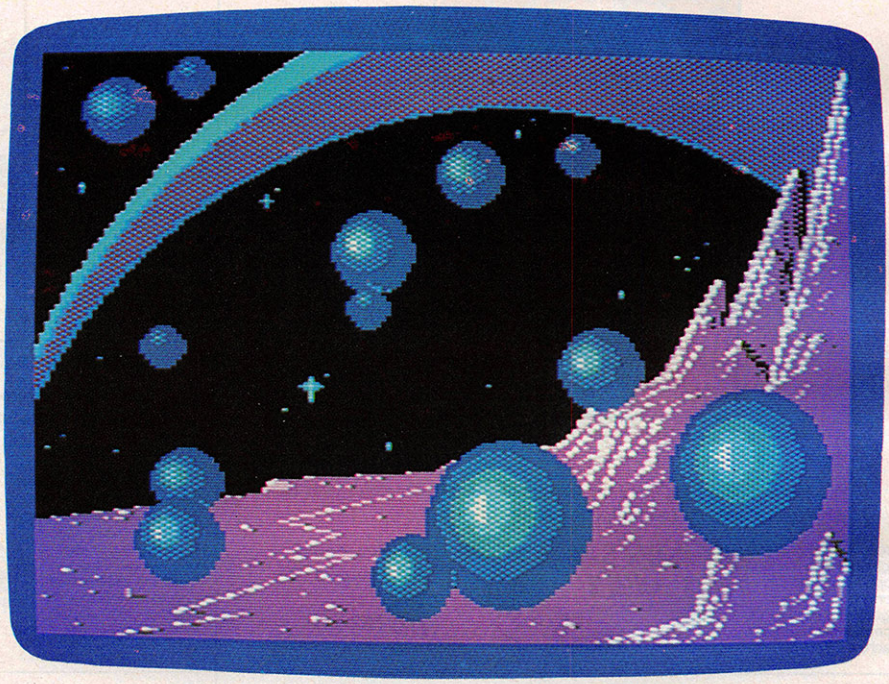
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KoalaPad For PCjr

Lee Noel, Assistant Editor, Art & Design

Requirements: IBM PCjr with 128K RAM, disk drive, DOS 2.1, and color display.



"Bluemoon," an imaginary world made with the KoalaPad and KoalaPainter. *The blue spheres were designed on the alternate screen and then copied to the main screen. (All works reproduced here, except the fox, were created by author Lee Noel.)*

Long before I picked up the new PCjr KoalaPad, I was using the KoalaPad for the Commodore 64. In combination with its accompanying *KoalaPainter* program, it was—and still is—the most flexible and satisfying computer graphics tool I've ever used.

After testing the PCjr KoalaPad package for more than a month, I'm pleased to report that it's virtually identical to the Commodore 64 version. The essential features have all been retained, and the few differences are improvements.

A Screen In Your Lap

The KoalaPad is compact: about six by eight inches overall, with a pressure-sensitive drawing surface about four inches square. There are two large black buttons at the top. It's sturdily constructed of plastic and should withstand moderate abuse from children.

The KoalaPad plugs into one of the joystick ports on the rear of the PCjr with a 5-1/2 foot cord, and it works on the same principle as a game controller. But instead of reporting the position of a movable joystick, the KoalaPad reads the position of an object pressing against the pressure-sensitive membrane. (This can be the plastic stylus supplied with the package or even a finger.)

The program running in the computer then converts this input into some meaningful form. Not unexpectedly, the two buttons at the top of the pad act like fire buttons on a joystick. Unlike the joystick buttons, though, both buttons on the pad do exactly the same thing, so it never matters which one you press. Two buttons make the pad convenient for both left- or right-handed people.

It's up to the program to make use of the pad's readings. You could write your own programs to work with the KoalaPad, or even use it with some existing software. Of course, the pad comes with its own graphics program, *KoalaPainter*. It treats the pressure-sensitive surface as a representation of the computer's display screen. Pressing a certain point on the pad's surface causes a lighted arrow to appear at a corresponding point on the screen. Moving across the surface as you press also moves the arrow across the screen. Removing all pressure from the pad makes the arrow disappear. In computer jargon, the arrow is a cursor.

However, pressing two or more places at once does not make two arrows appear onscreen. The KoalaPad is designed to recognize only one contact at a time; more merely confuse it. Therefore, you have to keep stray fingers off the

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membrane. (This is a major difference between the KoalaPad and a competitive touch tablet, the PowerPad from Chalkboard, which can distinguish multiple contact points and report them all to the computer.)

The KoalaPad is easiest to use with its special stylus. The stylus moves smoothly across the surface and greatly aids accurate work. However, just about anything can be used as a stylus. Children often prefer just to press with a finger, in a fashion similar to fingerpainting. But even though the membrane is very durable, you should avoid sharp objects that might permanently damage it.

Easy To Run

Before using the *KoalaPainter* diskette for the first time, you must transfer parts of DOS 2.1 onto it. The procedure is very well explained in the manual, even for beginners. Once it's done, you'll never have to do it again; you boot up with this disk each time.

All you have to do is plug the pad into the rightmost (as you face the system unit) joystick port, then insert the prepared disk and turn on the computer. Everything runs automatically.

The *KoalaPainter* menu denotes various functions with tiny pictures on the screen, sometimes called *icons*. Even nonreaders can use this program. The menu is well-designed and extremely easy to understand. For example, a picture of two circles indicates the CIRCLE function, which lets you draw circles. It's that simple.

To activate the CIRCLE function—or any similar option—you just move the stylus across the pad so the screen arrow points inside the box containing the appropriate icon. Then press either of the KoalaPad's fire buttons. At once, the box changes color, verifying your choice. The function remains active until you select another one.



This finely crafted picture of a red fox is included on the KoalaPainter *disk.*

Of course, you don't want to draw pictures over the menu, so the program has a blank screen ready. To reach it, stop pressing against the pad and press one of the buttons. Instantly, the blank screen appears. You can return to the menu anytime by removing pressure and pressing the button again. That's basically all there is to operating the system.

The KoalaPad system shows how easy computers can be. There's rarely a need to touch the keyboard, and there's no mysterious new computer language to learn. Naturally, taking advantage of *KoalaPainter*'s many functions to create a detailed picture does take some practice, but you can start experimenting immediately. Thanks to the excellent manual (despite a few typographical errors), the task of learning the program is simplified considerably.



"Janus" shows one application of the KoalaPainter *mirror mode.*

Low-Resolution Graphics

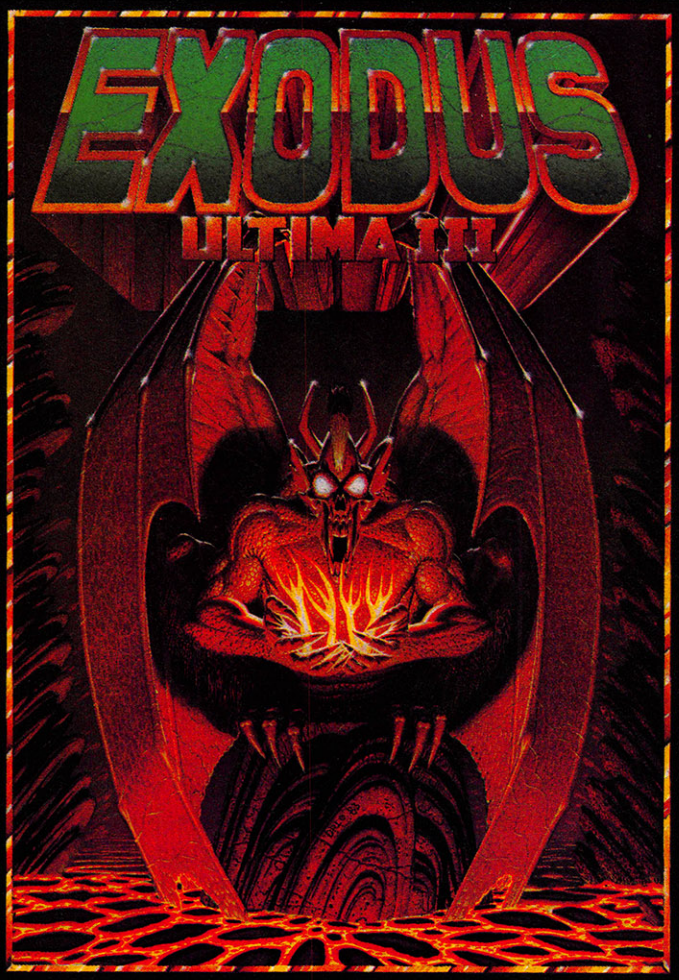
For some reason, *KoalaPainter* only uses the PCjr's low-resolution 160 × 200 pixel graphics mode (SCREEN 3 in Cartridge BASIC). This mode does offer 16 simultaneous colors, but so does one of the medium-resolution (320 × 200) modes. The greater the resolution, the more detailed the pictures you can draw.

Koala Technologies says it chose low-resolution graphics to conserve memory and to insure a clear display on ordinary TV sets and composite color monitors. While the latter point makes some sense—TVs may indeed have difficulty with the finer display—it's hard to understand why memory was a factor. The PCjr version of *KoalaPainter* requires 128K RAM, more than enough memory to support all the requirements of the program. The Commodore version runs easily in 64K, and similar programs for other computers can run in as little as 16K. Koala says the decision to use the low-resolution mode was a judgment call, but it seems a shame that *KoalaPainter* cannot take full advantage of the PCjr's excellent display capabilities.

Of course, a lot can be done even with 160 × 200 graphics, as the accompanying screen photos prove. The picture of the fox, one of several demos on the *KoalaPainter* disk, contains plenty of detail. And the resolution is comparable to that offered by competing graphics packages for other home computers.

Still, it would be nice to have the highest full-color resolution the PCjr can support. Perhaps some RAM could be conserved if Koala supplied *KoalaPainter* on ROM cartridge instead of disk. That would, however, increase production costs, and therefore the retail

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price. As Koala says, it's a judgment call.

A Hundred Shades

You can actually simulate more than 16 colors with *KoalaPainter*. Although the PCjr is limited to displaying only 16 true colors—or, more accurately, two shades of eight colors—you can mix any two colors into a halftone dot pattern. This creates the effect of different shades. Further, there's a special new rainbow color feature that mixes lots of colors together for you—children should love this. All in all, there are more than a hundred shades and combinations to choose from.

The border on the drawing screen changes to match the drawing color selected. Otherwise, it's easy to try to draw in, say, white on a white background. Without the border, you might wonder for a long time why nothing was happening. However, the border can display only a single solid color—not the rainbow color or the halftones.

In addition to all the colors, *KoalaPainter* gives you eight different types of brushes. You can use a fine brush for drawing, a broad brush for rapid painting, a brush that makes several parallel lines, a brush that letters in *italics*, and more. Of course, the brushes are just a software illusion—you always use the same stylus or fingertip.

Drawing Options

Once you've selected your color and brush, you choose one of the drawing commands from the menu. There's everything from a freehand drawing mode to a Zoom command that magnifies a section of your picture so you can make precise changes to any dot of color on the screen. Here's a summary of *KoalaPainter* drawing options:

• Line, Lines, and Rays let you draw perfectly straight lines in various ways. They use a technique called *rubber-banding*. First, you set an initial point by pressing the stylus against the pad and hitting the button. Then, maintaining pressure, you move the stylus. On the screen, you'll see a flashing line stretching back to the original point from the current stylus position. As you continue to move the stylus, the line moves to accommodate the new position. This looks a lot like a rubber band being stretched over the screen, hence the term.

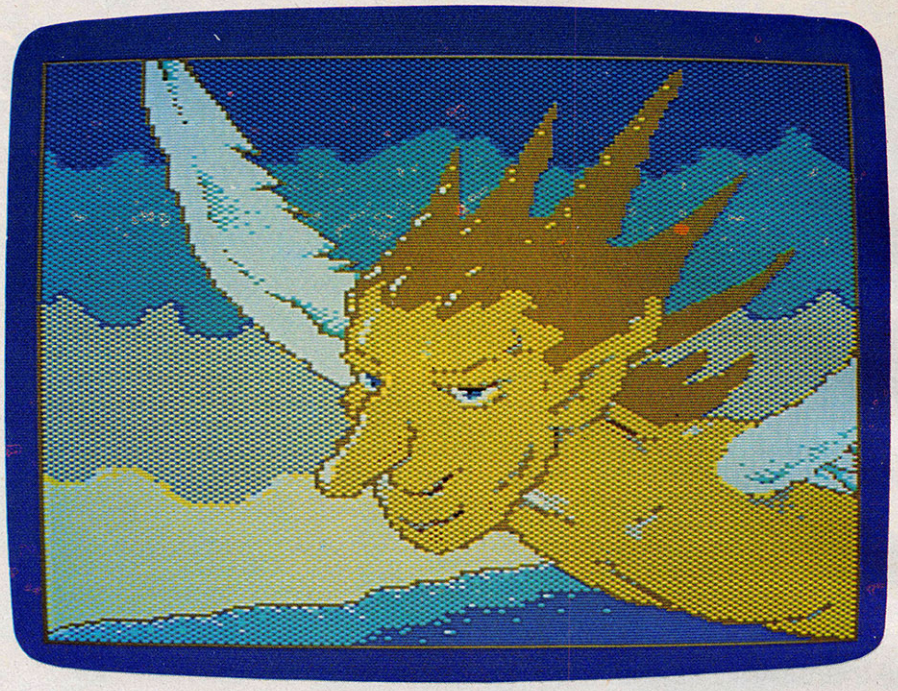
When you're happy with the length and direction of your line, you press the button a second time. Then you can move the line (now of fixed length and direction) to any area of the screen. Pressing the button a third time locks the line in place. If you wish, you can continue putting identical lines all over the screen just by pressing the button repeatedly.

• Frame, Box, Circle, and Disk draw just what you'd expect. (A box is a solid frame and a disk is a solid circle.)

• Mirror lets you draw symmetrically in three different ways. For example, one of the mirror modes produces a top-bottom mirror image—anything you draw in the top half of the screen appears simultaneously, but inverted, at the bottom of the screen, and vice versa. You could draw a reflection in a pond or some other flat, shiny surface with about half the effort you might otherwise expect.

• Fill is another readily grasped command. If you've got a child who loves coloring books but is frustrated by not being able to color pictures evenly, Fill will come as a blessing. (They can't draw on walls with it, either.) You can fill any completely closed outline with any color. Using it is really child's play: Select the Fill command and a color from the menu, move to the picture screen, put the cursor inside the closed outline, and press the button.

The *KoalaPainter* Fill command is not only fast, but also the most thorough I've seen in any graphics package. While Fill (sometimes called Paint) commands are common to lots of graphics programs, they are sometimes fooled by complex



"Icarus," the mythical Greek who flew too close to the sun.

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outlines and fail to fill them completely. With *KoalaPainter*, as long as the outline is fully closed and the fill color doesn't conflict with the background color, Fill works flawlessly.

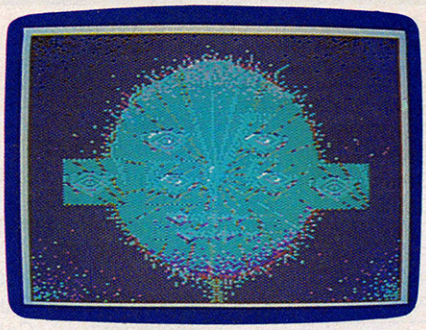
There are limitations, though. Remember that Fill actually "looks" for the border around the space it's supposed to fill. So you can't refill an area already filled with a halftone, for example; every point in a halftone pattern is surrounded by four others in a contrasting color. However, there are ways to get around this (see below).

• Copy lets you select a portion of your picture and transfer it anywhere on screen. You can draw a detail once and use it over and over again.

• Swap lets you flip between two drawing screens, completely independent of each other. Apart from the obvious fun of working on two pictures at once, there are a couple of interesting applications that come to mind for this command. For one thing, you could reserve one screen for your picture, keeping the other as a work area where you create details for the main picture. Once the details are complete, the Swap and Copy commands can transfer the images from the work screen to the main screen. You can test and perfect certain elements of your picture before committing them to the main screen.

I've used some expensive graphics software that makes a big deal out of allowing you to create individual picture/detail libraries for various purposes. *KoalaPainter* provides the same capability with Swap and Copy, especially when used with the Zoom and Mirror modes.

Another (as yet untested) application for Swap is cartoon-like animation. You could copy an entire picture from one screen to the other, making the slight changes required to produce the illusion of movement. This process could be repeated until the desired sequence was completed. The resulting frames could be filmed or videotaped.



"Moons." The night has a thousand eyes.

Oops-Proof

• The Erase command blanks out a hopelessly botched screen, but only the one you were looking at most recently. The second screen is safe and can be reached with the Swap command.

• Oops fixes your minor mistakes. It nullifies the effect of your last menu selection. This is a very useful feature, and it's missing from lots of graphics software. Let's say you want to test a certain fill color in part of your picture. Just go ahead. If you don't like the way it looks, *immediately* go back to the menu and select Oops. The picture is restored exactly as it was before. But you have to use Oops immediately. If you fill, then select Draw, and suddenly decide you don't like the fill color, Oops can't rescue you. It would work only on the more recent Draw selection.

By the way, this is one method of remedying an unsatisfactory halftone fill. You just use Oops and try again with a different color.

• X-Color may seem a little weird at first, but it's a command I use a great deal. Amazingly, it will change *all* areas of a certain color in your picture to any other color. This is possible because the PCjr is the only home computer besides the Atari that has a color-indirection system (although this feature can be simulated in software on other computers, as *KoalaPainter* does on the Commodore 64). Let's say you suddenly realize outer space isn't really black, it's purple. Just select X-Color and purple, go to the picture screen, place the cursor on any black area of the picture, and all the black turns purple. (That's all the black, so if something should have remained black, it's time to use Oops!)

X-Color can also extricate you from a halftone fill problem, especially if Oops won't work. You just use X-Color to make one of the tone colors the same as the other. Then you've got a solid color which can be filled in the normal way.

• Storage lets you name, save, and recall your pictures with the disk drive. It calls up a special disk menu which requires elementary reading skills. Picture files must be named and typed in on the keyboard. Parents may need to help young children at this point.

Jittery Drawing

• The Draw option lets you draw freehand, just like you would with a pen or brush. Marks appear on the screen only when the pad button is pressed. This mode ought to be simple and straightforward, but it's not.

First, the cursor is always jiggling around with *KoalaPainter*. It's almost impossible to draw a smooth line with Draw. Instead, Draw makes a spontaneous, lively line. This is fun for some purposes, but frustrating for others. When rigid control is required, you must switch to one of the precise drawing commands, such as Line.

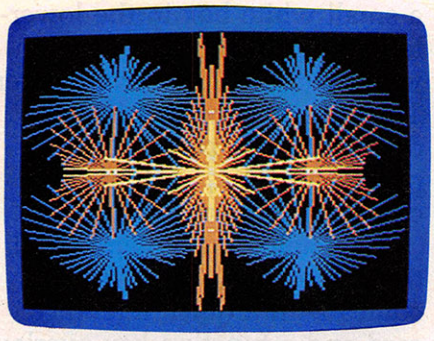
More importantly, there is a relatively minor but annoying bug in the KoalaPad system. The pad keeps track of the

stylus's position by constantly comparing it with a theoretical pressure point at the upper-left corner of the pad. Sometimes, mostly when using the Draw command, if your stylus pressure is a little light, the pad suddenly decides it's *you* up there in the left-hand corner. Consequently, a line instantly splashes up to that corner of the screen. If this happens, go straight to Oops, unless you've drawn a great deal since the last menu selection. If that's the case, it's better to choose a thick brush and erase the pesky line by painting over it with the background color.

Be alert for this problem. It's built-in, but won't be a danger unless you forget what's happening.

• Zoom is the ultimate command for the detail-minded. When you select Zoom, a small rectangle appears on your drawing screen. It can be moved to any area of your picture that needs close inspection or detailed revision. Then press the button. You'll see not only a greatly enlarged view of the area under the rectangle, but also a normal-sized view of that general part of the screen. A special palette display lets you change colors without going to the menu. You can use the magnified cursor to change any of the individual dots of color that make up your picture. The changes appear instantly in the normal-sized section of the picture. The only *KoalaPainter* command supported in Zoom is Draw. This means you are pretty well restricted to changing just one block of color at a time.

Other graphics packages offer Zoom commands that support more complex drawing functions, but you usually can't even tell what you're looking at unless you call back the main picture screen. The KoalaPad Zoom is far superior to any other I've seen or used.



"Geo," a symmetrical geometric abstraction created with rays, lines, and four-way mirroring.

Art Or Doodling?

As an instrument for creating art and graphics, the KoalaPad and *KoalaPainter* are a boon to the serious designer as well as the computer doodler.

While personal computers are now widely recognized for their serious financial and communications applications, there seems to be some reluctance to acknowledge them as a viable medium for the graphic arts. Artists who make full use of the power of the KoalaPad system may help turn this around.

It would also help if *KoalaPainter* provided a way to make hardcopy printouts of its screen displays. At the moment, you can permanently save your creations only by storing them on disk, recording them on videotape, or photographing them off the screen. Maybe someday a good programmer will write a utility to dump the images to a color printer.

There will always be skeptics who think the home computer is, at best, an art toy. After all, what do those dots of color on a TV screen have to do with real art? But traditional artists have created great works using similar techniques. One example is Georges Seurat (1859–1891), the famous French artist and champion of the Neo-Impressionist movement. His significant contribution was largely based on a system of isolated dots of color used to build up entire paintings. Although his unfortunately brief working life spanned a number of years, Seurat's demanding, precise technique limited his lifelong output to seven major paintings. I suspect that Georges Seurat might have been very interested in the efficient and powerful KoalaPad and *KoalaPainter*.

KoalaPad
Koala Technologies Corporation
3100 Patrick Henry Drive
Santa Clara, CA 95052-8100
$124.95

OmniWriter & OmniSpell

Joseph R. Sutton

Requirements: Commodore 64, a disk drive, and a printer on either the serial bus or user port (parallel only). See text for the printers supported.

OmniWriter is a page-oriented word processor for the Commodore 64 which includes *OmniSpell*, a 30,000-word spelling checker. The package is best suited for page-oriented writing applications, such as letters.

A bit of explanation: Word processors are either page-oriented, line-oriented, or character-oriented. For the sake of convenience, most word processors these days are character-oriented; you can move a cursor anywhere in the document, and all the writing and editing is done on the same screen. In other words, a character-

oriented word processor does not treat a document traditionally as a group of pages during the writing and editing phases. Instead, the document is written and edited as if it were one very long page. Only when the document is printed (or print-previewed, if the word processor has such a feature) is the text broken up into separate pages.

Page-oriented word processors work quite differently. Usually they treat a document as separate pages onscreen. Often there are separate screens for various functions. For instance, *OmniWriter* has a work page, header page, footer page, and text pages. The work page can be used for such things as comments and rearranging text. The header and footer pages, obviously, hold the header and footer information. The text pages hold your document. In addition, the first text page has a format line where you can specify right and left margins, tab settings, and other formatting options.

Any number of format lines are allowed on any of the pages. Lines can be up to 240 characters long, scrolling horizontally across the 40-column screen. Each file can hold up to 34,000 characters, and files can be linked together for printing out larger documents.

OmniWriter constantly displays useful information at the top of the screen: the title *OmniWriter*, your filename for the document in memory, the page number, number of pages, line number, and column number. Activating the page-width command highlights the *W* in the title *OmniWriter*. Prompts for other commands are just below the filename of the document. To use any command, you press the Commodore logo key and the appropriate letter. You can embed formatting commands in the text by pressing the CONTROL key, lighting up a small white box in the lower-left corner of the screen. Then you select the appropriate letter. This inserts a symbol in the document and performs the proper function, such as line centering, tabbing, and so on.

To help you remember all the commands, *OmniWriter* comes with a quick reference card and a function key overlay.

Merging And Printing

Like most word processors, *OmniWriter* lets you merge other documents or files into your text from disk or tape. It allows two types of merges: pasting text into the document with an editing command, and mail merging. The merged document can be created with *OmniWriter*, *HEswriter*, *EasyScript*, *Wordcraft*, *WordPro*, *SuperScript*, *Micro-Script*, or *Busicalc*—that is, it can be any standard Commodore sequential file. You can also merge disk directories. Mail merge takes place at the time of printing and is activated by the embedded merge command. The merged text (such as an address from a mailing list) is taken from either the work page or a disk file. This feature can be used for producing form letters.

The print command brings up a screen of options to make *OmniWriter* compatible with a number of different printers. It supports VIC, Epson, Que/Diablo, New Spinwriter, Triumph Adler TRD170S, Ricoh Flowriter, and ASCII printers. Unfortunately, *OmniWriter* does not support RS-232 serial printers.

As a page-oriented word processor, *OmniWriter* presents some advantages and disadvantages when printing out documents. Among the advantages: You can specify the starting and ending pages of the document to be printed. This can save you lots of paper, trouble, and time when you have to reprint only a portion of a document—after making a minor last-minute change, for example. Also, the screen shows formatted text at all times, except for multiple-line spacing. This too can save paper and labor.

But there are also some disadvantages. For one thing, page endings are not automatic. If you don't specify the page breaks, you'll have one long page. If you decide later that you want double-spacing, you have to do some arithmetic to rearrange the page breaks again. (Practically all character-oriented word processors calculate page breaks automatically.)

Headers and footers cannot be turned on and off from within the text, so if you want a header on all pages except the first, you must print the first page separately with the header turned off. Footers cannot be turned off at all. To remove a footer you must delete all information from the footer page.

A minor problem is that if you separate sentences by typing two spaces after periods, and if a sentence ends at the end of a line, *OmniWriter* prints the second space at the beginning of the next line. The solution is to type only one space after periods, although this runs counter to some typists' training.

Fast Spell-Checking

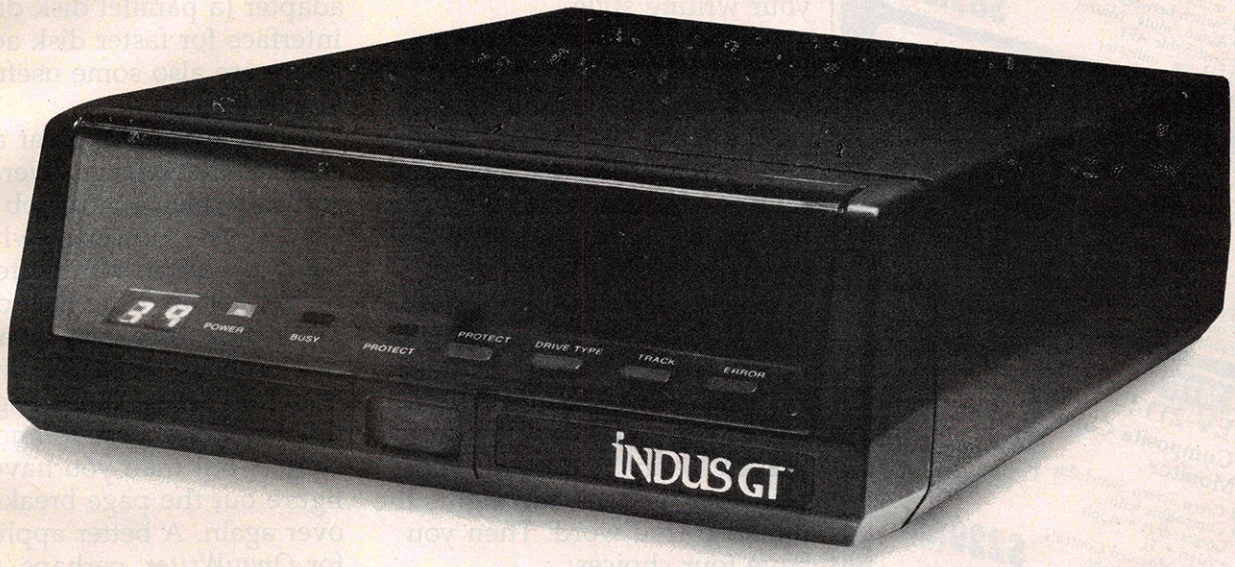
OmniSpell is included with *OmniWriter* to check for spelling errors. I was pleasantly surprised with its speed of operation. After it's loaded, it arranges all the unique words in the text in alphabetical order, then presents a menu:

F1—Spell-Check Document
F3—Alphabetical Word List
F5—High-Usage Word List
F7—Dictionary Search
F8—Return to *OmniWriter*

When you check the spelling, the words in the ordered list are displayed on the screen in two columns. The words are checked against a dictionary on

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the disk which has a file for each letter of the alphabet, and a user dictionary for your own new words. As each word is checked, it is highlighted. When no match is found, the word remains highlighted.

The alphabetical and high-usage word lists, as well as various statistics about your document compiled beneath the menu, are useful when studying your writing style.

The dictionary search option is used to look up words. If you're not exactly sure how to spell a word—after all, that's why you're looking it up, right?—you can type just a portion of the word with some wild card symbols (*,?). The wild cards are similar to those used when specifying filenames with some Disk Operating Systems.

To correct spelling errors, you return to *OmniWriter* and use the verify command. Verify scans the text and highlights the unrecognized word. Then you have four choices:

EDIT—Change text.
SKIP—Continue scanning without taking any action.
ACCEPT—Treat the word as if it is recognized.
LEARN—Add the word to a list to update the user dictionary.

All the commands, except EDIT, return to verify mode when done.

One note: It's best to switch the screen into the 40-column mode when using verify; otherwise, some highlighted words may be partially off the screen, and there's no way to scroll them into view except to exit the verify mode.

When you're finished correcting errors, you should return to *OmniSpell* if you've used the LEARN command. Then you can add all new words to the user dictionary.

OmniSpell comes on a single disk with all the programs and files. Unlike *OmniWriter*, it may be copied for backup purposes. Duplicate copies of the entire disk are available from HES (for a nominal fee) if something happens to the original.

The *OmniSpell* disk also contains several utility programs: dictionary maintenance, interface software so you can convert the user port into a parallel printer port with BASIC, a backup program, and a program that makes the software work with the MSD IEEE-488 bus adapter (a parallel disk drive interface for faster disk access). There are also some useful example files.

The manual is clear and easy to understand. Overall, the software does a good job and is easy to use. However, when using *OmniWriter* to write this review, I found the lack of automatic page breaks to be a very real problem (especially with double-spacing). Rearranging text from one page to another is simple, but then you have to figure out the page breaks all over again. A better application for *OmniWriter*, perhaps, would be short letters and form letters.

OmniWriter & OmniSpell
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WizType

James V. Trunzo

WizType *requires an Atari, Commodore 64, or Apple II-family computer with at least 32K RAM and a disk drive. The Atari version is reviewed here; other versions are similar.*

Not so long ago you had to search through the fine print in computer software ads to find a program that would help teach you how to type. Now, practically any respectable computer dealer can show you an entire shelf of such products. A new program from Sierra (formerly Sierra On-Line) adds yet another program to this selection, and it just might be the best one yet. It's called *WizType*, and it's certainly a wizard of a product.

WizType is based on the characters who frequent the popular comic strip "The Wizard of Id." These include the Wizard himself; the spirit he conjures from the well; and Bung, the frequently inebriated court jester.

After booting the program disk, you are asked to enter your name, a standard feature of many programs. Next, however, a bar graph appears on the screen, illustrating the progress you've made during your lessons. Next there's a menu which shows the variety of options available in *WizType*:

1. **Game**
2. **Drill**
3. **Practice**
4. **Words**
5. **Own Lesson**
6. **Paragraphs**

Entertaining Graphics

The Game option, for example, is not just fun and play. It's a good example of the graphics and animation built into *WizType*. Three-fourths of the screen shows the Wizard of Id facing the spirit that has emerged from the well. Letter combinations begin to appear on the screen midway between the two characters. As you correctly type the letters, the Wizard zaps the spirit with a lightning bolt, keeping it docile. If you make errors, the spirit begins to metamorphose into a ferocious dragon's head which eventually starts breathing fire at the Wizard, reducing him to a pile of ashes. The combination of smooth animation, facial expressions, and instructional lessons is hard to describe; you must see this program to appreciate it fully.

As you progress, the material you're supposed to type becomes more difficult and appears more frequently, demanding more speed and accuracy if you are to continue playing.

Even in the Game section, *WizType* does not simply display random letter combinations on the screen. Each level gears itself to a different set of keys in order of difficulty (that is, home row keys at the easiest, and numbers and symbols at the hardest). You're always shown which keys will be used, the correct finger positioning, and the finger reaches that will be exercised at each level of play.

Sierra has a good reputation for not cutting corners in its products. The Game section of *WizType* includes such touches as bonus rounds, multiple lives, and comic strip-type balloons in which the Wizard cracks jokes after you successfully complete each level.

A Little Literature

While Games contains some surprises and challenges, the Drill and Practice sections are exactly what they sound like. You can work on areas of weakness for as long as you want and select a comfortable typing speed, varying from 10 to 60 words per minute at 10-word intervals.

You can also control the typing speed after selecting the Words option from the menu. In Words, however, *WizType* assumes you are familiar with the keyboard. You start out by typing two- and three-letter words and progress to longer, more difficult words as your skill improves.

The two options which really set *WizType* apart from most typing-practice programs are Paragraphs and Own Lesson.

With Paragraphs, you type parts of eight literary works saved on the program disk. You can type the introductory paragraphs from Charles Dickens's *A Tale Of Two Cities* or a few scenes from William Shakespeare's *Hamlet*. Or perhaps you'd prefer The Gettysburg Address or selections from Mother Goose. You can also choose to have Bung serve as a pacer, hopping along on his pogo stick above the sentence being typed, at a rate you select.

In any case, typing entire paragraphs helps you attain well-rounded typing skills and arrive at a true idea of your typing speed and competency. Typing letters and words is fine for the purpose it serves, teaching the keyboard. But typing lengthy paragraphs adds new elements—fatigue, consistency, and smoothness. You can learn to establish a rhythm (and see the importance of rhythm) that cannot be achieved merely by typing single words.

If you tire of typing "To be or not to be," no problem: *WizType* also lets you create your own lessons. There are two ways to do this. First, you can simply select the Own Lesson option. This accepts individual words only. Or you can select the Paragraph option and then choose Create Paragraph from a submenu.

There are many fine typing programs currently on the market. Sierra's *WizType* certainly meets their standards, and surpasses most of them.

WizType
Sierra
P.O. Box 485
Coarsegold, CA 93614
$34.95

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Computers And Society

David D. Thornburg

Over the past several months a considerable amount of mail has come in regarding a few of my columns. Although it isn't possible to respond to all of you individually, hearing from you is appreciated.

The column on the PCjr and Macintosh stimulated a large response. Judging from many of the letters, PCjr owners should be careful not to move their computer with the cables plugged in. Apparently, this can break the connectors and require expensive repairs of the mother board. While many of you shared some sympathy with my views of IBM's entry into the consumer marketplace, IBM's new version of the PCjr addresses at least some of Junior's problems.

Some of you wrote to express concern that the Macintosh may not make it in the marketplace. If Macs have indeed been selling at an alleged monthly rate well in excess of the total installed base of PCjr's, it is logical to conclude that it already is a success. Of course, it takes more than machines to make a market—the software from third parties is an essential component of any computer system. While a recent check of local computer stores showed less than 20 Mac titles in stock, this computer is so popular that one has to drive as far as 90 miles from the San Francisco Bay area to buy blank disks for it. Since the 3.5-inch disks are made by Sony, Apple, Hewlett-Packard, BASF, and Memorex, the scarcity of these disks in the retail outlets is a pretty good measure of the Mac's popularity, at least locally.

Some of you felt that there wasn't enough sensitivity in the critique of Craig Brod's book, *Technostress*. It was never my intention to claim that technological change couldn't induce stress in people; clearly it can. But this stress is not technology-specific. We need only look at the attempts of the weavers to kill Jacquard, the inventor of the automatic loom, or the attempts of the Luddites to thwart the industrial revolution, to see that major societal changes induce stress in some people. My concern about Brod's book was that he directed it to the general public rather than to his fellow health-care professionals. As a result of being directed to a larger audience, his book has been used by some people as further support for their own belief that computer technology is intrinsically evil.

Technology is neutral. The computer that is used to help a handicapped author write a novel can be used to help rob a bank. The computer that allows one businessperson to spend more time with the family can be used by another as an excuse for withdrawal from society. Unless a single piece of technology can be shown to induce the same stress reaction in everybody, we would perform a greater service to our species by looking at the causes of stress within the human psyche rather than in the artifacts of man. This is not to say that technology can't be abused. It can, and it has. What is of critical importance is to realize that the source of the abuse is human, not mechanical.

Videogame Microworlds

All of which brings us to a perennial topic: videogames. In his book *Mindstorms*, Seymour Papert, the father of Logo, talks about the samba schools in Brazil where children learn the dance from their peers, selecting the group that best represents their skill levels. This environment of peer teaching suggests to Papert a model of educational reform in our own classrooms, a model where children are free to explore computer-based microworlds and to acquire skills and knowledge in the context of these microworlds.

Of course, Papert had Logo in mind as the computational language to be used by the children. But, independently of our schools, and without the benefits of Logo, child-centered computational environments have sprung up in our society almost spontaneously. These are, of

---

David Thornburg is an author and speaker who has been heavily involved with the personal computer field since 1978. His main interest is in making computers responsive to people's needs. He is the inventor of the KoalaPad graphics tablet and is the author of nine books about programming, including Computer Art and Animation: A User's Guide to Atari Logo, The KoalaPad Book, *and* Exploring Logo Without a Computer *(Addison-Wesley). His* 101 Ways to Use a Macintosh *will appear soon from Random House. He has been called "an enthusiastic advocate for a humanistic computer revolution," and his editorial opinions have appeared in COMPUTE! since its inception.*

course, the game arcades.

Whenever parents and teachers talk about videogames, there are always several strong opponents to the arcades. They talk about the arcades as hangouts for delinquents, they talk about the addictive nature of the games themselves, and they talk about the violence and mayhem represented by the nature of the games themselves. What they don't talk about is their own experience in the arcades because, almost without exception, the most vocal detractors of the arcades *have never been inside one!* Before giving views on what is happening in the arcades, let's explore the research of some people who *have* taken the time to study what is going on there.

Sherry Turkle, whose doctorate is in sociology and psychology from Harvard, has spent a lot of time in game arcades, including over 100 hours carefully studying 30 game-players of all ages. Her results are included in her book *The Second Self—Computers and the Human Spirit* (Simon and Schuster, $17.95). She acknowledges the ambivalence felt by adults toward the game arcades. Their children are coming home from school with new skills, they are learning how to program, and they take computer technology for granted. Parents want their children to have these skills, but they also realize that their expertise in the computer world may create a new generation gap. Consequently, when a game arcade applies for a business license, this is a chance for the parents to say,"Let's wait." As Turkle says, "It feels like a chance to buy time against more than a video game. It feels like a chance to buy time against a new way of life." With respect to the commonly expressed belief that game players are caught in a "mindless addiction," she replies:

> There is nothing mindless about a video game. The games demand skills that are complex and differentiated. Some of them begin to constitute a socialization into the computer culture: you interact with a program, you learn how to learn what it can do, you get used to assimilating large amounts of information about structure and strategy by interacting with a dynamic screen display. And when one game is mastered, there is thinking about how to generalize strategies to other games. There is learning how to learn.

It is this epistemological aspect of videogaming that gives it the power to become a good educational medium, if anyone wanted to really explore that field. But this still doesn't address the issue of "addiction." Turkle points out that, yes, some players can become addicted to their games. But she also points out, "Most people don't become addicted to video games just as most people who diet don't become anorexic."

A Man's World

In another in-depth study of videogaming, psychology professors Geoffrey and Elizabeth Loftus have examined many aspects of these games and their influence on players in their book *Mind at Play—The Psychology of Video Games* (Basic Books, $14.95). Among many other things, they point out that, in addition to the eye-hand coordination skills acquired through playing these games, there are other indirect benefits as well. One of these is the development of intense interest in computers which can lead the game players into the computer field as a profession.

Another criticism leveled against arcades is that they appear to be male-dominated. Clearly the content of the games themselves has something to do with this. *Dragon's Lair*, a videodisc based game, has a male player that you control to help save the princess. If this game had the roles reversed, or otherwise took into consideration the types of fantasies that might appeal more to women, it would perhaps encourage more women to visit the arcades.

Of course, there have been some games that seem to appeal equally well to men and women. Among these are *Centipede* (which was written by a woman), *Pac-Man* (and its offspring), *QIX*, *Tempest*, and several other recent games. If the arcades are the breeding ground for interest in employment in the information sector, then we should do everything in our power to insure that the arcades attract men and women alike.

Of course, there is the additional argument that the games are too violent. But violence has to be viewed in a context. We don't have a videogame in which we see someone go into a restaurant and kill babies in their mother's arms, but we can see that on television if we watch the evening news. We don't have videogames in which the goal is to demoralize the opponent by killing his livestock, laying waste to his property, and killing his children, but we can read all about it in the Bible. If violence is bad in games, then violence is bad, period. Ban the violent games if you wish, but then ban the Bible, ban the news, ban Hans Christian Andersen's fairy tales, ban Prokofiev's "Peter and the Wolf."

It is one thing to say that our society is too violent, and another to say that videogames are too violent. One can make the argument that we should do something about violence in our society, but violence won't be reduced by removing the videogames. My opinion is that anyone who lets their children read fairy tales or the Bible, but who becomes concerned when the child plays a game defending the earth from alien invaders, is a hypocrite.

Some videogames may be violent, but at least they aren't hypocritical. ©

All About The Status Register

Part 2

Louis F. Sander

Beginning machine language programmers are often confused by the 6502's status register, a collection of eight bits which act as status flags. Part 1, published last month, briefly described the function of each flag. Part 2 picks up with a more detailed explanation and includes a sample program for the Commodore 64, PET/CBM, Apple, and Atari.

Last month's short description of the 6502's eight-bit processor status register and the seven status flags it contains may have cleared some mystery away, but it surely wasn't comprehensive. That sort of description is found in most machine language programming books, to which you are now referred, and which will be much easier to understand once you've mastered what is presented here. Let's gain that mastery by running a simple test program, using a *machine language monitor* to observe its effects on the status register.

6502 Monitors

A monitor is nothing more than a machine language program that makes it easier to work with other ML programs, and there are many, many different monitors available for the 6502. Sometimes monitors are called debuggers. PET/CBMs and Apples have simple monitors built into their ROMs, while Ataris have one in the *Assembler Editor* cartridge. Commodore 64s can use "Supermon64," a program that appeared in COMPUTE! (January 1983). Our test program works identically on all those machines, but since their monitors are somewhat dissimilar, we'll show the screen dialogue for each one.

The monitor is a wonderful tool for the beginning ML programmer, and if you've dabbled with ML, you've at least used it to examine memory locations and to save ML programs on tape or disk. I used mine for those things for many months, but never paid much attention to the registers display. That's the line of labeled numbers the monitor sometimes prints on the screen, and it looks like this on Commodore machines:

```
PC   IRQ  SR  AC  XR  YR  SP
0005 72E8 30  00  5E  04  F8
```

(If you have an Apple or Atari, please follow the Commodore explanation anyway. Your monitor is only slightly different.)

PC shows the address in the 6502's program counter, which is nothing more than the address of the next instruction to be executed. Because of various quirks, monitor PC displays are not all alike. Supermon64 and the Atari monitor show the address of the BRK instruction which activated them; the Commodore monitor shows the address one byte *after* the BRK; and the Apple shows the address two bytes after the BRK. Some monitors don't label the address, but all of them display it.

IRQ (not shown on many monitors) gives the so-called interrupt vector, a very important address, but one beyond the scope of our interest here.

SR gives the contents of the processor status register, expressed in hexadecimal form. (The

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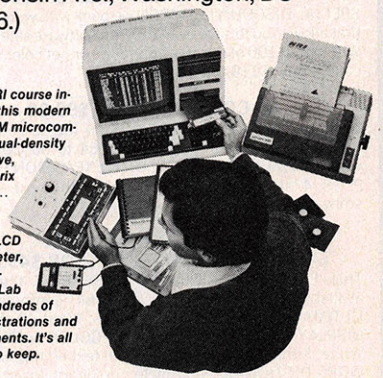
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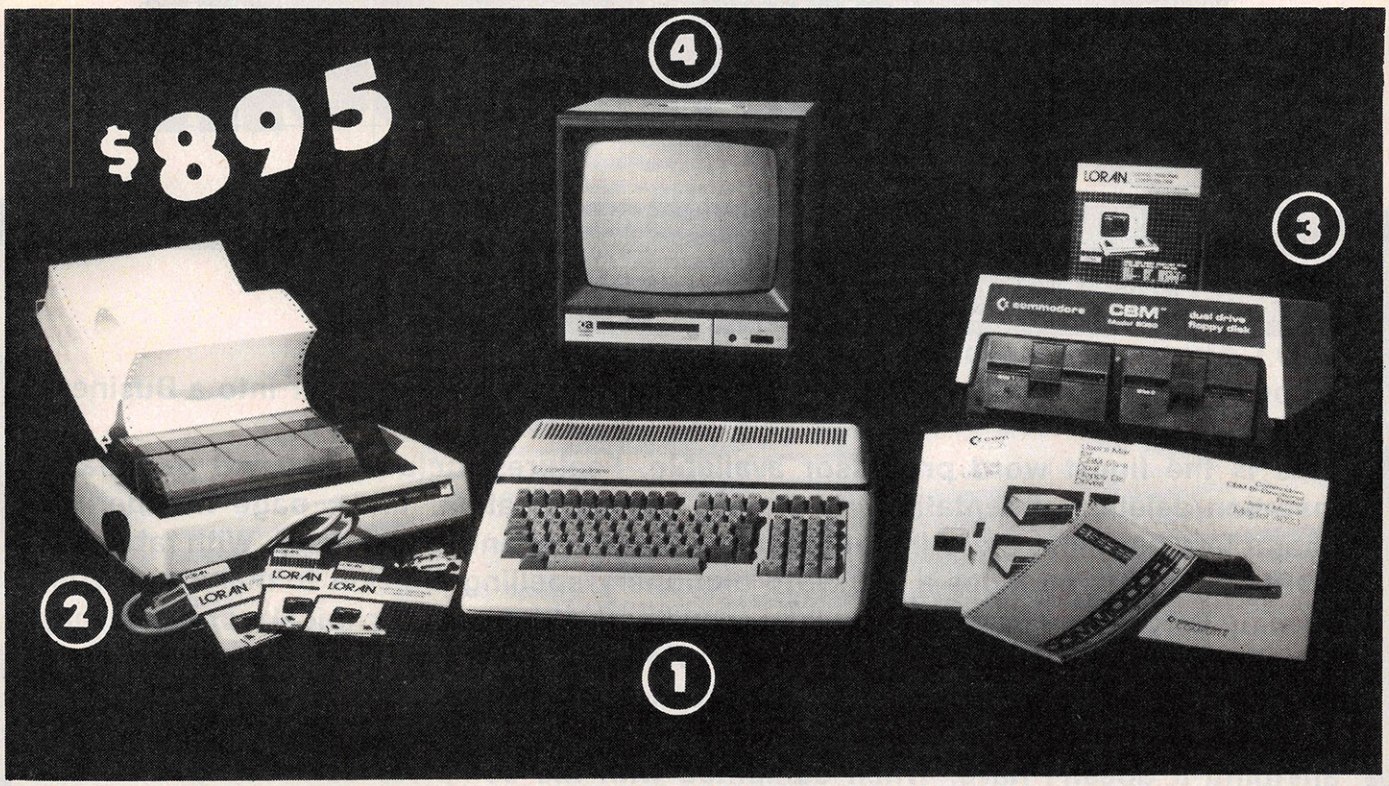
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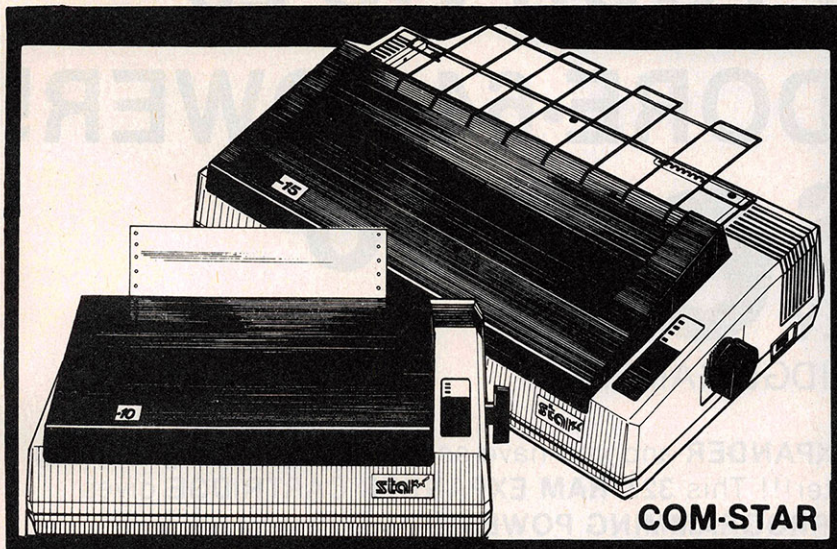
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label is P in Apple/Atari, but what it displays is exactly, absolutely, positively identical in all the monitors.) People with 6502's in their cerebral cortices may be able to determine individual flag statuses from a hex display, but it's a burdensome interpretation for the rest of us. Who can figure out whether $FB means the Z flag is set or clear? Not me, I can guarantee you. The table is a handy guide for interpreting that byte. With it, you can tell at a glance which flags are set or cleared in a given status byte, and just what each flag means. And that ability can be a golden key to better machine language programming.

AC, XR, and YR show the contents of the accumulator, X, and Y registers, respectively, at the moment the monitor was activated. They're labeled A, X, and Y in some monitors, but mean the same thing, regardless of the label.

SP (or S) gives the value of the stack pointer, which is yet another useful value that's beyond our present scope. The value will vary from time to time and from machine to machine.

Figure 1: Apple Screen Dialogue

Step 1 To activate the monitor, type CALL−151, then press RETURN.	]CALL-151
Step 2 Put the program into memory by making these entries *exactly* as shown. Press RETURN at the end of each line.	*3300:D8 18 A9 00 AA A8 C9 FF *3308:00 A9 80 00 A9 7F 00 A9 *3310:00 00 A9 FF 00 69 01 00 *3318:69 01 00 C9 02 00 00 00
Step 3 Check your work by entering this command and comparing your screen display with the program.	*3300L
Step 4 Type the G command, then press RETURN. When this line appears, return to the text.	*3300G 330A- A=00 X=00 Y=00 P=30 S=F0
Step 5 This and the following steps are identical to Step 4, except for the numbers entered and displayed.	*3309G 330D- A=80 X=00 Y=00 P=B0 S=EE
Step 6 As above.	*330CG 3310- A=7F X=00 Y=00 P=30 S=EC
Step 7 As above.	*330FG 3313- A=00 X=00 Y=00 P=32 S=EA
Step 8 As above.	*3312G 3316- A=FF X=00 Y=00 P=B0 S=E8
Step 9 As above.	*3315G 3319- A=00 X=00 Y=00 P=33 S=E6
Step A As above.	*3318G 331C- A=02 X=00 Y=00 P=30 S=E4
Step B As above. This is the last step in our demonstration.	*331BG 331F- A=02 X=00 Y=00 P=33 S=E2

Stepping Through Flags

Now that you've seen a description of the register display, plus that handy table, let's use them to experiment with the important flags. Our experiment will have the dual benefit of making us more fluent in ML, and giving us practice using the register display.

The program at the end of this article is an instructive, but do-nothing, ML program that occupies an innocuous corner of memory. From left to right, each line shows a memory address, the bytes held by it and maybe its upward neighbor, and the mnemonic for the instruction that those bytes represent. The program's first seven lines set all the 6502's flags and registers to zero, then break to the monitor, where we can review their status.

Single, Simple Operations

The rest of the program is a series of single, simple operations, each followed by a break to the monitor. We're about to go through them one by one, and see what happens to the negative, break, zero, and carry flags. We'll leave V, D, and I for another day, for the reasons previously mentioned.

Figures 1–3, the different versions for PET/CBM, Apple, and Atari, will be used to track our demonstration. Find the version which applies to you, and follow it as you read on.

Steps 1–3. Our first step will be to put the ML demo program into memory. Do it now, by carefully following Steps 1, 2, and 3 of the appropriate version of Figure 1, 2, or 3. If you've never worked with ML before, don't worry—the process is easy, and we'll take you through it step by step. When you finish Step 3, come back here for further instructions.

At the end of Step 3, the monitor should still be active, and your screen should be showing you its distinctive monitor prompt. You're now ready to run the ML demo program, which you do by executing your monitor's G command.

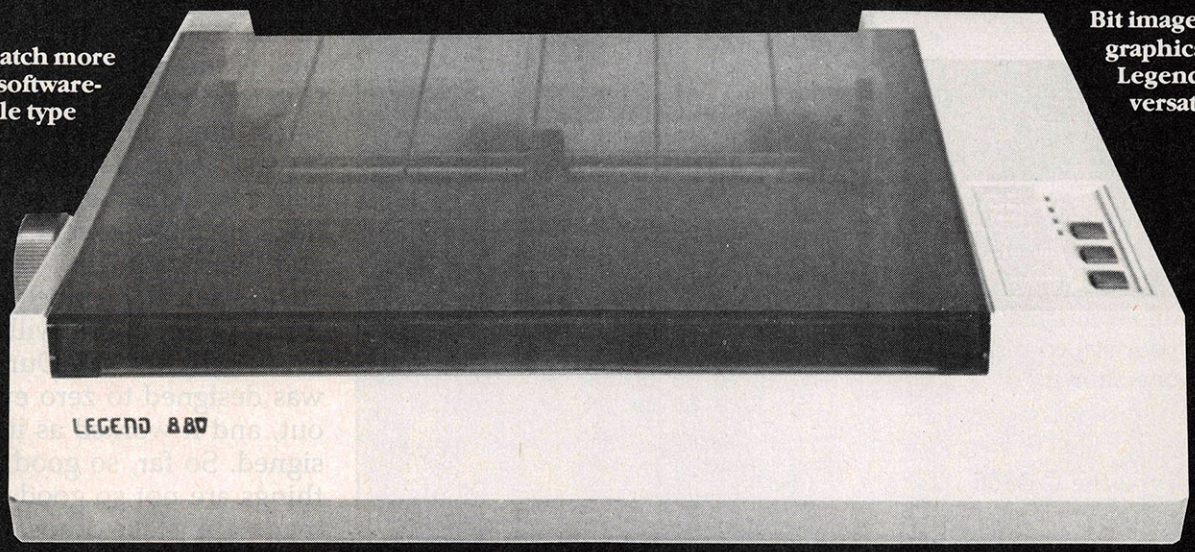
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Figure 2: Atari Screen Dialogue

Step 1 To activate the monitor, insert the *Assembler Editor* cartridge, and answer the EDIT prompt by typing BUG, then pressing RETURN.

Step 2 Put the program into memory by making entries *exactly* as shown. Press RETURN at the end of each line.

```
DEBUG           DEBUG           DEBUG
C3300<D8        C<00            C<01

DEBUG           DEBUG           DEBUG
C<18            C<A9            C<00

DEBUG           DEBUG           DEBUG
C<A9            C<7F            C<69

DEBUG           DEBUG           DEBUG
C<00            C<00            C<01

DEBUG           DEBUG           DEBUG
C<AA            C<A9            C<00

DEBUG           DEBUG           DEBUG
C<A8            C<00            C<C9

DEBUG           DEBUG           DEBUG
C<C9            C<00            C<02

DEBUG           DEBUG           DEBUG
C<FF            C<A9            C<00

DEBUG           DEBUG           DEBUG
C<00            C<FF            C<00

DEBUG           DEBUG           DEBUG
C<A9            C<00            C<00

DEBUG           DEBUG           DEBUG
C<80            C<69            C<00

                                DEBUG
```

Step 3 Check your work by entering this command and comparing your screen display with the one shown.

```
D 3300,331F

3300 D8 18 A9 00 AA A8 C9 FF
3308 00 A9 80 00 A9 7F 00 A9
3310 00 00 A9 FF 00 69 01 00
3318 69 01 00 C9 02 00 00 00

DEBUG
```

Step 4 Type the G 3300 command, then press RETURN. When DEBUG appears, return to the text.

```
G 3300
3308      A=00 X=00 Y=00 P=30 S=00
DEBUG
```

Step 5 This and the following steps are identical to Step 4, except for the numbers entered and displayed.

```
G 3309
330B      A=80 X=00 Y=00 P=B0 S=00
DEBUG
```

Step 6 As above.

```
G 330C
330E      A=7F X=00 Y=00 P=30 S=00
DEBUG
```

Step 7 As above.

```
G 330F
3311      A=00 X=00 Y=00 P=32 S=00
DEBUG
```

Step 8 As above.

```
G 3312
3314      A=FF X=00 Y=00 P=B0 S=00
DEBUG
```

Step 9 As above.

```
G 3315
3317      A=00 X=00 Y=00 P=33 S=00
DEBUG
```

Step A As above.

```
G 3318
331A      A=02 X=00 Y=00 P=30 S=00
DEBUG
```

Step B As above. This is the last step in our demonstration.

```
G 331B
331D      A=02 X=00 Y=00 P=33 S=00
DEBUG
```

Each monitor has its own syntax for this; yours is illustrated in the appropriate figure. Monitor commands are fussy about spaces, etc., so pay close attention to details at this point. Now go do Step 4, which will start execution of the machine language routine at address $3300. That routine will run until a BRK instruction is executed, at which point processing will stop and the monitor's register display will appear on the screen. When that happens, which should be immediately, come back here.

Step 4. Study the register display, disregarding IRQ and SP, and observe that AC, XR, and YR are all set to $00. (Non-Commodore people observe the same thing, labeled A, X, and Y.) Use the table to confirm that $30 means that all SR (or P) flags are clear, except for the B and the meaningless bit that's always set. Remember what the B flag is for, and it will be easy to see why it's set. Our program was designed to zero everything out, and it worked as it was designed. So far, so good. (If things are not so good, you've made a mistake. Repeat your work from the beginning.)

Nothing Has Changed

Step 5. Now perform Step 5, and notice what has happened. The program has loaded $80 (1000 0000) into the accumulator, and the monitor AC display so indicates. Since the high-order bit of $80 is a 1, the computer set its own N flag. The program counter has advanced, but nothing else has changed. (If your stack pointer changed, never mind—the monitor, not our program, changed it.) The BRK brought us back to the monitor. Simple, isn't it?

Step 6. The LDA has loaded $7F (0111 1111) into the accumulator, setting N to match its highest bit. The register display shows the $7F, and proves

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that N is now clear, while all other flags remain the same. Now do Step 7.

Step 7. Putting $00 (0000 0000) in the accumulator sets the Z bit, since zeros beget zeros. Notice how the PC is stepping right along with us, and do Step 8.

Step 8. $FF (1111 1111) is *not* a zero, so the zero flag is cleared. Its high bit is a 1, so the N flag is set. Move on to the next step.

Step 9. The ADC instruction adds 1 to the accumulator. Like driving another mile when the speedometer reads 99999, this rolls the accumulator over to $00 (0000 0000). We can tell when this happens, because the rollover automatically sets the carry flag. The carry bit is often used in just this way, to tell when a counter has reached its maximum. In our example, Z is also set, since the operation resulted in a zero. When you've absorbed those simple details, go on to Step A.

Bump A Counter

Step A. The last operation did not roll over the accumulator, so the carry bit was cleared. What it did was to add 1 to the zero in the accumulator, giving a result of 2. How on earth does 1 + 0 = 2? The answer is in the carry bit. An ADC adds its operand plus the carry bit to the contents of the accumulator, then reconditions C based on the result. That's very useful, because often when a counter rolls over, we want to increment a higher-order counter, so nothing gets lost in the counting. Many programs look for the carry bit, and bump a counter if it's set. Our own little program didn't go that far, but it did show us how such things can be done. Now do the next G.

Step B. What's this? We compared a 2 to a 2, and the zero and carry flags got set. That's a special use of flags in comparing numbers. CMP and

Figure 3: Commodore Screen Dialogue

Step 1 To activate the monitor, type SYS 4, then press RETURN. (If you have a PET with original ROM, you must first load the monitor program from tape.)

```
SYS4

B*
     PC  IRQ  SR AC XR YR SP
.;  0005 E62E 30 00 5E 04 F8
```

Step 2 Type this command, then press RETURN.

```
.M 3300 331F
```

Step 3 You will see a display like this, but with different two-digit numbers. Carefully change them to these numbers by typing over them. Press RETURN at the end of each line.

```
.:  3300 D8 18 A9 00 AA A8 C9 FF
.:  3308 00 A9 80 00 A9 7F 00 A9
.:  3310 00 00 A9 FF 00 69 01 00
.:  3318 69 01 00 C9 02 00 00 00
```

Step 4 Type the G 3300 command, then press RETURN.
When this line appears, return to the text.

```
.G 3300
B*
     PC  IRQ  SR AC XR YR SP
.;  3309 E62E 30 00 00 00 F8
```

Step 5 This and the following steps are identical to Step 4, except for the numbers entered and displayed.

```
.G 3309
B*
     PC  IRQ  SR AC XR YR SP
.;  330C E62E B0 80 00 00 F8
```

Step 6 As above.

```
.G 330C
B*
     PC  IRQ  SR AC XR YR SP
.;  330F E62E 30 7F 00 00 F6
```

Step 7 As above.

```
.G 330F
B*
     PC  IRQ  SR AC XR YR SP
.;  3312 E62E 32 00 00 00 F6
```

Step 8 As above.

```
.G 3312
B*
     PC  IRQ  SR AC XR YR SP
.;  3315 E62E B0 FF 00 00 F6
```

Step 9 As above.

```
.G 3315
B*
     PC  IRQ  SR AC XR YR SP
.;  3318 E62E 33 00 00 00 F6
```

Step A As above.

```
.G 3318
B*
     PC  IRQ  SR AC XR YR SP
.;  331B E62E 30 02 00 00 F4
```

Step B As above, but when the registers display appears, type X and press RETURN. Then go back to the text.

```
.G 331B
B*
     PC  IRQ  SR AC XR YR SP
.;  331E E62E 33 02 00 00 F4
```

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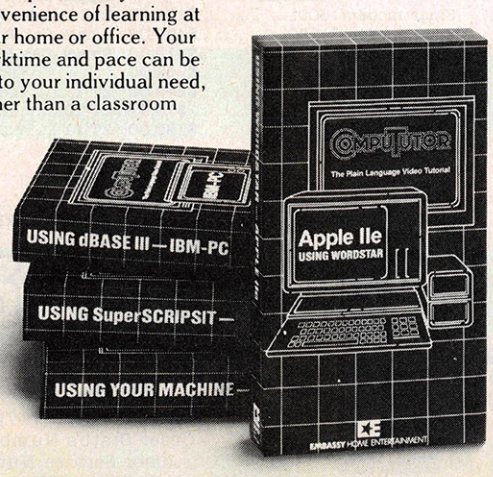


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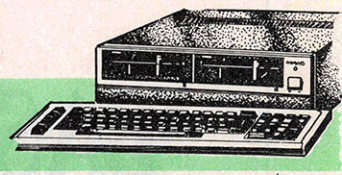
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the other comparison instructions don't store their results anywhere, but they *do* condition the N, Z, and C flags in a special way that facilitates branching after the comparison. Read up on the CMP, CPX, and CPY instructions for full information on how they set the flags.

We're now at the end of our flag-waving tour. If you kept with us this far, you're in the know about some elementary but important attributes of the processor status register, and you may have improved your knowledge of your monitor. Dig into those ML texts that you didn't understand last time, and you'll be surprised how easy they've become. If you're really feeling like an expert, come up with a branch instruction to take our program back to $3300.

Machine Language Demonstration Program

```
3300 D8        CLD
3301 18        CLC
3302 A9 00     LDA #$00
3304 AA        TAX
3305 A8        TAY
3306 C9 FF     CMP #$FF
3308 00        BRK
3309 A9 80     LDA #$80
330B 00        BRK
330C A9 7F     LDA #$7F
330E 00        BRK
330F A9 00     LDA #$00
3311 00        BRK
3312 A9 FF     LDA #$FF
3314 00        BRK
3315 69 01     ADC #$01
3317 00        BRK
3318 69 01     ADC #$01
331A 00        BRK
331B C9 02     CMP #$02
331D 00        BRK
```

Decoding Status Displays

First Digit		Second Digit	
0		0	D I Z C
1		1	D I Z **C**
2	N V - B	2	D I **Z** C
3	N V - **B**	3	D I **Z** **C**
4		4	D **I** Z C
5		5	D **I** Z **C**
6	N **V** - B	6	D **I** **Z** C
7	N **V** - **B**	7	D **I** **Z** **C**
8		8	**D** I Z C
9		9	**D** I Z **C**
A	N V - B	A	**D** I Z C
B	N V - **B**	B	**D** I Z **C**
C		C	**D** **I** Z C
D		D	**D** **I** Z **C**
E	N **V** - B	E	**D** **I** **Z** C
F	N **V** - **B**	F	**D** **I** **Z** **C**

This table decodes two-digit hex displays of the processor status register. Bold face indicates bit set; regular face, bit clear.

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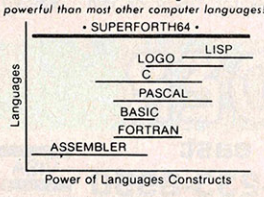
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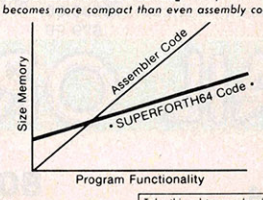
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INSIGHT: Atari

Bill Wilkinson

Comparing Printers

After disk drives, probably the most frequently purchased peripheral for personal computer systems is a printer. But buying a printer is a lot harder than buying a disk drive. Usually your choice of drives is limited to the computer manufacturer's own unit plus a few produced by third-party companies. And despite some slight differences, they all deliver similar performance.

But printers are another story. There are hundreds of printers on the market for personal computers. Most of them can be made to work with your Atari. And they vary widely in terms of price, performance, features, and compatibility.

One of the main differences between printers is their printing speed. Usually this is measured in characters per second, abbreviated cps. By comparing the speed ratings, you can decide whether a certain printer is fast enough for your applications. But recently I discovered how misleading those speed ratings can sometimes be. It all started when those of us at Optimized Systems Software (OSS) began looking around for a new printer.

To begin, let me tell you that we have a rather unique requirement for a printer: We needed a good, fast, reliable printer which we could hook up to any of several computers. And, of course, it had to be compatible with all our software: several languages, four different operating systems, and a couple of word processors.

It is also time for a bit of history. For the last couple of years, our mainstay printer has been a venerable DEC LA-120 Decwriter. This is actually a printing terminal (remember, from the days of mainframe timesharing?) which operates via a serial RS-232-C connection at 120 cps. As reliable as this beast has proven to be, it has a few problems: Its print quality is marginal at best, without even descenders on lowercase letters; because it uses a serial instead of the more standard parallel interface, much software simply will not work with it; although it is rated at 120 cps, it is actually capable of only about 105 to 110 cps when printing typical documents.

At the time, the only other printers we had (or had significant experience with) were a Diablo daisywheel (also serial, at 30 cps), an Atari 825 (rated at 60 cps), and a C. Itoh Prowriter (rated at 120 cps). All had performed adequately (or, in the case of the Prowriter, more than adequately), but all were too slow for our purposes.

And, of course, software compatibility was another big issue. Our primary problem in the past had been that some of our computers transmitted a linefeed after a carriage return (for example, the CP/M based machines), while others (our Atari computers) did not. We were well aware, also, that more problems would be coming as we acquired more software and wanted more capabilities.

Instantaneous Vs. Continuous Speed

For the sake of compatibility then, the first printer that came to mind was the Epson MX-80. Why? Simply because it is used on so many machines with so much software. Yet we immediately rejected the MX-80. Rated at only 80 cps, it is simply way too slow for our applications.

So we started looking for a *fast* printer which would be largely compatible with the MX-80. To make a long story short, we bought an Epson FX-100, a wide-carriage version of the FX-80. Imagine our surprise when this printer, rated at 160 cps, was only marginally faster than the Prowriter and actually *slower* than the Decwriter!

It turns out that with few exceptions, the printer speeds published by manufacturers and often faithfully reported by magazines are the *maximum instantaneous* speeds of which a machine is capable. This instantaneous speed rarely correlates to the actual number of lines a printer will produce in a minute.

What's more, even those companies which do admit that speed ratings are maximum values employ other claims to suggest that their printer is faster than the competition. For example, many claim that because their printers are *bidirectional* or *logic-seeking*, they are faster than the old-fashioned machines which print in only one direction (*unidirectional*).

Let me describe how the FX-100, for example, prints a typical program listing. First, it receives and prints a line (say, 50 characters), moving the print head from left to right, stopping at the end of the line. Then, it receives the command to print the next line (say, 70 characters). It moves the print head to the seventieth

column, stops, advances the paper to the next line, and prints backward from right to left. If the next line is indented (mine often are), it goes through the same sequence of stopping, moving the head, and advancing the paper once again.

But stopping, starting, moving paper, and starting again all take time. A lot of time compared to the actual printing time. Printers like the Prowriter, on the other hand, contain an internal buffer which they use intelligently. After printing a 50-character line, it checks to see where the right end of the next line needs to be and automatically continues to move the head to that position. One stop-and-start sequence eliminated. The results? See for yourself in the following chart, which records the time it took for three different printers to print the same moderate-length program listing:

Printer	Rated Speed (cps)	Time Required	Approx. Actual Speed (cps)
Decwriter	120	6 min 30 secs	110
Prowriter	120	7 min 45 secs	90
FX-100	160	7 min 30 secs	95

Oh, yes. Did I forget to mention that the Decwriter has no logic-seeking and prints unidirectionally only? That's a lot of stopping and starting. Sometimes raw power can accomplish what "logic" can't.

Throughput: True Speed

Well, I would like to report that we ran out and bought 30 or 40 different printers and tested them, too, just so I could bring you a full comparison chart. But our budget at OSS won't stretch that far.

I did, however, go to several dealers and informally time the speed of various printers. Since I had a couple of reference points (the speeds of the Prowriter and FX-100), it wasn't too hard to get a fair idea of true *throughput* figures: the printing speeds they could actually sustain.

Then I discovered another trick used by a few manufacturers. Many printers are capable of two or three (or more) character widths or fonts (typically 10, 12, and 17 characters per inch). It seems to me that at least a few printers are rated only for their smallest (and hardest to read) fonts.

Luckily we had an understanding dealer who allowed us to "trade up" our FX-100. And what printer did we then buy? Actually, we ended up buying two.

Because of our need for a printer capable of using the vast library of MX-80-compatible software, we got an Epson MX-100 (simply a wide-carriage MX-80). We have been very happy with it, though I am sure any of several MX-80-compatible printers would have done as well. True, the MX-80 is slow. But its throughput rate seems to be around 50 to 60 cps, which is respectable compared to its rated speed.

Because we needed speed, though, we disregarded MX-80 compatibility for our other new printer, an Okidata 2350 (the model number seems to reflect its retail price). It is rated at over 300 cps and surprised us by performing our little speed test in 1 minute 55 seconds, for a throughput rate of over 360 cps. However, sometimes it gets too hot while printing long listings and stops to wait for the head to cool off. Even so, it probably has a throughput rate of 300 cps or more.

So, did you learn anything from our experiences? I sincerely hope so.

When shopping for a printer, ask to see a demonstration of its speed. Many printers perform better with uniform-length lines (such as those produced by a word processor), so ask to see a program listing also. And make your own time trials.

Judge the print quality for yourself. Ask about replacement ribbon costs. (We found one printer that worked only with carbon ribbons. $$$$! But if you need good print quality, it might be worth it.)

Above all, be certain a particular printer is compatible with your computer *and* software. Few things are worse than saving $50 on a printer only to find out you have to spend another $100 because your current word processor isn't compatible with your new printer.

Of Memory And Machines

We've received a few letters recently on seemingly different subjects, but which all relate to what is obviously some confusion and uncertainty about the Atari XL computers. Let's address these letters and, at the same time, shed some light on the workings of these little gems.

First, Jacqueline Patton of San Antonio, Texas, asks whether she is "stuck with a problem computer [1200XL] and an unreliable disk drive [Atari 1050]." We'll discuss the 1200XL's compatibility problems in a moment. First, a few words about the 1050.

I have not personally observed the 1050 to be any more or less reliable than any other drive on the market. Disk drives, in general, tend to be like automobiles: Sometimes you get one which goes 100,000 miles with no maintenance, and sometimes you get a lemon, but most often you get one which will last a reasonable time with reasonable care and regular checkups. This is not surprising: Disk drives and cars are both mechanical nightmares, subject to extremely close manufacturing tolerances and acute material stresses.

If the 1050 has a problem, it may be simply that it cannot read all of the more strangely protected software disks that are flooding the market. There are antipiracy measures in use today that try the limits of many drives and their controllers. Yet most programs will load fine on any good Atari-compatible drive, including the 1050.

My objections to the 1050 are centered around only one point: Although every other Atari-compatible drive manufacturer has complied with the Percom-standard double-density format (derived in turn from Atari's defunct double-density 815 drive), only Atari chose to be different. Further, Atari's method gives you a maximum of 128K bytes per disk. The others get 180K bytes. There is no excuse for this. It results from Atari's typical blindness when it comes to outside vendors.

All this does not mean the 1050 is no good. It just means that, on a bytes per dollar basis, it is overpriced.

Use Your Options

Another letter, from Shahid Ahmal of London, England, was actually a complaint to OSS about the fact that some programs (including our disk-based *MAC/65*) would not load and run properly on his 800XL. The problem is that these programs require you to remove the BASIC cartridge before booting up—impossible on the 800XL and 600XL, since the BASIC "cartridge" is built into the newer computers as a standard feature. His solution was to write a program which switched off the built-in BASIC, changed RAMTOP, and closed and reopened the screen driver.

Whew! I am impressed. Doing all that in the proper order is not easy. But there really is a much simpler way.

This discussion applies only to disks containing programs which *do not* use Atari BASIC. Obviously, such things as assemblers, compilers, and utility programs fit this category. Not so obviously, many game disks will not run if Atari BASIC is present. In any case, if you own an 800XL (or, I assume, a 600XL with expanded memory), and the directions for a disk or program tell you to remove your BASIC cartridge, try this:

Turn on power to all devices *except* the computer. Insert the disk you wish to boot. Push *and hold down* the OPTION button. Turn on the computer's power. When the disk starts to load, you can release the OPTION button.

This has the effect of disabling the built-in BASIC. Atari's manuals tell you all this. But they don't emphasize enough that you should try this with any disk/program if it otherwise doesn't work. And they don't tell you about the OPTION button when used with the *Translator Disk*. "What's that?" Glad you asked . . . .

I have mentioned the *Atari Translator Disks* before in this column, but only part of what I'll add is repetition.

If you own an Atari 1200XL, 800XL, or expanded 600 XL with a disk drive, run—do not walk—to your nearest Atari users' group and purchase (usually for about $10) the pair of *Atari Translator Disks*. (You may still be able to get them from Atari directly.)

The instructions tell you to boot the version A disk first, wait for it to give you a message, insert your otherwise unbootable disk, and push the SELECT key. If that doesn't work, you are supposed to try the version B disk. (Both disks actually load an old Atari 800-style operating system into your XL machine's memory, thus hopefully assuring compatibility with programs that rely on the older operating system.)

What the instructions don't say is that you may also need to hold down the OPTION button. Why? Because otherwise, good old Atari BASIC is still there, messing up the memory address space.

Six Ways To Boot

There are, then, no less than six ways to try booting a disk on an XL machine: with or without holding down the OPTION button alone or in combination with either of the two *Translator Disks*. This sounds like a real pain, but once you find the method that works with a given disk, you can write it down for future reference.

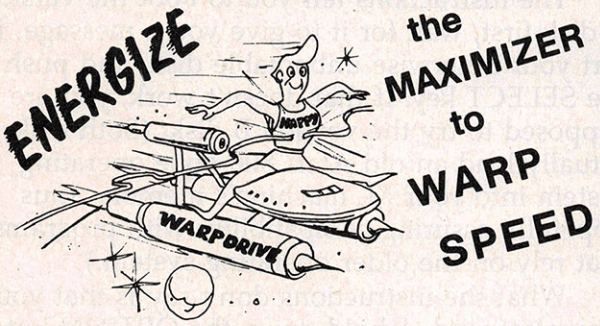
I should note that all of these methods still result in compatibility with only about 97 percent of all software (85 percent of heavily protected software). Is there anything you can do if your favorite piece of software won't boot using any of these methods? Yes, two things.

First, you can write, phone, telex, or otherwise cajole and threaten the software manufacturer. I have said before, and I am sure I will go hoarse saying again, that I believe the responsibility for the lack of compatibility does *not* rest with Atari. No other manufacturer has ever produced a series of computers with as many changes and improvements as the XL line and yet maintained as much compatibility as has Atari.

Second, you can try one of the commercial translator programs. I am aware of two at this time: *XL BOSS* from Allen Macroware and *XL FIX* from Computer Software Services. I have used neither, so I cannot comment on them. However, I recommend that to avoid unnecessary expense you should certainly seek verification from these manufacturers that the particular software package you want to use will work correctly with their product.

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And More Memory

The commercial translator programs do have one interesting bonus: They give your XL computer an extra 4K of memory. Let's see why.

The original Atari 400 and 800 computers had a 10K operating system and a 2K input/output space. Since the maximum RAM they supported was 48K, that left 4K unused in the total address space of 64K (unless you bought a third-party RAM board—such as those from Mosaic—which placed RAM in this unused space). The empty 4K was located at address $C000 (49152), just above the normal 48K RAM.

When the XL computers arrived, they sported more graphics modes, device downloaders, parallel bus support, self-diagnostics, and more, all of which pushed the size of the operating system up to 14K. Guess where Atari got the extra 4K from? Yep. No more "unused" space.

However, the commercial translators effectively emulate the original 10K operating system, leaving that 4K free again. But since an XL machine has 64K of RAM, the unused space becomes free RAM. If you are using a cartridge-based program (even the built-in Atari BASIC), this isn't a real big help. The 4K of RAM is still at address $C000, above the cartridge address space. You could install machine language routines here, use it as a buffer for disk I/O or player/missile graphics, or even use it for any graphics screen up to the size of that of GRAPHICS 7. But the average beginner will have a hard time using this space.

On the other hand, programs which don't use a cartridge don't have this restriction. For example, if you use one of these translators to load *VisiCalc* into an XL machine, you'll gain 4K of valuable spreadsheet space. Try it sometime. It's easy.

And one more comment before we pause until next month: Since the *Atari Translator Disks* work much like the commercial translators, it may just be possible to modify them and gain the same 4K of RAM. I have not had the time to investigate this, but if any COMPUTE! readers discover anything in this regard, we'd be happy to hear about it. ©

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MACHINE LANGUAGE

Jim Butterfield, Associate Editor

Stack Tricks

The 6502 stack sits quietly in page 1 (typically addresses $01FA down to about $0140) and works behind the scenes. If you call a subroutine using JSR, a couple of entries push their way onto the stack; they pop back off when RTS is used. Everything is tidied up, and we don't need to think about the stack workings most of the time.

Once in a while, however, we want to squeeze a little more performance out of the stack. We may read the stack pointer by transferring it to the X register with TSX, or even set it by transferring the other way with TXS. We may set up a dummy return address by pushing values to the stack before an RTS. Often such tricks are more trouble than they are worth, but sometimes they can be useful.

A Subroutine Limitation

An early 6502 text suggested that an easy way to pass data to a subroutine would be to place it on the stack. It can be done, but it's not easy; I tend to discourage this kind of coding for beginners.

Here's the problem: You take one or more values and place them on the stack using the PHA (PusH A) command, then call a subroutine. The idea is that the subroutine can simply pull these values from the stack with PLA (PuLl A) and use them, but that won't work. When the subroutine is called with JSR, the last two values placed on the stack are the subroutine return address (to be exact, the address minus 1). So the pull command gets, not the data, but the return address. Annoying.

There are a couple of ways around the problem, but they are clumsy. First, you can pull the return address (two bytes) from the stack and save them. Then the data bytes are pulled and saved. Finally the return address is recalled and put back on the stack. That's a lot of work. It would be easier to have the calling routine store the data somewhere.

The second method is a little more workable, but still clumsy. If the stack pointer is transferred to the X register with TSX, we may now look directly at the stack as it lies in page 1. An instruction such as LDA $0100,X would look at the stack memory area, but would miss the real stack: The effective address would be of the first "empty" stack location. We'll have to climb a little higher to see the "live" stack. For example, LDA $0101,X would look at the last item on the stack; LDA $0102,X would look at the previous item, and so on.

Back to our original problem. There's a byte of data on the stack, behind a subroutine call. We can read it with TSX followed by LDA $0103,X. But we can't remove it from the stack without setting up a loop to repack everything. We can also change this stack item with a STA command. When the subroutine returns, the main routine must pull the extra item back from the stack.

It's often more trouble than it's worth, but it does work. A small example will illustrate.

This routine prints a triangle of asterisk signs. There are better ways to do the job, but it does illustrate moderately advanced stack work.

```
033C A9 01     LDA #$01   ;start count at 1
033E 48        PHA        ;pass to the stack
033F 20 4B 03  JSR $034B  ;call print subrtn
0342 68        PLA        ;get back the count
0343 18        CLC
0344 69 01     ADC #$01   ;add one to count
0346 C9 10     CMP #$10   ;stop at 16
0348 90 F4     BCC $033E  ;else do it again
034A 60        RTS
          ; SUBROUTINE TO CHECK STACK
034B BA        TSX        ;get the pointer
034C BD 03 01  LDA $0103,X ;dig out the count
034F A8        TAY        ;put it in Y
0350 A9 2A     LDA #$2A   ;asterisk character
0352 20 D2 FF  JSR $FFD2  ;print it
0355 88        DEY        ;count down
0356 D0 FA     BNE $0352  ;if more, go back
0358 A9 0D     LDA #$0D   ;carriage return
035A 20 D2 FF  JSR $FFD2  ;print it
035B 60        RTS        ;quit
```

Call the above program from BASIC with SYS 828.

If you'd rather enter the program as BASIC DATA statements, the following program will do the job:

```
100 DATA 169,1,72,32,75,3,104,24
110 DATA 105,1,201,16,144,244,96
120 DATA 186,189,3,1,168,169,42
130 DATA 32,210,255,136,208,250
140 DATA 169,13,32,210,255,96
200 FORJ=828TO861
210 READX
220 T=T+X
230 POKEJ,X
240 NEXT J
```

```
250 IFT<>3911THENSTOP
260 SYS828
```

More Muscle

Perhaps a more useful task for the stack is to streamline frequently used subroutines. For example, if there's a popular subroutine that I call a dozen times or more, it will be in my interest to make the calling sequence as brief and easy as possible.

Here's a common one. I often need to print various messages, and expect to use a subroutine to do it. The normal calling sequence would be to load the address of the particular message into a couple of registers—say, A and Y—and then have the subroutine use this address to print the message. This means that the subroutine will have an overhead of two instructions: the LDA and LDY before the call. The overhead might in fact be greater: I might need to save previous values in A and Y in order to continue my program after the message is printed.

Suppose I could do this: just call the subroutine, and leave the *message itself* behind the calling routine. I could flag the end of the message text with a zero byte. Now, if I could make the subroutine smart enough to go after this message, I could save a lot of setup coding.

Not too hard. The subroutine would need to pull the return address from the stack and set it into an indirect address. The return address would need to be adjusted by a value of 1, since it has a built-in offset. Now the subroutine could walk through the message, printing out the characters as it found them. When it finds a zero, it's time to return; but we must adjust the return address so that we'll go to the address *behind the message*. All this takes a little careful work, but we can do it.

More Complex

Now let's make the task a little more complicated. Not only do we want our subroutine to print the message located behind the JSR instruction; we want it to do this without affecting any registers—A, X, or Y.

The natural thing to do is to push A, X, and Y to the stack, using the sequence PHA:TXA:PHA:TYA:PHA; just before we return, we'll pull everything back and restore the original register values. If we do this, however, we can't pull the return address from the stack, since it's buried beneath the new stuff we have just stacked. If we go this way, we must dig out the return address from midstack, using TSX and so on.

This kind of coding has been seen in various application programs; it's not new and revolutionary, just a little more careful work.

Commodore is using this technique for the first time in the ROM of its new computer series, the Commodore 16 and the Plus/4. You can track the coding in one of the machines by using the built-in machine language monitor. Start the disassembler at address $FBD8 with command DFBD8. You'll see code along the following lines:

Save all registers to the stack:

```
PHA:TYA:PHA:TXA:PHA
```

Copy the stack pointer, and adjust it to match the return address:

```
TSX:INX:INX:INX:INX
```

Copy the return address to zero page, so that it can be used as an indirect address:

```
LDA $0100,X:STA $BC:INX:LDA $0100,X:STA $BD
```

The indirect address in $BC and $BD is one too low, since a JSR return is offset by one. Add one to it:

```
BUMP INC $BC:BNE PASS:INC $BD
```

Get a character—it will come from behind the calling JSR instruction. If it's zero, we're finished and go to EXIT:

```
PASS LDY #$00
GETCH LDA ($BC),Y:BEQ EXIT
```

If it's not zero, print it; then go back to bump the address and get another one:

```
JSR $FFD2:INY:BNE GETCH
```

Y will never reach 255 (no messages are that long), so the BNE is an "always" branch. If we reach EXIT, we must get the count of characters from Y:

```
EXIT TYA
```

Now we recompute the position of the return address in the stack:

```
TSX:INX:INX:INX:INX
```

We add the count to the indirect address, and put the new return address directly into its place in the stack:

```
CLC:ADC $BC:STA $0100,X
LDA #$00:ADC $BD:INX:STA $0100,X
```

And finally, we restore our three registers and return:

```
PLA:TAX:PLA:TAY:PLA:RTS
```

For many of us, this type of stack manipulation is overkill. It makes programs hard to disassemble for study purposes, and the memory saving on small programs is negligible. For that matter, what are you going to do with the few dozen bytes you save?

Nevertheless, it can be a great coding convenience to allow a programmer to simply "drop" his data in line with the coding. This can save extra coding for setup, extra labels—and possible mistakes.

And it can be satisfying and fun to know that you can get that extra ounce of control over the workings of your computer. ©

C. Regena

Algebra Tutorial

Part 2

Last month's column introduced "Algebra Tutorial," an educational program for students learning higher math. Part 2 presents the rest of the program listing and line-by-line explanation.

You'll recall that "Algebra Tutorial" is intended for students who already have some knowledge of algebra. It assumes the student is familiar with terms usually introduced before binomial multiplication. (A binomial is a numeric expression of two terms.) Basically, the tutorial covers the multiplication of one binomial by another—such as (x+5) times (x+4).

Last month's column included the program listing for lines 110 through 1300. Briefly, these lines redefine a few characters into special algebraic symbols (160–170); print a screen showing a comparison of binomial multiplication and numeric multiplication problems (190–300); display the general form of the multiplication problem and its answer (310–460); present a problem to the student (470–950); print a screen showing numeric coefficients for the first term (960–1110); present a problem to the student involving numeric coefficients (1120–1180 and the subroutine starting at 1960); and display a screen of information about using positive and negative numbers (1190–1300).

Picking up where we left off, lines 1310–1320 (and the subroutine at 1880) give the student a problem which may contain positive and negative numbers and coefficients in the first term. Lines 1330–1520 are two more screens of final information.

Helping Where It Is Needed

One advantage a computer tutorial has over a textbook is that a student can work at his or her own pace, yet get immediate feedback. Random numbers make the problems different each time so the student doesn't just memorize a sequence. If the student has trouble with one section, the computer can repeat the section many times. On the other hand, if the student knows the subject, the computer can keep track of the progress and advance accordingly.

Each time the student works on a problem, a flag F is set to zero. The student presses a key at each prompt. If the key pressed is incorrect, there is a low "uh-oh" sound, the flag F is set to 1, and the student must try again. For the numbers, the program won't continue until the correct numbers are pressed. On the + or − signs, however, the correct sign is printed and the program continues. If the problem is completed without any errors, the student has the option to try another problem or to continue the program. If an error has occurred, the flag F will be 1, and the student will be given another problem.

The program from line 1530 to the end contains subroutines which are used in several places. Lines 1530–1570 are the subroutine that checks if the ENTER key has been pressed. Lines 1580–1610 are the subroutine for an incorrect response—the computer plays an "uh-oh" sound and F is set to 1.

Lines 1620–1680 play a prompting beep, blink a question mark while waiting for the student to press a key, then print the key pressed.

The prompting is always done on the twenty-third row, or the row just printed. The column C is specified before the subroutine is called. Lines 1690–1730 play an arpeggio after the problem has been completed.

Lines 1740–1870 contain the subroutine to get an answer. P$ is the string value of the correct answer. The numbers may be one or two digits, so this subroutine also determines the number of digits in the answer and where to place the prompting positions. CC and C are variables used for determining the columns.

Presenting Problems

Lines 1880–2690 are the subroutine to present a problem to the student. The first type of problem (T=1) is for positive numbers only, and the subroutine is entered at line 1960. For the second type of problem (T=2), the subroutine is entered at line 1880. SD and SE are the signs for the second terms, D and E. SD$ and SE$ are the corresponding symbols. For the first type of problem, SD and SE are 1, but for the second type they may be 1 or −1.

Lines 1970–2020 choose the coefficients of the first terms, A and B, and the constants D and E for the second terms. Lines 2010–2020 make sure there will be a middle term in the multiplication. F is the flag for error checking. A$ and B$ are the string values of A and B, which are necessary for ease in printing. X$ is the variable in the binomials, which may be X, Y, or Z.

Lines 2070–2110 print the problem. Lines 2120–2600 print sections of the problem and get the student's answers. For each answer SS is the sign (plus or minus), C or CC is the column for the prompt and answer, and P$ is the correct answer. SGN is a function used to determine the sign. SGN returns 1 for a positive number, 0 for zero, and −1 for a negative number.

Lines 2700–2840 are the subroutine to get the student's answer for the + or − sign. When a sign needs to be chosen, a plus, minus, and question mark blink in position while waiting for the student's answer. The student must press the plus or the minus sign. If the answer is incorrect, a low "uh-oh" sounds, then the correct sign is printed. Both symbols are shifted. The student should use the LEFT SHIFT key to type these symbols to avoid an accidental FCTN + (QUIT). If you prefer to let the student press only the keys without SHIFT, change lines 2770 and 2810.

Customizing The Tutorial

Using the ideas in this program, you can design more subroutines to cover positive and negative first terms, alphabetic coefficients, alphabetic characters in the second terms, multiplying polynomials, factoring, etc.

If you prefer to save the typing time and effort, you may have a copy of this program by sending $3, a diskette (please pack in stiff cardboard) or blank cassette, and a stamped, self-addressed mailer to:

C. Regena
P. O. Box 1502
Cedar City, UT 84720

Please be sure to specify the name of the program and that you need the TI version.

Algebra Tutorial, Part 2

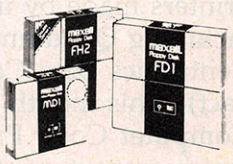
```
1310 T=2
1320 GOSUB 1880
1330 CALL CLEAR
1340 CALL SCREEN(4)
1350 PRINT "THERE MAY BE CASES WHEN
     "
1360 PRINT :"THE MIDDLE TERM BECOME
     S ZERO"
1370 PRINT :"SO YOU DO NOT NEED TO"
1380 PRINT :"SPECIFY A MIDDLE TERM.
     "
1390 PRINT ::"  X + 3";TAB(20);"4X
     + 2"
1400 PRINT "  X - 3";TAB(20);"4X -
     2"
1410 PRINT "  _____";TAB(19);"_____
     __"
1420 PRINT "(3 SPACES)^";TAB(22);"^
     "
1430 PRINT "  X - 9";TAB(19);"16X -
      4"::
1440 GOSUB 1530
1450 PRINT "OTHER MULTIPLICATION"
1460 PRINT :"PROBLEMS INCLUDE + AND
      -"
1470 PRINT :"NUMBERS IN THE FIRST T
     ERM"
1480 PRINT :"AND ALPHABETIC CHARACT
     ERS"
1490 PRINT :"FOR COEFFICIENTS."
1500 PRINT ::"THIS COMPLETES THIS U
     NIT"
1510 PRINT :"OF INSTRUCTION.":::
1520 STOP
1530 PRINT ::"PRESS <ENTER>"
1540 CALL KEY(0,K,S)
1550 IF K<>13 THEN 1540
1560 CALL CLEAR
1570 RETURN
1580 CALL SOUND(100,165,2)
1590 CALL SOUND(100,131,2)
1600 F=1
1610 RETURN
1620 CALL SOUND(150,1497,2)
1630 CALL KEY(0,K,S)
1640 CALL HCHAR(23,C,63)
1650 CALL HCHAR(23,C,32)
1660 IF S<1 THEN 1630
1670 CALL HCHAR(23,C,K)
1680 RETURN
1690 CALL SOUND(100,262,2)
1700 CALL SOUND(100,330,2)
1710 CALL SOUND(100,392,2)
1720 CALL SOUND(200,523,2)
1730 RETURN
```

```
1740 L=LEN(P$)
1750 IF L=2 THEN 1770
1760 CC=CC+1
1770 C$=""
1780 FOR I=1 TO L
1790 C=CC+I
1800 GOSUB 1620
1810 C$=C$&CHR$(K)
1820 NEXT I
1830 IF C$=P$ THEN 1870
1840 GOSUB 1580
1850 CALL HCHAR(23,CC+1,32,L)
1860 GOTO 1770
1870 RETURN
1880 SD=(-1)^(INT(2*RND)+1)
1890 SD$="+"
1900 IF SD=1 THEN 1920
1910 SD$="-"
1920 SE=(-1)^(INT(2*RND)+1)
1930 SE$="+"
1940 IF SE=1 THEN 1960
1950 SE$="-"
1960 CALL CLEAR
1970 A=INT(7*RND)+1
1980 B=INT(7*RND)+1
1990 D=INT(7*RND)+1
2000 E=INT(7*RND)+1
2010 IF (A=B)+(D=E)=-2 THEN 1970
2020 IF (A*E*SE=(-1)*B*D*SD)THEN 19
     70
2030 F=0
2040 A$=STR$(A)
2050 B$=STR$(B)
2060 X$=CHR$(88+INT(3*RND))
2070 PRINT "MULTIPLY"
2080 PRINT TAB(19);A$;X$;" ";SD$;"
     ";D
2090 PRINT :TAB(19);B$;X$;" ";SE$;"
      ";E
2100 PRINT TAB(18);"_________"
2110 PRINT :" ";STR$(E);"*TOP";TAB(
     20);X$;" +"
2120 IF T=1 THEN 2180
2130 IF SE=1 THEN 2150
2140 CALL HCHAR(23,3,45)
2150 SS=SE
2160 C=18
2170 GOSUB 2700
2180 P$=STR$(A*E)
2190 CC=19
2200 GOSUB 1740
2210 IF T=1 THEN 2250
2220 SS=SGN(SE*SD)
2230 C=24
2240 GOSUB 2700
2250 P$=STR$(D*E)
2260 CC=25
2270 GOSUB 1740
2280 PRINT TAB(14);"^"
2290 PRINT B$;X$;"*TOP";TAB(13);X$;
     "  +{3 SPACES}";X$
2300 P$=STR$(A*B)
2310 CC=12
2320 GOSUB 1740
2330 IF T=1 THEN 2370
2340 SS=SD
2350 C=18
2360 GOSUB 2700
2370 P$=STR$(B*D)
2380 CC=19
2390 GOSUB 1740
2400 PRINT TAB(11);"_______________
     "
2410 PRINT TAB(14);"^"
2420 PRINT "ADD";TAB(13);X$;"  +
     {3 SPACES}";X$;" +"
2430 P$=STR$(A*B)
2440 CC=12
2450 GOSUB 1740
2460 IF T=1 THEN 2500
2470 SS=SGN(A*E*SE+B*D*SD)
2480 C=18
2490 GOSUB 2700
2500 P$=STR$(ABS(A*E*SE+B*D*SD))
2510 CC=19
2520 GOSUB 1740
2530 IF T=1 THEN 2570
2540 SS=SGN(SD*SE)
2550 C=24
2560 GOSUB 2700
2570 P$=STR$(D*E)
2580 CC=25
2590 GOSUB 1740
2600 GOSUB 1690
2610 IF F=0 THEN 2640
2620 GOSUB 1530
2630 IF T=1 THEN 1960 ELSE 1880
2640 PRINT :"CHOOSE:  1 ANOTHER PR
     OBLEM"
2650 PRINT TAB(10);"2 CONTINUE PROG
     RAM"
2660 CALL KEY(0,K,S)
2670 IF K=49 THEN 2630
2680 IF K<>50 THEN 2660
2690 RETURN
2700 CALL SOUND(150,1497,2)
2710 CALL KEY(0,K,S)
2720 CALL HCHAR(23,C,63)
2730 CALL HCHAR(23,C,43)
2740 CALL HCHAR(23,C,63)
2750 CALL HCHAR(23,C,45)
2760 IF S<1 THEN 2710
2770 IF (K=43)+(K=45)THEN 2780 ELSE
      2710
2780 S$="+"
2790 IF SS=1 THEN 2810
2800 S$="-"
2810 IF K=ASC(S$)THEN 2830
2820 GOSUB 1580
2830 CALL HCHAR(23,C,ASC(S$))
2840 RETURN
2850 END
```

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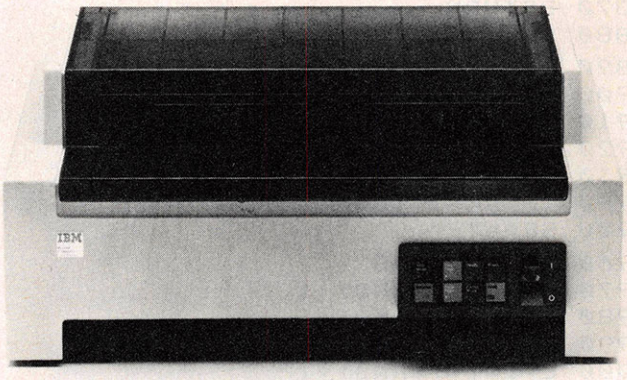
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IBM Personal Computing

Donald B. Trivette

Editor's Note: We're pleased to welcome a new column to COMPUTE! *this month—Donald B. Trivette's "IBM Personal Computing." Trivette will be covering topics of interest to users of all IBM microcomputers, including the IBM PC, PCjr, PC-XT, and Portable PC. (Much of the information will be useful to owners of compatibles, too.) Based in North Carolina, Trivette is a freelance writer, author, and consultant whose work has appeared in such magazines as* INC, Business Computer Systems, PC World, *and* Softalk. *He also wrote the "Getting Down To Business" column in* COMPUTE!'s PC & PCjr *magazine. From 1969 to 1981 he taught computer science courses and was the director of computing services for the University of North Carolina at Wilmington, and founded its Computing Center. His most recent book* A BASIC Primer for the IBM PC *(Scott, Foresman & Co.).*



If you need a hard copy of your color graphics, the IBM Color Printer can print at speeds up to 200 characters per second in eight colors.

Hard Copy Color Graphics

There are two basic ways to generate a hard copy of the color graphics on your display screen: photographic techniques and color printers. Photography is ideal if you need a slide to project at a business meeting or presentation, but it requires special equipment and at least some photographic skill. That's why many people opt for the more direct method, color printers.

One of two technologies is used to print a color image. The printer either sprays colored ink through a tiny jet onto the paper (ink-jet technology), or it hammers the image onto the paper with a multicolored ribbon (impact technology). Although there are several IBM-compatible color printers made by independent companies—including Quadram's Quadjet (ink-jet) and Centronics Data Computer's Model 358 (impact)—this month we'll discuss the IBM Personal Computer Color Printer, Model 5182. It's a dot-matrix impact printer that plugs into the parallel interface of a PC or PC-XT. (It also works with a PCjr equipped with a parallel interface, but not all software supports the Color Printer when attached to a Junior.)

The IBM Color Printer produces color printouts with a cartridge ribbon that has four bands. It works like the old two-band black and red typewriter ribbons, except the printer automatically switches from one color to another and, of course, there are more colors. The Process Ribbon cartridge ($19.95) has yellow, magenta (red), cyan (blue), and black bands. By printing one color on top of another, it can produce four additional hues—orange, green, violet, and brown. For example, when yellow is printed over magenta, the result is orange.

The Primary Ribbon cartridge (also $19.95) is suitable for less colorful printouts. Its four bands are also red, blue, green, and black, but no overprinting is allowed.

Finally, for everyday correspondence, you can buy an all-black cartridge ribbon ($12.95). It has automatic band shifting to extend the ribbon's life and snaps into place just like the other cartridges.

The IBM Color Printer is more than just a dot-matrix printer with a color ribbon. It has three speeds for printing text in various qualities. At 200 characters per second (cps) the print quality is good enough for preliminary drafts, informal notes, and program listings. At 110–150 cps the dot matrix is printed more densely to improve the character images, resulting in what is sometimes called correspondence quality. At 30–40 cps the printing approaches letter quality. In fact, the dot matrix pattern is hardly visible unless you examine the characters very closely.

Figure 1: Text Samples Generated On The IBM Color Printer

```
DATA-PROCESSING QUALITY:
    Printing Speed:       200 characters per second
    Print Head Travel:    Bi-directional, one pass
    Printing Sizes:       10 characters per inch (fixed spacing)
                          12 characters per inch (fixed/proportional spacing)
                          17.1 characters per inch (fixed/proportional spacing)
TEXT QUALITY:
    Printing Speed:       110 to 150 characters per second
    Print Head Travel:    Bi-directional, one pass
    Printing Sizes:       10 characters per inch (fixed/proportional spacing)
                          12 characters per inch (fixed/proportional spacing)
                          17.1 characters per inch (fixed/proportional spacing)
NEAR-LETTER QUALITY:
    Printing Speed:       30 to 40 characters per second
    Print Head Travel:    Uni-directional, two passes
    Printing Sizes:       10 characters per inch (fixed/proportional spacing)
                          12 characters per inch (fixed/proportional spacing)
                          17.1 characters per inch (fixed/proportional spacing)
```

The IBM Color Printer can also print in boldface type, automatically justify text, underline, print subscripts and superscripts, and space proportionally. Three pitches are selectable to print 10, 12, or 17.1 characters per inch. In graphics mode the printer has a resolution of 168 dots per horizontal inch and 84 dots per vertical inch—more than enough to represent the circle of a pie chart or the bud of a rose.

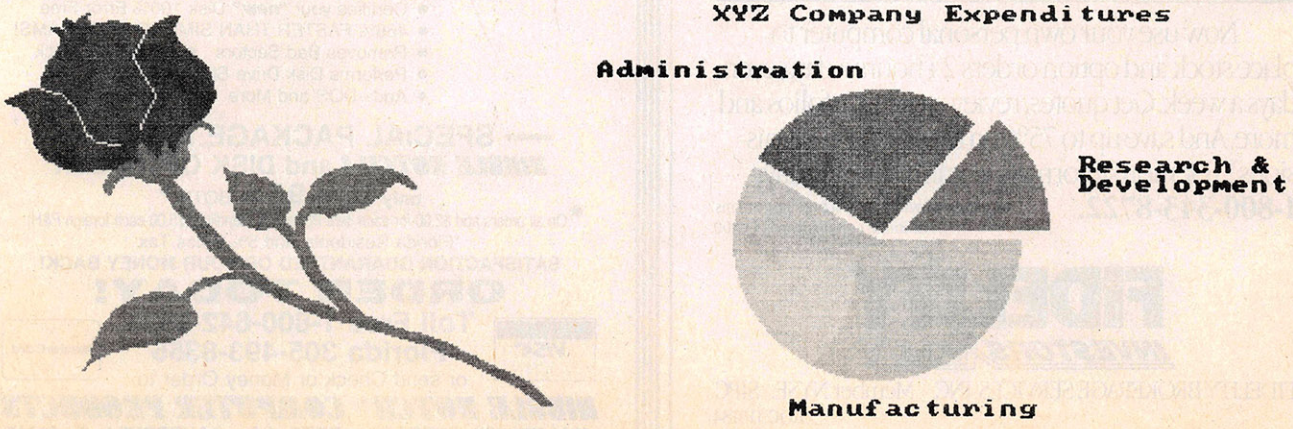
Color Limitations

Since the PC can generate 16 colors and the Color Printer can reproduce only eight, there is a slight incompatibility. We say "slight" because actually the PC generates only eight basic colors; colors 8–15 are simply brighter luminances of colors 0–7. Therefore, the Color Printer reproduces the high-intensity colors as their low-intensity equivalents. Unfortunately, background colors are not reproduced. The colorful bar graph you've created with a blue background will have a white background unless you can find blue computer paper.

Enough about the technology of color printing—the real question is how *easy* is it to get an image from screen to paper? By using a little-known IBM utility program, it's as easy as pressing two keys. The *IBM Personal Computer Print Screen Utility Program* (product #6024186, $35) sends a screen of text or graphics, color or monochrome, from the display buffer to the Color Printer when you press the Shift-PrtSc keys. You run the utility program once when starting up DOS, and then it remains quietly in memory until it's called forth to print a screen. It must be reloaded each time DOS is rebooted. Unfortunately, it works only with the eight-color Process Ribbon.

Some software, particularly graphics software, has color printer options built-in. *IBM Graphing Assistant* is one of these—it directly supports the IBM Color Printer. Simply issuing

Figure 2: Graphics Dumps Made With The IBM Color Printer



the print command reproduces the graph on the screen in color. Two excellent graphics programs from Digital Research, *DR Draw* and *DR Graph*, also support color printers, but not the IBM Color Printer. At least, not yet. A spokesperson for Digital Research says the company plans to add an IBM Color Printer option for both of these popular programs.

Color printers vary in price from $900 to $9000; the IBM Color Printer retails for $1995. The quality, as the accompanying printout shows, is quite good. (In fact, this is the printer that COMPUTE! recently started using to make program listings for IBM, Atari, Apple, Texas Instruments, and the TRS-80 Color Computer.) If you frequently need color graphics hardcopy, the output from a color printer may be better than a screen photograph.

Tougher Rules For Computer Deductions

Congress needs (wants) more money, so they recently changed the rules for deducting the purchase of personal computer equipment as a business expense. It used to be fairly easy to qualify for this deduction. But the 1984 Tax Bill limits the tax write-off for an employee who buys a computer to do company work at home.

Under the old rule, you could deduct the full cost of the computer if it were used exclusively for business, and a proportional amount if it were used for both business and pleasure. Formerly I advised people that keeping a log of use would help document their claims should the Internal Revenue Service (IRS) come calling.

It's no longer that simple. According to a story in *The Wall Street Journal*: "For purchases made after June 18, employees won't be able to claim any business deduction unless the computer is 'required for the convenience of the employer and as a condition of employment.' " The story goes on to say that a letter from your employer stating that you are required to have a computer at home *will not* be sufficient to support a tax deduction.

It seems Congress anticipated that your employer might be *too* willing to provide such a letter. So even with a letter, you'll have to prove to the IRS that you really need a computer at home. A log of personal and business use is now *required*.

Two questions an IRS auditor would likely raise: "Why didn't you stay late at the office and use the equipment there?" and "If this is really a condition of employment, why didn't the employer purchase the computer for you?" Have your answers ready—April 15, 1985 isn't that far away. ©

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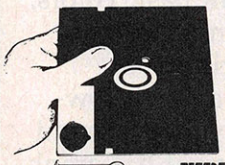
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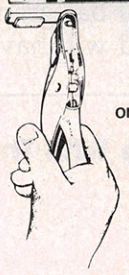
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Enhanced Commodore 64 DOS Support

Stephen S. Melsheimer

The wedge program that comes with every Commodore disk drive makes input/output much simpler. "Enhanced Commodore DOS Support" takes the wedge a few steps further by adding APPEND and VERIFY commands, allowing the use of wedge commands within a BASIC program, and several other features. There are also instructions on how you can further customize your wedge.

The Commodore 1541 disk drive used with the Commodore 64 and VIC-20 is *intelligent*—the disk unit contains a 6502 microprocessor, 16K of ROM holding the disk operating system (DOS), and 2K of RAM that serves as a buffer for information going to or from the disk. Thus, the computer is freed from the chore of managing the disk operations, and no computer memory is appropriated for a disk operating system when a disk drive is added.

Unfortunately, there are no simple commands in the *computer's* operating system to provide simple communication with the disk and its DOS. For example, there is no SCRATCH command to delete a file from the disk. Instead, you must use a cumbersome statement like:

OPEN 1,8,15,"S0:*filename*":CLOSE 1

To make up for this, Commodore provides a DOS support program named "DOS 5.1" (and a simpler "VIC-20 Wedge" for use with the VIC) to facilitate use of the disk. These programs appear on the *TEST/DEMO* disk which comes with the drive. This DOS wedge program is not needed to operate the disk, and adds no extra capabilities beyond those already present in the disk drive DOS ROM. What it provides is a set of shorthand commands that make things easier for the user. These commands do provide features that are vast improvements over what is possible directly from BASIC. In particular, the ability to display the disk directory without disturbing the program currently in memory is a great convenience.

The Theory Of Wedging

Programs like "DOS 5.1" are called *wedge* programs because they are wedged into the stream of BASIC interpreter processing. Central to the operation of BASIC is a subroutine called CHRGET (located at addresses $73–$8A in the 64 and VIC). This subroutine gets characters from a BASIC statement and delivers them to the interpreter. A wedge program intercepts each character and inspects it to see if it is a symbol recognized by the wedge. If not, control immediately returns to BASIC.

The "DOS 5.1" wedge also looks in the microprocessor stack and checks the return address of the BASIC routine which called CHRGET. If it is not an address which indicates the start of a new statement, control returns to BASIC. This allows the symbol characters to have their normal meaning in the middle of a statement. Finally, "DOS 5.1" checks whether BASIC is in direct or program mode, and exits to BASIC if in program mode. Obviously, all of this takes time—a couple of simple benchmark programs took about 15 percent longer to run when the wedge was active, even though it has no useful effect in program mode. Thus, the wedge should be deactivated before running any program where execution speed is important. For those who are curious about the details of "DOS 5.1," Table 1 gives an abbreviated memory map to facilitate exploring it with a machine language monitor.

Extending "DOS 5.1"

"DOS 5.1" provides a table of symbols, and a list of associated vectors that point to the routines for the various functions. Functions can thus be added by altering a vector to point to the new function, and changing the corresponding symbol to the desired character. Since "DOS 5.1" has seven distinct functions, but provides eleven symbols (several are redundant), it is not necessary to delete any existing functions to add new ones. While "DOS 5.1" is very handy, I

found that I wanted a few features that were not provided. The resulting "Enhanced DOS Support" program includes APPEND and VERIFY commands, provides a safety feature requiring user confirmation before erasing information on a disk, permits use of DOS commands within BASIC programs, and adds several other features. Still more commands could be added, and procedures for doing this are described below.

APPEND And VERIFY Commands

This revision of "DOS 5.1" originated because I wanted a simple procedure to append a BASIC program on disk to a BASIC program resident in memory. This would allow linking library subroutines or utility programs to other BASIC programs. Mark Niggemann presented an appending technique for the VIC-20 (COMPUTE!, March 1983) which is also applicable to the 64. All that is necessary to append a new program to an existing program is to determine the end address of the program in memory, and alter the starting address of the relocating loader accordingly. A LOAD command then executes as an APPEND. While this method is simple, it uses several direct-mode commands.

To automate the process, I made a patch in the LOAD section of the DOS support program at $CE26 (see the memory map, Table 1). The patch causes the jump to a new routine at $CF5F–$CF7E which alters the starting address in a manner similar to that presented by Niggemann. & was selected as the symbol to be replaced, so to append a program on disk with the name PROG2 to a program in memory, one simply enters

```
&PROG2
```

It should be noted that this is not a *merge*: All statement numbers in the appended program must be higher than those in the program already in memory.

The ease with which APPEND was added encouraged me to add further enhancements to "DOS 5.1." Since the same 64 ROM routine handles both LOAD and VERIFY, it seemed reasonable to add a VERIFY command. The = character was assigned as the symbol. In order to produce the OK or VERIFY ERROR messages, a routine ($CE36–$CE6B) was written to check the error status byte for LOAD/VERIFY errors, and issue the appropriate messages. A typical application of VERIFY is

```
=PROG3
```

which compares PROG3 on disk with the program currently in memory.

The *disk* error status read by the @ command of "DOS 5.1" indicates errors detected within the 1541 disk drive and is completely independent of the computer. Although it is essential to check the 64's status byte on VERIFY (and tape LOAD) operations, there is no great reason to check the status byte on disk LOAD operations, since most potential errors are monitored by the disk unit. However, Enhanced DOS Support reads the Commodore 64 error status on all LOAD/VERIFY operations, and does provide some useful messages even on disk LOADs (for example, BREAK ERROR).

Destruction Warnings

Certain disk commands may be disastrous if executed inadvertently—NEW erases an entire diskette, and SCRATCH deletes a file. BASIC 4.0 (used on larger Commodore PET/CBM computers) issues a warning on such commands, and requires user confirmation before executing them. Since "DOS 5.1" makes issuing commands to the disk very easy (and thus increases the prospect of careless errors), Enhanced DOS Support provides this safety feature for destructive commands issued via the DOS support program.

The portion of "DOS 5.1" ($CD48–$CD6E) that sends such commands to the disk was rewritten, and a new section was added at $CFBD–$CFEF that prints an ARE YOU SURE (Y/N)? message to the screen, and waits for a keyboard response. If N, the command is aborted. This revision also changed the scheme for decoding the commands for deactivating the wedge and for setting the device number. The effect was to free two vectors previously used, compensating for the two used for VERIFY and APPEND. In addition, the command for changing device numbers was simplified to @*n* rather than @#*n*.

Since SAVE&REPLACE also deletes a file, provision was made to issue the warning when the replace option is specified with SAVE operations. The revised SAVE routine is located at $CFF0–$CFFF.

Enabling Program Mode

While Enhanced DOS Support is mainly intended for direct-mode use, a few of the commands can be quite valuable in program mode. Thus, the portion of "DOS 5.1" ($CED1–$CED6) that prevented use of wedge commands within a program was deleted. Several other small changes were also needed to enable the commands to be used in program mode, and the LOAD/VERIFY routine ($CE36–$CE6B) was revised to facilitate program mode use of the % and & commands. With these changes some of the Enhanced DOS Support commands may be used within a program. The symbols =, ↑, and / are *not* allowed as DOS commands. In addition,

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the * and ? symbols cannot be used as wild cards in filenames while Enhanced DOS Support is active. In program mode these symbols are all tokenized by BASIC with codes other than the ASCII codes, and thus are not recognized by Enhanced DOS Support.

Of the commands that are operable in program mode, % is especially useful for loading machine language routines or screen images since it does not cause BASIC to restart as a LOAD command does. Thus, constructions like line 100 of Program 1 or line 10 of Program 2, which prevents repeated LOADing, are not needed. The & command was also designed to permit a program to automatically append BASIC subroutines, though using it is a little tricky. A procedure like

```
10 IF(PEEK(2))<>1THENPOKE2,1:&SUBPROG
20 POKE2,0
```

must be used since & restarts BASIC after it is executed, and also CLRs all BASIC variables. Obviously, this should normally be done at the very beginning of the program. Memory location 2 is convenient to use as a flag since it is not used by the computer and has a value of zero on power-up. By using each bit of location 2 as a separate flag, up to eight subprograms could be appended in this manner. Another command that is valuable in program mode is @Q which deactivates the DOS wedge, thus speeding up program execution by about 15 percent. SYS52222 can activate the wedge from within a program, so it can be turned on only when needed.

Note that Enhanced DOS Support commands can be placed in multiple-statement lines, as illustrated in line 10 above. However, they must appear last on any line in which they are used, and thus only one DOS command can be placed on a line. Further, the Enhanced DOS Support symbol must be the first character of a statement for it to be recognized as such.

Other Changes

After SAVE operations, "DOS 5.1" reads the disk error status in order to verify a successful SAVE. A minor annoyance was that the disk status message appeared after the filename without any spacing or punctuation. Revision of $CD9C–$CDAE added a carriage return to provide a neater and cleaner error report.

The symbol table and list of vectors, located from $CC03 to $CC26, were revised considerably. The number of symbols was increased from 11 to 12, making the start of the symbol table $CC1B rather than $CC19 as given in the DOS 5.1 memory map of Table 1. Including the new & and = commands, seven distinct symbols have been used. For various reasons, > and ., both synonyms for @, were added, thus using two more symbols. Since "Supermon64" (COMPUTE!, January 1983) was used extensively in developing Enhanced DOS Support, a symbol (!) was added that branches to Supermon64 (or to any other monitor that is entered via the break vector). Of course, the monitor must have previously been loaded. With ten symbols now assigned, two remain available for future use.

Command Summary

Table 2 lists the commands currently available in Enhanced DOS Support. Note that the . symbol is indicated for most disk command functions, while > is shown for device code changes and @ for reading the disk error status. This is strictly a matter of taste since all three (@, >, and .) are synonyms that perform exactly the same functions. Program 2 is a BASIC boot program that writes a command summary to the screen as well as LOADing and activating Enhanced DOS Support (assuming you saved it with the program name used in line 10). Use Program 2 as you used "C-64 Wedge" to activate the original "DOS 5.1."

Entering The DOS 5.1 Enhancements

Program 1 will make all the necessary modifications to "DOS 5.1" to create the Enhanced DOS Support program. Before you run Program 1, make sure you have a disk containing the "DOS 5.1" program in the drive; otherwise, you will get the message FILE NOT FOUND ERROR IN 100. If any errors are detected in the DATA statements, the program will stop and report which lines contain errors. When Program 1 has finished, the cursor should be resting on a line of POKE statements. At this point you should insert the disk on which you want to store Enhanced DOS Support. Press RETURN, and the cursor should move to the line with the SAVE statement. Press RETURN again, and Enhanced DOS Support will be stored on the disk with the filename DOS 5.1E. At this point you will need to turn the computer off and back on (or reset with SYS 64738) to return the system to its normal configuration.

If you want to take the easy way out, send a diskette containing "DOS 5.1" with $3 and a stamped, self-addressed mailer, and I will add the revisions for you.

Stephen S. Melsheimer
Clemson University
Department of Chemical Engineering
Clemson, SC 29631

To use Enhanced DOS Support, load it from disk by running Program 2. The original "C-64 Wedge" supplied with "DOS 5.1" can also be

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Table 1: "DOS 5.1" Memory Map

$CC00	Wedge activation entry (52224)
CC03	Symbol vectors
CC19	Symbol table
CC27	Text buffer
CC77	Device number
CC78	Filename suffix
CC7A	Current symbol
CC7B	"DOS MANAGER 5.1 ..." text
CCE1	Wedge activation routine
CCF3	Normal entry point
CCF8	CHRGET call address validation ($A7E6 and $A48C are allowed)
CD0E	Check character against symbol table
CD30	Branch to execute routine if symbol matched
CD48	Execute @ commands
CD71	Send command string to disk (for example, @S0:filename)
CD90	Read disk error status (@)
CDB2	List directory (@$)
CE22	Execute LOAD (including /, %, and ↑)
CE6C	Disable wedge (@Q)
CE79	Execute SAVE (←)
CE7E	Set device code (@#N)
CEA3	Process line into text buffer
CF4B	Print DOS MANAGER message
CF5B	End of "DOS 5.1"

Table 2: Enhanced DOS Support Commands

.$	Directory Listing
/ *filename*	Load
↑ *filename*	Load and run
& *filename*	Append
← *filename*	Save
← @0:*filename*	Save and replace
= *filename*	Verify
% *filename*	Absolute Load
.S0:*filename*	Scratch
.R0:*newname*=0:*oldname*	Rename
.C0:*newfile*=0:*oldfile* ,*old2*,...*old4*	Copy/Concatenate up to four files
.N0:*diskname,id*	Format disk
.I	Initialize disk
.V	Validate disk
@	Read disk error status
!	Break/Activate monitor
>*n*	Change disk device number to *n*
.Q	Disable DOS Support
SYS 52224	Reactivate DOS Support

(Note: ., >, and @ can be used interchangeably in any command beginning with one of these symbols.)

used, if the filename in line 10 is changed from DOS 5.1E to DOS 5.1.

One caution: Commodore may in the future issue revisions of the DOS wedge. The enhancements given here may not work with versions different from the one on which it is based. If you get the message DOS MANAGER V5.1/071382 when you activate the original DOS 5.1, you have the correct version. If Program 1 checks out okay, but your program will not work, that may be the problem. The "easy out" mentioned above is still available in that case, of course.

Further Extensions

Two symbols remain unassigned in Enhanced DOS Support, and two of the three redundant command codes (@, >, and .) could be reassigned for other uses if needed. Thus, additional functions can easily be added to the program. One possibility is a command to link other utility programs (for example, a programmer's aid package) in a manner similar to the ! monitor link. Another handy addition might be a help routine that could display a summary of the Enhanced DOS Support commands on the screen without disrupting the program in memory. This could also include monitor or even BASIC commands as well.

To add a command, put the ASCII value of the desired symbol character in location $CC26. Then, put the high byte of the starting address of the new routine in $CC0E, and put the low byte of the target address *less one* in $CC1A. For a second command, decrement each of these addresses by one. The only other thing you must do is the hard part—writing the routine that will accomplish the new function. Locations $CF7F–$CFB1 are unused in DOS 5.1E, but extensive routines would have to be located outside the $CC00–$CFFF block. Remember that if a routine is to be used in program mode, the symbol must not be tokenized by BASIC (for example, do not use * as a symbol).

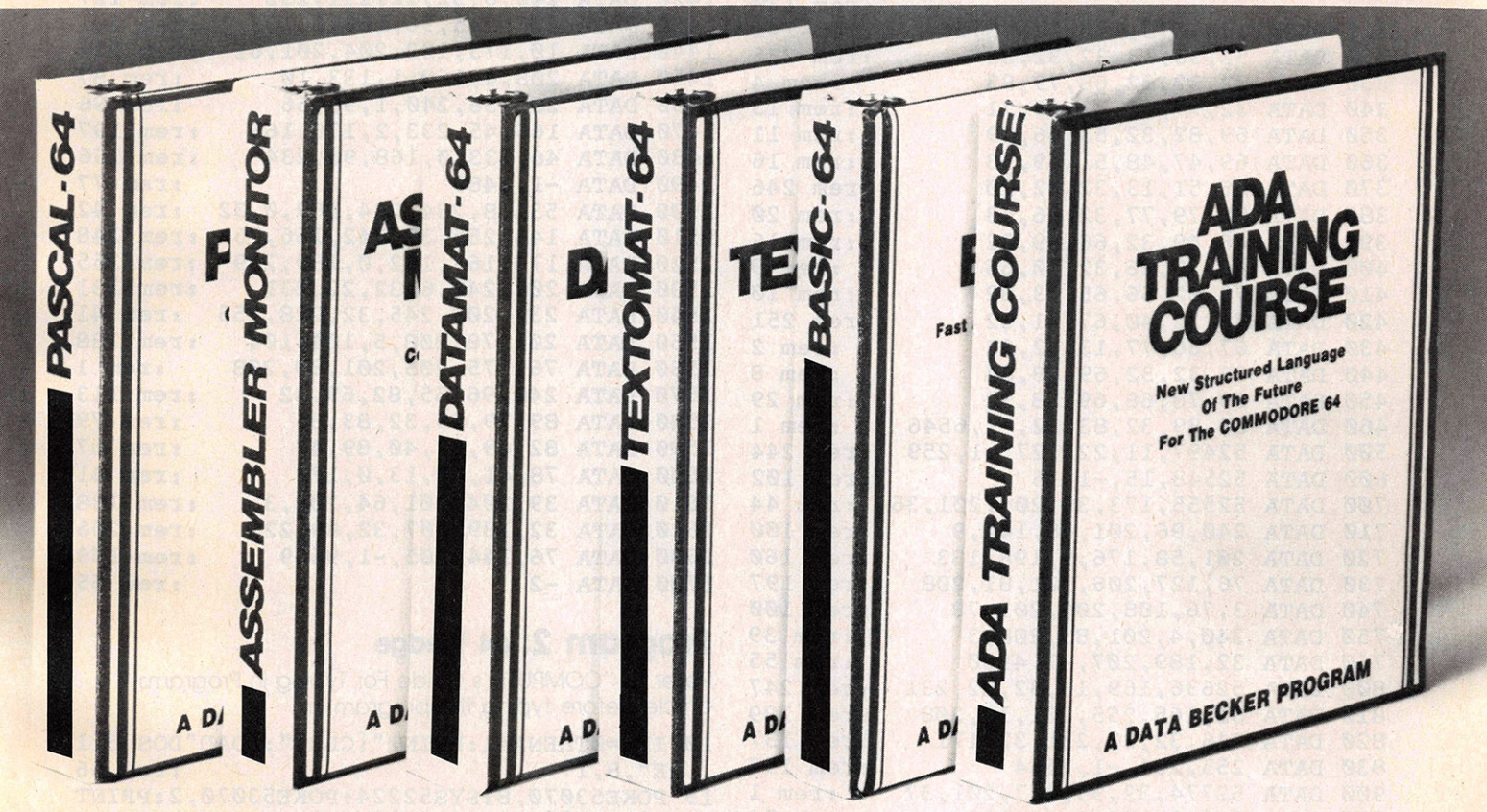
Program 1: Enhanced DOS Support

Refer to "COMPUTE!'s Guide For Typing In Programs" article before typing this program in.

```
100 IF A=0 THEN A=1:LOAD "DOS 5.1",8,1
                                    :rem 133
110 READ AD:IF AD=-2 THEN 180      :rem 229
120 CK=0:FL=PEEK(64)*256+PEEK(63) :rem 72
130 READ DT:IF DT=-1 THEN 150       :rem 9
140 POKEAD,DT:CK=CK+DT:AD=AD+1:GOTO 130
                                    :rem 71
150 LL=PEEK(64)*256+PEEK(63)       :rem 28
160 READ CS:IF CS<>CK THEN PRINT"ERROR IN
    DATA: LINES";FL;"-";LL:STOP :rem 108
170 GOTO 110                       :rem 99
180 PRINT "{CLR}ENHANCEMENTS ADDED":PRINT
    "{2 DOWN}PO43,0:PO44,204:PO45,0:PO46,
    208"                           :rem 1
190 PRINT "{2 DOWN}SAVE"+CHR$(34)+"DOS 5.
    1E"+CHR$(34)+",8":PRINT"{HOME}":END
                                    :rem 180
200 DATA 52232,207,205,205,205,204
                                    :rem 122
210 DATA 205,205,33,33,33,33       :rem 79
```

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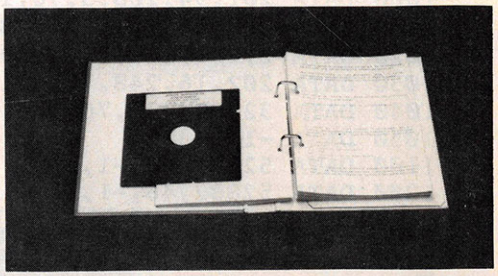
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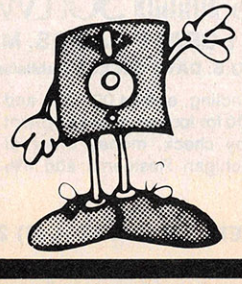
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```
220 DATA 33,239,71,71,71,220        :rem 90
230 DATA 71,71,37,47,38,94           :rem 8
240 DATA 61,95,64,46,62,33           :rem 3
250 DATA 64,64,83,-1,3203          :rem 198
300 DATA 52334,170,170,170,170,170
                                    :rem 130
310 DATA 170,170,170,170,8,56      :rem 141
320 DATA 52,33,13,32,32,32         :rem 235
330 DATA 32,32,32,68,79,83           :rem 4
340 DATA 32,77,65,78,65,71          :rem 13
350 DATA 69,82,32,53,46,49          :rem 11
360 DATA 69,47,48,51,49,53          :rem 16
370 DATA 56,51,13,32,32,70         :rem 246
380 DATA 82,79,77,32,86,53          :rem 20
390 DATA 46,49,32,66,89,32          :rem 16
400 DATA 66,79,66,32,70,65           :rem 9
410 DATA 73,82,66,65,73,82          :rem 10
420 DATA 78,32,40,67,41,32         :rem 251
430 DATA 67,66,77,13,32,32           :rem 2
440 DATA 32,32,32,69,88,84           :rem 8
450 DATA 69,78,68,69,68,32          :rem 29
460 DATA 66,89,32,83,32,-1,6546      :rem 1
500 DATA 52497,11,221,27,-1,259    :rem 244
600 DATA 52548,15,-1,15            :rem 102
700 DATA 52555,173,39,204,201,36    :rem 44
710 DATA 240,96,201,48,144,9       :rem 100
720 DATA 201,58,176,5,198,183      :rem 160
730 DATA 76,127,206,201,81,208     :rem 197
740 DATA 3,76,108,206,201,78       :rem 100
750 DATA 240,4,201,83,208,3          :rem 39
760 DATA 32,189,207,-1,4950          :rem 55
800 DATA 52636,169,13,32,22,231    :rem 247
810 DATA 32,165,255,201,13,208     :rem 189
820 DATA 246,32,22,231,32,171      :rem 137
830 DATA 255,234,-1,2564           :rem 157
900 DATA 52774,32,95,207,201,37      :rem 1
910 DATA 208,3,169,1,44,169         :rem 54
920 DATA 0,133,185,165,10,32         :rem 88
930 DATA 213,255,144,3,76,249      :rem 156
940 DATA 224,165,10,240,3,76         :rem 94
950 DATA 126,225,32,183,255,41     :rem 200
960 DATA 191,240,3,76,156,225      :rem 155
970 DATA 173,122,204,201,37,208    :rem 243
980 DATA 1,96,134,45,132,46          :rem 56
990 DATA 32,94,166,173,122,204     :rem 205
1000 DATA 201,94,208,3,76,178      :rem 145
1010 DATA 207,76,161,225,234,162    :rem 33
1020 DATA 2,189,171,227,149,124    :rem 246
1030 DATA 202,16,248,76,121,0      :rem 132
1040 DATA 32,89,225,76,144,164     :rem 203
1050 DATA -1,11372                 :rem 104
1100 DATA 52874,48,-1,48           :rem 160
1200 DATA 52882,48,-1,48           :rem 160
1300 DATA 52945,234,234,234,234,234
                                   :rem 192
1310 DATA 234,-1,1404              :rem 247
1400 DATA 53067,165,123,201,2,208  :rem 81
1410 DATA 13,162,0,189,123,204     :rem 183
1420 DATA 240,6,32,22,231,232      :rem 127
1430 DATA 208,245,96,169,0,133     :rem 201
1440 DATA 10,173,122,204,201,61    :rem 224
1450 DATA 208,4,169,1,133,10        :rem 87
1460 DATA 201,38,240,1,96,56        :rem 96
1470 DATA 165,45,233,2,170,165     :rem 197
1480 DATA 46,233,0,168,96,234      :rem 156
1490 DATA -1,6489                   :rem 77
1500 DATA 53168,234,234,169,0,32    :rem 42
1510 DATA 144,255,32,142,166,76    :rem 248
1520 DATA 174,167,162,0,189,219    :rem 255
1530 DATA 207,240,6,32,22,231      :rem 131
1540 DATA 232,208,245,32,228,255    :rem 41
1550 DATA 201,78,208,5,104,104     :rem 188
1560 DATA 76,175,205,201,89,208      :rem 1
1570 DATA 240,96,65,82,69,32       :rem 113
1580 DATA 89,79,85,32,83,85         :rem 79
1590 DATA 82,69,32,40,89,47         :rem 67
1600 DATA 78,41,63,13,0,173         :rem 41
1610 DATA 39,204,201,64,208,3      :rem 138
1620 DATA 32,189,207,32,89,225     :rem 206
1630 DATA 76,144,205,-1,9669       :rem 109
1700 DATA -2                        :rem 65
```

Program 2: 64 Wedge

Refer to "COMPUTE!'s Guide For Typing In Programs" article before typing this program in.

```
10 IFA=0THENA=1:PRINT"{CLR}":LOAD"DOS 5.1
   E",8,1                           :rem 56
15 POKE53070,8:SYS52224:POKE53070,2:PRINT
   "{DOWN}{10 SPACES}{RVS} COMMAND SUMMAR
   Y "                              :rem 81
20 PRINT".$ DIRECTORY{8 SPACES}@
   {2 SPACES}ERROR STATUS           :rem 198
25 PRINT".V VALIDATE{8 SPACES}>N
   {2 SPACES}DEVICE# = N            :rem 206
30 PRINT".I INITIALIZE{7 SPACES}!
   {2 SPACES}MONITOR/BREAK           :rem 88
35 PRINT".Q{2 SPACES}DISABLE DOS SUPPORT
                                    :rem 173
40 PRINT"SYS 52224{2 SPACES}REACTIVATE DO
   S SUPPORT                         :rem 28
45 PRINT"/FILENAME{14 SPACES}LOAD:rem 168
50 PRINT"↑FILENAME{14 SPACES}LOAD & RUN
                                    :rem 238
55 PRINT"&FILENAME{14 SPACES}APPEND
                                     :rem 56
60 PRINT"←FILENAME{14 SPACES}SAVE:rem 228
65 PRINT"←@0:FILENAME{11 SPACES}SAVE & RE
   PLACE                            :rem 181
70 PRINT"=FILENAME{14 SPACES}VERIFY
                                    :rem 105
75 PRINT"%FILENAME{14 SPACES}LOAD ABSOLUT
   E                                  :rem 0
80 PRINT".S0:FILENAME{11 SPACES}SCRATCH
                                     :rem 75
85 PRINT".R0:NEWNAME=0:OLDNAME{2 SPACES}R
   ENAME                            :rem 112
90 PRINT".C0:NEWFILE=0:OLDFILE{2 SPACES}C
   OPY/MERGE 1-4                     :rem 15
92 PRINT"{2 SPACES},0:OLD2,---0:OLD4
   {6 SPACES}FILES                  :rem 100
95 PRINT".N0:DISKNAME,ID{8 SPACES}FORMAT
   {SPACE}NEW DISK                  :rem 230
100 NEW                           :rem 123 ©
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IBM Personal Computers have the option of using a 40-column or 80-column display in text mode. This is done primarily because you have a choice of various types of monitors (screens), ranging from special RGB (Red-Green-Blue) computer displays to ordinary TV sets. The 40-column option is necessary because on most TV sets the letters of an 80-column display are too small and fuzzy to be seen clearly. The resolution on TV screens is not as good as on special video monitors. For people who have invested in a dedicated computer monitor, however, the 80-column display allows twice as much information to be displayed on the screen.

While these options make IBM computers more versatile for users, they cause some problems for programmers. If a program is written in the 80-column mode, some of the words that are printed on the screen may be split when the program is run in the 40-column mode. For example, if your program displays the message PRESS M FOR MENU, R TO REPEAT COMPUTATIONS, the word COMPUTATIONS will be split between the O and the N when the program is run in the 40-column mode. One way to avoid this problem is to insert enough spaces before the word that would be split so it starts on the next line in 40-column mode. Unfortunately, this sometimes looks very strange in the 80-column mode. When printing PRESS M FOR MENU, R TO REPEAT COMPUTATION, for example, you would have to insert ten spaces before the word COMPUTATION, which would look odd on an 80-column screen.

A Better Solution

A more effective way to solve this problem is to take advantage of a feature built into the PRINT statement in IBM BASIC. When the PRINT statement is printing a series of strings separated by semicolons, it checks to see if each string will fit in the space remaining in the current screen line. If it won't, the string automatically starts on the next line.

For example, if A$ and B$ are both 30 characters long, the statement:

```
PRINT A$;B$
```

prints A$ and B$ on the same line if the screen is in the 80-column mode, but on different lines on a 40-column screen. B$ starts printing on the next line because it won't fit completely on the same line with A$.

Therefore, by splitting the text in your PRINT statement after a space within the first 40 characters, you can be sure the words will not be broken. Just count the characters until you get to the fortieth, then backtrack until you get to a space and split the text after the space into two sections separated by a semicolon. For example, the statement:

```
PRINT "PRESS M FOR MENU, R TO REPEAT COMPUTATION."
```

becomes

```
PRINT "PRESS M FOR MENU, R TO REPEAT ";"COMPUTATION."
```

You may need to split the text in the PRINT statement in several places if the second portion of the string is more than 40 characters long.

In some cases, you may be printing out a string variable (such as A$) rather than a string literal (characters enclosed in quotes). Sometimes you may not even know the length of the string,

such as when the string was input by the user. In these instances, the following subroutine will print the contents of the string variable (in this case A$) without splitting any words—regardless of the screen width or the length of the string (provided there's at least one space per 40 characters). The line numbers in this subroutine are arbitrary, so use whatever line numbers you like (omit lines 10–30 when using this as a subroutine). Just assign the text you want printed to A$ and GOSUB 65000. (Be sure to put an END statement after your main code so the subroutine isn't accidentally executed twice.)

IBM Screen Formatter

Refer to "COMPUTE!'s Guide To Typing In Programs" before typing in this program.

```
HO 10 CLS:A$="THE IBM PERSONAL COMPUTE
      R HAS THE OPTION OF USING A 40-C
      OLUMN OR 80-COLUMN DISPLAY"
MB 20 GOSUB 65000
CF 30 END
LI 65000 WS=1
NJ 65010 WE=INSTR(WS,A$," ")
KA 65020 IF WE>0 THEN PRINT MID$(A$,WS
         ,WE-WS+1);:WS=WE+1:GOTO 65010
JC 65030 PRINT MID$(A$,WS)
JK 65040 RETURN
```

©

Apple Disk Verify

Ilan Reuben

Here's a short but useful verification utility for checking BASIC programs saved on disk. It works with all Apple II-family computers.

The VERIFY command in Apple DOS 3.3 indicates only whether a saved program is legible. Sometimes this isn't enough. If you need to be absolutely sure that the program you just saved is safely stored on the disk, "Verify+" is the answer. It's a utility written in machine language which insures that the BASIC program saved on disk is exactly the same as the program in memory. Verify+ is only about 400 bytes long and uses two 256-byte buffers.

The program following this article is a BASIC loader which creates Verify+ by encoding the machine language (ML) in DATA statements. Type in the program and run it. If any errors are detected in the data, the program stops. When you see the message ML LOADED, save the ML by typing:

```
BSAVE VERIFY+,A$8E00,L$175
```

Now that you have saved the machine language for Verify+, you can reload it whenever it's needed by typing:

```
BLOAD VERIFY+
```

To run it, you can type this command:

```
CALL 36352
```

If you plan to run Verify+ frequently, there's an even easier way. First, load the utility by typing BLOAD VERIFY+ as before. Then enter these two statements:

```
POKE 1014,0:POKE 1015,142
```

Then all you'll have to type to perform the verification is the ampersand symbol, &.

A Simple Test

After typing in Verify+ and saving it as described above, try this easy test. First, create a one-line BASIC program:

```
10 PRINT "HELLO"
```

and save it on disk with the filename TRIAL. Then, run Verify+ by typing:

```
CALL 36352 "TRIAL"
```

(or, if you entered the appropriate POKEs, run Verifyby typing & "TRIAL"). If the program was properly verified, you'll see the message FILE OK.

Now, slightly modify the BASIC test program:

```
10 PRINT "JELLO"
```

and try verifying it again: CALL 36352 "TRIAL" or & "TRIAL". You should get the message VERIFY ERROR.

Unfortunately, Verify+ works only with BASIC programs. This is because of the different ways that BASIC, binary, and text files are stored on the disk. But if Verify+ ever keeps you from losing even one important BASIC program because of a faulty disk or other problem, you'll be glad you kept it handy.

Apple Disk Verify

```
10  FOR ADRS = 36352 TO 36724
20  READ BYTE:X = X + BYTE
30  POKE ADRS,BYTE
40  NEXT
50  IF X <  > 47562 THEN  PRINT "ERR
    OR IN DATA STATEMENTS": END
100 DATA 160,31,169,160,153,43,143,
    136,16,250,200,32,177,0,166,184
    ,177,184,201,34
110 DATA 240,12,9,128,153,43,143,20
    0,232,192,31,144,239,96,232,134
    ,184,169,140,141
120 DATA 98,143,169,17,141,93,143,1
    69,0,141,94,143,32,79,143,173,1
    ,140,141,93
130 DATA 143,173,2,140,141,94,143,1
    3,93,143,208,3,76,210,142,32,79
    ,143,169,11
140 DATA 133,6,169,140,133,7,160,32
    ,185,40,143,209,6,208,7,136,192
    ,2,208,244
150 DATA 240,11,165,6,24,105,35,133
    ,6,208,231,240,198,160,0,177,6,
    141,1,140
160 DATA 200,177,6,141,2,140,200,16
    9,7,133,9,169,255,133,8,169,141
    ,133,7,169
170 DATA 0,133,6,169,140,141,98,143
    ,173,1,140,141,93,143,173,2,140
    ,141,94,143
180 DATA 13,93,143,240,49,32,79,143
    ,169,141,141,98,143,162,11,232,
    240,221,189,0
190 DATA 140,141,93,143,232,189,0,1
    40,141,94,143,13,93,143,240,18,
    32,79,143,177
200 DATA 6,209,8,208,13,200,208,247
    ,240,221,169,0,240,29,169,30,20
    8,25,24,152
210 DATA 101,8,133,8,144,2,230,9,56
    ,229,175,201,2,176,6,165,9,197,
    176,240
220 DATA 229,169,16,168,169,141,32,
    240,253,185,5,143,200,32,240,25
    3,201,141,208,245
230 DATA 96,135,198,201,204,197,160
    ,206,207,212,160,198,207,213,20
    6,196,141,135,214,197
240 DATA 210,201,198,217,160,197,21
    0,210,207,210,141,198,201,204,1
    97,160,207,203,141,197
250 DATA 160,207,203,141,203,141,20
    0,160,160,160,160,160,160,160,1
    60,160,160,160,160,160
260 DATA 160,160,160,160,160,160,16
    0,160,160,160,160,160,160,160,1
    60,169,143,160,89,32
270 DATA 217,3,96,0,0,1,96,1,0,17,1
    5,111,143,0,140,0,0,1,0,0
280 DATA 96,1,0,0,0,0,0,0,1,239,216
    ,0,254,255
```

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Commodore Potpourri

COMPUTE! Readers
Compiled by Todd Heimarck, Assistant Editor

Who hasn't felt the thrill of finding a new programming technique that's a little faster, takes less memory, or somehow seems to be a more elegant way of doing things? Here are a few such techniques discovered by readers of COMPUTE! *and* COMPUTE!'s GAZETTE. *For Commodore 64, VIC-20, and PET.*

Random Access DATA Statements

Ian Adam

DATA statements are a handy way of feeding information to a program. You don't have to fool around with opening, reading, and closing tape or disk files. The information you need is right there in the program, waiting for a READ statement.

But there are two disadvantages to using DATA. First is that the program reads each item only once. After you use a piece of data, you can't go back and read it a few more times. Second is that, like tape files, DATA statements are sequential. You begin at the beginning and end at the end. Try to go past the last item and you get an ?OUT OF DATA error.

Of course, there is a way to solve the first problem. RESTORE resets the data pointer to the beginning of the list. RESTORE isn't too flexible, though. What we really need is a command to go back to a specific line number, like RESTORE to 1000. Some versions of BASIC, such as Atari BASIC, have this feature built-in.

Here's a way to do almost the same thing, with just a couple of POKEs:

```
POKE65,PEEK(61):POKE66,PEEK(62)
```

This resets the DATA pointer (at locations 65 and 66) to the current position of the program counter (at locations 61 and 62, also used for the CONTinue command). In other words, it tells the computer, "Please start reading right here."

If you want to play a specific tune encoded in the DATA lines, for example, you would make the POKEs the first line in a subroutine, followed by the DATA statements and the READ, POKE section. (Note to PET users: Depending on which ROM you have, the technique is the same, but the zero-page locations will be different—62, 63 and 58, 59 for BASIC 4.0 PET/CBM machines.)

Graphic REMarks

Daniel Shaffer

If you've ever tried to use capital letters or graphics symbols in a REMark, you know it can be frustrating. For example, when you enter:

```
10 rem Designed by Frank Dow
```

What you see after LISTing is:

```
10 rem str$esigned by ascrank str$ow
```

The computer interprets the shifted letters as BASIC tokens and prints them in full. Sometimes this quirk can be useful (SHIFT-L is interpreted as SYNTAX ERROR and stops people from LISTing past the line containing it), but usually it's annoying. A simple way to get around the problem is to enter quote mode. After the REM, type a quotation mark. The rest of your message will appear as you typed it, graphics and all.

Embedded Carriage Returns

Hla T. Thein

It's common knowledge that a carriage return is built into the PRINT statement unless you follow it with a semicolon or comma. To print three different things on three different lines, you would have to use three PRINTs:

```
10 PRINT"QUICK": PRINT"BROWN": PRINT"FOX"
```

But most people don't know there's a way of embedding carriage returns in a string. First type this line:

```
10 PRINT"QUICK BROWN FOX"
```

If you run the program, everything goes on the same line. Now list the program and cursor up to the space between QUICK and BROWN. Press RVS ON (CTRL-9) and type a SHIFT-M. Move the cursor right and do the same thing between BROWN and FOX.

The program now thinks there is a SHIFT-RETURN between the letters, and it will print the words on three different lines. Note that this trick also affects the way the program lists.

(Editor's Note: The two hints above can be combined for some interesting effects. Enter this line: 10 REM". Press RETURN, move the cursor up, turn on reverse, and right after the quotation mark put a REVERSE-SHIFT-M followed by a REVERSE-SHIFT-S. Now try to list line 10. The screen clears. The line is, in effect, unlistable. The SHIFT-M forces a carriage return, which turns off quote mode. The reverse heart then causes the screen to clear. Adding such a REM to every program line can help you hide the listing from snoopy users. You can also include cursor movements with REMarks.)

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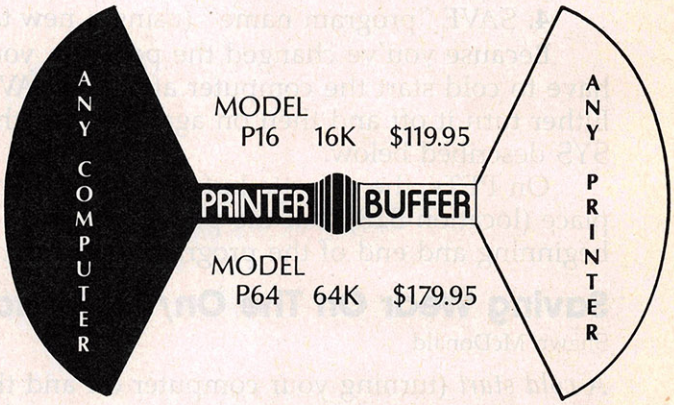
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Machine Language Backup On Tape

Willem Schaaij

A broken or worn-out tape can be a disaster if you don't have a backup. Duplicating BASIC programs is easy enough, but machine language (ML) programs are a headache to copy.

If you have a machine language monitor, and know the starting and ending addresses of the ML program, it's easy to make backups. But what if you don't have a monitor, or don't know where the program begins or ends?

Looking through a memory map suggests an answer. The tape header contains the information we need. And after a LOAD, the header information is stored in the cassette buffer at locations 829–832. BASIC expects to find the program's beginning and ending addresses at locations 43–46. The solution:

1. LOAD "program name",1,1
2. Type NEW
3. POKE 43, PEEK(829)
   POKE 44, PEEK(830)
   POKE 45, PEEK(831)
   POKE 46, PEEK(832)
4. SAVE "program name" (using a new tape)

Because you've changed the pointers, you'll have to cold start the computer after the SAVE. Either turn it off and then on again, or use the SYS described below.

On PETs, the cassette buffer is in the same place (location 828), but the pointers to the beginning and end of the program may vary.

Saving Wear On The On/Off Switch

Shawn McDonald

A *cold start* (turning your computer off and then on) quickly clears memory and resets everything. But does it do any harm to the computer if you do it frequently?

The good news is, it doesn't do any significant harm to the circuits or chips, although it does cause minimal wear to the power switch. One way to do the same thing is to use this line: SYS 64802 (VIC), SYS 64738 (64), SYS 64790 (PET/CBM). After entering this line, you should see the usual opening message.

This can be a useful way to end a game—for example, if the user answers *no* to PLAY AGAIN (Y/N)?—or to reset the computer if you are working with custom characters or a high-resolution screen.

There are a few things which may not be reset. If you have POKEd 128 into 650, to make the keys repeat, you will find that the keys still repeat after the cold start.

Slightly different from the cold start SYS is a warm start SYS, which preserves the pointers to the beginning and end of memory.

If you have partitioned a section of memory to be used for custom characters or machine language, SYS 58232 (VIC) or SYS 58260 (64) will simulate a warm start. If you want to set the pointers before this SYS, POKE the beginning of BASIC (in low-byte, high-byte format) into 641 and 642, and the top of BASIC into 643 and 644.

One more tip: Certain televisions, when connected to a VIC, display a wavy, jumpy picture. I've discovered that POKE 36864,133 corrects the problem, although RUN/STOP– RESTORE causes the picture to start bouncing again. Zenith TVs seem to be most affected by the bouncing.

Unlistable Programs

Shawn K. Smith

On the VIC and 64, locations 774 and 775 contain a vector pointing to the LIST routine. If you change the values with a POKE, the program in memory becomes unlistable. What I do is POKE 774,255. It's a good idea to use a PEEK to learn what number *should* be in address 774 in case you want to reenable the LIST command.

If a program containing the POKEs is loaded, but not run, it can be listed, so this method can be circumvented. But in combination with other tamperproofing methods (*like REM SHIFT-L, described above*), you can keep most prying eyes out of your programs.

If you look at a good memory map, you can find some other useful vectors in the same area of memory. Locations 808 and 809 point to the STOP routine (called when unshifted RUN/STOP is pressed); put some new values there and you can disable the STOP key.

Defining A Joystick Function

Richard Mehalick

DEFine FuNction can be very useful in a program that frequently reads the joystick. For example, to read the joystick in port 1 of the Commodore 64, use DEF FNJO(Y) = 15 − (PEEK (56320) AND 15).

To make it even easier to use, combine it with the ON-GOTO command:

```
10 DEFFNJO(Y)=15-(PEEK(56320)AND15)
20 ON FNJO(Y) GOTO 50,60,20,70,30,30,30,80
30 GOTO20
50 PRINT"NORTH":GOTO20
60 PRINT"SOUTH":GOTO20
70 PRINT"WEST":GOTO20
80 PRINT"EAST":GOTO20
```

To include the fire button, define a separate function, or change every 15 in the function above to 31.

Since a defined function can include PEEKs, you can take this idea a step further and use it to check current screen position, watch for collisions, or read the jiffy clock. ©

Atari Easy Scroll

Eugene D. McMillin

These short, simple BASIC scrolling routines demonstrate a method for scrolling using the Atari computer's string variables. For beginners, there is a detailed explanation of how both programs work.

Sooner or later most BASIC programmers find that they would like to set up multiple screens and scroll through them. For the advanced programmer who understands the inner workings of the machine, this usually isn't too difficult. But for most BASIC programmers, struggling with such things as bytes per line, display lists, write and screen memory locations, pointers, and interrupts can be confusing.

Fortunately the Atari offers a simple way to scroll vertically. This can be done in BASIC without even one PEEK or POKE. The method involves using string variables. With the Atari we have the ability to dimension string variables to almost any size and then to access any portion of them we want. For instance, a string variable named NAME$, dimensioned to a size of 10, could contain two names of five characters each. If we want to view the first name, we PRINT NAME$(1,5) and all the letters between the first and fifth are displayed. Or, if we want to view the last name, we PRINT NAME$(6,10).

Scrolling An Entire Screen

Program 1 demonstrates how to use a string variable to simulate vertical scrolling of the entire screen. Here's how it works:

Line 10: Sets up a full GRAPHICS 1 screen. This technique will work with any graphics mode. However, in the higher resolution modes the memory requirements are unrealistic.

Line 20: Dimensions a string variable SC$ large enough to accommodate three full screens. A GRAPHICS 1 + 16 screen contains 24 lines with 20 characters on each line. However, it seems that some Ataris won't print to position 19,23 without getting a CURSOR OUT OF RANGE error. In order to get around this, the screen size is reduced to 23 lines. With this in mind, each screen requires 20 characters per line multiplied by 23 lines for a total of 460 characters per screen. As a result, the three screens require a string variable consisting of three screens multiplied by 460 characters per screen, or 1380 characters.

Line 30: Sets the first 460 characters of the string variable to C. In other words, the first screen will consist entirely of the letter C.

Line 40: Sets the second screen to the letter J.

Line 50: Sets the third screen to the letter W.

Line 60: POS is a variable which designates the first position of the character string SC$ that we will print to the screen. In this case it is the first character in the string.

Line 70: Sets a variable equal to the position of the joystick.

Line 80: If the joystick is forward, the screen will scroll down. As there are 20 characters in each line of GRAPHICS 1, the program subtracts 20 from the variable set up in line 60.

Line 90: The same as line 80 except the joystick is in the opposite direction. Therefore, we add 20 rather than subtract.

Line 100: Tests the variable POS to see if it's less than 1. If it is, resets it to 1 to avoid trying to print a portion of our string variable that is 0 or less, which would result in an error.

Line 110: We test the variable POS to see if it's greater than 921. If it's greater, reset it to avoid printing past the end of the dimensioned string.

Line 120: In order to print the entire screen, this line sets the cursor to the upper left-hand corner.

Line 130: This prints a full screen of 460 characters. The exact portion of the string variable SC$ printed depends on the value of POS.

Line 140: Back up and sample the joystick and try it all over again.

Type in Program 1, hook up your joystick, and see what happens. It isn't quite as smooth or fast as machine language scrolling, but it gets the job done.

Scrolling Part Of A Screen

Program 2 demonstrates this same scrolling technique over a small portion of the screen. In a spreadsheet program or game, you might want stationary text at the top or bottom of your screen while the rest scrolls. For example, when you're looking out the window of an airplane cockpit, the horizon would rise or fall as you dive or climb, but the instrument panel would stay stationary on the screen. Here are the significant changes to Program 1.

Line 20: Sets up three screens; however, each screen will only have ten lines. Twenty characters per line multiplied by 10 lines multiplied by 3 screens gives us a variable size of 600.

Lines 30–50: The size of the FOR-NEXT loops is reduced to take into account the reduced size of the screens.

Lines 51–52: These are new lines. They provide a stationary text for the screen. This stationary text is positioned above and below the portion of the screen that will scroll.

Line 110: This line is changed to account for the reduced size of the string variable SC$.

Line 120: The cursor is positioned part of the way down the screen. This is the top left position of the scrolling portion of the screen.

Line 130: Again the only change is to accommodate the reduced size of the screen.

Program 1: Vertical Scroll

```
HF 10 GRAPHICS 1+16
BD 20 DIM SC$(1380)
MH 30 FOR I=1 TO 460:SC$(I,I)="C":NE
   XT I
DK 40 FOR I=461 TO 920:SC$(I,I)="J":
   NEXT I
HK 50 FOR I=921 TO 1380:SC$(I,I)="W"
   :NEXT I
MG 60 POS=1
EK 70 ST=STICK(0)
BP 80 IF ST=14 THEN POS=POS-20
BN 90 IF ST=13 THEN POS=POS+20
AO 100 IF POS<1 THEN POS=1
OH 110 IF POS>921 THEN POS=921
JE 120 POSITION 0,0
JN 130 PRINT #6;SC$(POS,POS+459)
DF 140 GOTO 70
```

Program 2: Vertical Scroll With Stationary Section

```
HF 10 GRAPHICS 1+16
NN 20 DIM SC$(600)
LP 30 FOR I=1 TO 200:SC$(I,I)="C":NE
   XT I
CL 40 FOR I=201 TO 400:SC$(I,I)="J":
   NEXT I
DN 50 FOR I=401 TO 600:SC$(I,I)="W":
   NEXT I
GO 51 POSITION 0,0:? #6;"SCROLL DEMO
   NSTRATION"
CK 52 POSITION 0,5:? #6;"SPLIT SCREE
   N"
MG 60 POS=1
EK 70 ST=STICK(0)
BP 80 IF ST=14 THEN POS=POS-20
BN 90 IF ST=13 THEN POS=POS+20
AO 100 IF POS<1 THEN POS=1
NJ 110 IF POS>401 THEN POS=401
JK 120 POSITION 0,6
JO 130 PRINT #6;SC$(POS,POS+199)
DF 140 GOTO 70
```


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FOR-NEXT Loop Etiquette

Jim Butterfield, Associate Editor

If you've ever run into problems with FOR-NEXT loops, maybe it's because you weren't minding your programming manners. This explanation of FOR-NEXT rules should clear things up. Although written for Commodore BASIC, the advice applies to nearly all versions of BASIC.

The FOR-NEXT loop structure is one of the foundations of efficient BASIC programs. It seems to be surrounded by a mystique: Can you or can't you exit a loop before it completes its allotted repetitions?

There's a maxim gaining ground which says: "Never jump out of a FOR-NEXT loop, or sooner or later you'll get an OUT OF MEMORY error." Partly right, partly wrong. You *can* jump out of a FOR-NEXT loop, but you must understand the rules.

The Problem

Let's suppose you have a list of 1000 cities around the world. You're writing a program to give the distance between any two cities. The list of city names is in an array called C$, dimensioned to hold 1000 names.

The coding would start by asking the user to enter a city name. Then there would be a search through the table for a name match. The program would partly look like this:

```
INPUT "ENTER CITY NAME";N$
FOR J=1 TO 1000
IF C$(J)=N$ ...
...
NEXT J
```

If the user typed in PARIS, and it happened that PARIS was the second city in array C$, it would seem to be a waste if the program was forced to look at the remaining 998 table entries. On the other hand, if we're forbidden to jump out of the loop (to a statement following NEXT J), we seem to have no choice but to allow the extra 998 iterations.

What Are Our Options?

First, we can indeed exercise the loop over its entire range. The coding would look something like this:

```
K=0
FOR J=1 TO 1000
IF C$(J)=N$ THEN K=J
NEXT J
```

At this point, K will hold the city number; if the city is not found in the list, K will equal zero. It will work, but the loop will be slow; there will be a significant pause for each city, even if the name is found at the top of the list. It seems inefficient.

Second, we can force the loop variable outside its range on the assumption that this will cause the loop to terminate. The coding would look like this:

```
K=0
FOR J=1 TO 1000
IF C$(J)=N$ THEN K=J:J=1001
NEXT J
```

This works, but it seems to me to be dangerous. If the city list were expanded to 2000 items, it might be easy to overlook the change that would be needed to the J=1001 statement. We could fix that part by changing it to J=1E20, a high number we never expect to reach.

Changing the value of a loop variable is bad practice. Some languages (even some BASIC implementations) forbid this, and may even stop with an error such as LOOP VARIABLE CHANGED WITHIN LOOP. Here's the problem: The FOR-NEXT loop was designed to allow strict control over the number of repetitions made by the loop. Once we play around with the variable, we endanger the integrity of the loop. Doing this might create a situation where the loop will never end or will behave unpredictably.

Third, we can jump out of the loop when it has done the job we want: found the matching item, or whatever. The coding in this case might go:

```
K=Ø
FOR J=1 TO 1ØØØ
IF C$(J)=N$ GOTO 31Ø
NEXT J
PRINT "NOT FOUND":GOTO ...
31Ø continue....
```

It seems natural, and in many languages it's heartily encouraged. Structured purists might look down their noses at the GOTO statement that gets you out of the loop, but it would be a syntax complaint rather than an objection to leaving the loop early. Very structured language might offer an EXIT command to escape the loop.

Departing from an incompleted loop has developed a bad reputation. The rumor has gotten around that if you do this, the loop will never go away and eventually you'll hang up on an OUT OF MEMORY error. Not true. There is, however, a slight chance that naive coding might produce a baffling NEXT WITHOUT FOR halt; in this case, a little understanding or application of good programming habits will eliminate the danger.

Some Theory

We don't want unclosed loops to hang around forever and clutter up our computer. There are four ways that a FOR-NEXT loop can be retired from service—apart from obvious extreme measures such as turning the computer off or typing NEW.

1. When the loop goes through its complete range, it will be scratched from the active loop list.

2. If a loop is within another loop, the inner loop will be scratched whenever the outer loop reaches a NEXT statement. Note that this doesn't mean the outer loop must complete its range; if it goes back for another repetition, that too will cancel the inner loop.

3. If a loop is opened within a subroutine, RETURN from that subroutine will automatically scratch the loop.

4. If a FOR statement is encountered, any existing loop using the same variable name will be scratched, together with any other loops nested within.

```
1ØØ FOR J=1 TO 5Ø STEP 3
11Ø T=T+J
12Ø NEXT J
```

After these lines are executed, loop J will no longer be active. It has completed its range.

```
1ØØ FOR I=1 TO 1
11Ø FOR J=1 TO 5Ø STEP 3
12Ø T=T+J
13Ø IF T>1ØØ GOTO 16Ø
14Ø NEXT J
15Ø STOP
16Ø NEXT I
```

After these lines are run, loops I and J will no longer be active. Why not? I has gone through its entire range. J has not; but the J loop was scratched from the active list the moment NEXT I was encountered. At first glance, the I loop seems to have no purpose, since there is no repetition of the lines between FOR and NEXT; but it does serve to clean away the J loop.

```
1ØØ GOSUB 2ØØ
11Ø END
2ØØ FOR J=1 TO 5Ø STEP 3
21Ø T=T+J
22Ø IF T>1ØØ THEN RETURN
23Ø NEXT J
24Ø STOP
```

After these lines are executed (reaching line 110), loop J will no longer be active. Why not? Because it was opened in subroutine 200, and the RETURN at line 220 canceled its status. Program style experts might criticize the subroutine at line 200 because RETURN is not at the end; put it there if you like.

```
1ØØ FOR J=1 TO 5Ø STEP 3
11Ø T=T+J
12Ø IF T>1ØØ GOTO 15Ø
13Ø NEXT J
14Ø STOP
15Ø K=J
16Ø FOR J=1 TO 1:NEXT J
```

When these lines are done, loop J will be inactive, even though the FOR-NEXT at 100–130 was not completed over its range. The opening of a new J loop in line 160 cancels the previous J loop.

Self-Repair

In most cases, rule 4 saves most programs from encountering loop problems. Opening a new loop cancels the old one even when we jump out of it. All we need to do is use the same variable name. Often, programs go back and repeat an early section; and the same loops are opened again, with old loops scrapped as the new ones come into force. We hardly need think about the question.

We can make this almost rigorous if we apply a simple rule: Give all your major loops the same loop variable name, and inner loops similar consistent variables. Any big loop will then automatically cancel the previous big loop, and so on.

But if we indulge in "barefoot" coding and pick variables according to the way that letters of the alphabet pop into our heads, we can run into trouble on rare occasions.

Horrible Example

Here's a horrible sample program. It doesn't do anything useful, but illustrates the puzzling prob-

lem that can occur when we let loops run free.

```
100 INPUT "YOUR AGE";A
110 FOR J=1 TO 99
120   A=A-J
130   IF A<0 GOTO 200
140 NEXT J
150 STOP
200 R=J:T=0
210 FOR M=1 TO R
220   T=T+M
230   FOR J=1 TO T
240     V=V+J
250   NEXT J
260 NEXT M
270 PRINT "I WISH YOU";V;"JOYS"
```

Here's the puzzling thing. This program stops with a NEXT WITHOUT FOR error in line 260. It's baffling to the programmer: The NEXT M is clearly matched with the FOR M in line 210. How dare the computer say they don't match?

Let's carefully trace what happens here, and how an open loop gets us into peculiar trouble.

The FOR-NEXT loop in lines 110 to 140 is not completed; line 130 exits directly to line 200. There's still a live J loop when line 200 is reached.

Line 210 opens a new FOR loop using variable M. Since the J loop is still active—the new one doesn't cancel it—we now have two loops. The outer loop uses variable J and the inner loop uses variable M.

Line 230 wants to open another FOR loop, this time using variable J. But wait a minute; we have an active loop still in existence that uses J. Fine. Cancel the old J loop; that's what rule 4 says. And since the M loop is inside the J loop, it gets canceled too. What do we have now? A brand-new J loop and nothing else. The old J and the M are scrapped.

Line 250 finds the NEXT J statement quite acceptable. There's a J loop active, and it will be exercised however many times the values call for. When the loop completes going through its range of values, it is retired from duty. Now there are no active loops, and we may proceed to line 260.

Line 260 says NEXT M, but the computer doesn't have an active M loop anymore. It was canceled back at line 230, remember? So the computer stops and reports NEXT WITHOUT FOR, causing the programmer to tear out his or her hair.

Fixing It

How do we fix it? Let me count the ways:

1. We fix it by rule 1. We change the FOR-NEXT loop at 110 to 140 to exercise its entire range. Line 130 would change to something like: IF A<0 THEN RJ; we'd eliminate the STOP in line 150 and change line 200 to just T0. Slower, but OK.

2. We fix it by rule 2. We insert the two lines:

```
105 FOR I=1 TO 1
205 NEXT I
```

The extra loop does nothing but cancel the J loop, but that makes everything OK.

3. We fix it by rule 3. The coding from line 110 to 150 is changed to a subroutine. RETURN cancels the open J loop.

4. We fix it by rule 4. We could insert a new line 205 that said FOR J=1 TO 1:NEXT J; this would certainly cancel the active J loop. It might be better, however, to use our variable hierarchy rule, making J the outer loop through the entire program. Lines 210 to 260 become:

```
210 FOR J=1 TO R
220   T=T+J
230   FOR M=1 TO T
240     V=V+M
250   NEXT M
260 NEXT J
```

Now the FOR J loop at line 210 immediately cancels the open J loop from earlier lines.

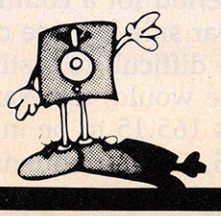
But perhaps it's not so much a problem of fixing a program gone wrong. If we develop good programming habits, using systematic variable names, there will never be anything to fix.

Conclusion: You can jump out of FOR-NEXT loops and still be considered a good person. It's sound programming. But you'd be well-advised to understand a little more about how these loops work, and to develop good habits in choosing loop variable names, to banish the possibility of these annoying—and puzzling—program halts. ©

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Modifications Or Corrections To Previous Articles

VIC Canyon Runner

Many readers have reported that parts of line 830 in Program 2 (p. 62) of this game from the October issue were blurred. The line reads:

```
830 DATA156,30,31,158,169,128,141,19,145,
    169,0,133,1,133,2,169,127,141,34,145,
    162,119                          :rem 141
```

Commodore Autoboot

One step in the process for creating programs that run automatically was not made immediately clear in this article from the September issue (p. 130). After typing the POKEs and saving your original program with a new filename, you must reset the computer by turning it off and back on before loading and running "Autoboot."

Programs created by Autoboot may not run when loaded immediately after the computer is turned on or immediately after a cold start reset. The solution is to load *anything*—even the disk directory—before loading the autorun program. Once any other file has been loaded, the autorun programs will behave as expected.

READing DATA

Our mail indicates that many readers have problems typing DATA statements. Some letters insist that programs containing DATA statements never work properly. Typing mistakes in DATA lines often result in cryptic error messages or in mysterious program crashes, which often baffle the beginning programmer.

If any program stops with a SYNTAX ERROR, ILLEGAL QUANTITY, or OUT OF DATA message (ERROR 3, ERROR 6, or ERROR 8 on an Atari), check the line where the program was reported to have stopped. If that line contains a READ statement, *the error is probably not in the line for which the error was reported.* Instead, it's almost certain that you've typed something incorrectly in one or more of the DATA statements.

Errors in DATA can be hard to find. A common mistake is typing a period for a comma. These two characters appear side by side on the keyboard, and they can be difficult to distinguish on the screen. This mistake would, for example, cause the two DATA items 165,15 to be interpreted as one item, 165.15. Other frequent problems are transposing digits in DATA items (for example, typing 236 as 263) and adding extra commas at the ends of lines.

Other messages may signal a flaw in the program, but any of the error situations mentioned above point toward a typing mistake. Check carefully before you blame the program.

Proofreader And MLX Caveat

Many readers may be unaware that BASIC programs entered with the aid of "The Automatic Proofreader" or machine language programs entered with "MLX" can still contain typing errors. While these two utilities greatly reduce the chances of making a typing mistake, there are errors that are not detected.

The Commodore and Atari Proofreader programs check only that the correct characters are present, not whether they are in the correct order. The following line has a Commodore Proofreader checksum of 117:

```
100 POKE 214,12:A=19.7:PRINT A
```

If you scramble the line and type:

```
100 PKOE 241,21:A=17.9:PNIRT A
```

the Proofreader still reports a checksum of 117. This is an extreme case; more subtle mistakes are more difficult to detect. One reader insisted that COMPUTE! had made an error, since his program didn't work even though the Proofreader showed his typing to be correct. However, the listing he sent along showed that in one line he typed GOTO 535 where he should have had GOTO 355. That mistake was invisible to the Proofreader—all the right characters were present—but it made the program crash without warning. The Proofreader can also cause you to overlook typing errors in DATA statements. The numbers 169 and 196 look the same to the Proofreader, but in the DATA for a machine language program such a difference will cause a prompt crash.

MLX, on the other hand, can detect the transposition of individual digits within a single number—if you type 196 where you mean 169, MLX will report the mistake—but it cannot detect transposition of entire numbers. For example, given the following line from an MLX-format listing:

```
49188 :160,000,185,071,201,201,086
```

MLX will *not* notice the mistake if you instead type:

```
49188 :160,185,000,201,071,201,086
```

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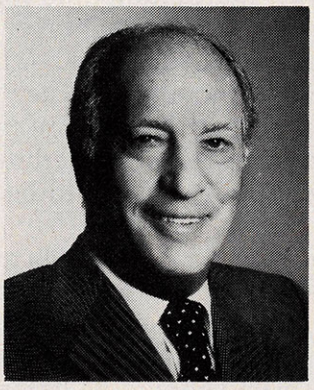
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Betty Ford, Reggie Jackson, Barry Goldwater, David Hartman, Coretta Scott King, Henry Kissinger, Dinah Shore, Harry Belafonte, Edward Kennedy, Joan Lunden, Rafer Johnson, Donna de Varona, Dom DeLuise, George McGovern and many others gave their time and thought to TV, radio and print messages urging all Americans to register and vote.



Now, it depends, as it always did, on you. As we move closer to Election Day, let's all remember: one vote does make a difference.

Leonard H. Goldenson
Chairman of the Board

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COMPUTE!'s Guide To Typing In Programs

Before typing in any program, you should familiarize yourself with your computer. Learn how to use the keyboard to type in and correct BASIC programs. Read your manuals to understand how to save and load BASIC programs to and from your disk drive or cassette unit. Computers are precise—take special care to type the program *exactly* as listed, including any necessary punctuation and symbols. To help you with this task, we have implemented a special listing convention as well as a program to help check your typing—the "Automatic Proofreader." Please read the following notes before typing in any programs from COMPUTE!. They can save you a lot of time and trouble.

Since programs can contain some hard-to-read (and hard-to-type) special characters, we have developed a listing system that spells out in abbreviated form the function of these control characters. You will find these special characters within curly braces. For example, {CLEAR} or {CLR} instructs you to insert the symbol which clears the screen on the Atari or Commodore machines. A symbol by itself within curly braces is usually a control key or graphics key. If you see {A}, hold down the CONTROL key and press A. Commodore machines have a special control key labeled with the Commodore logo. Graphics characters entered with the Commodore logo key are enclosed in a new kind of special bracket. A graphics character can be listed as [<A>]. In this case, hold down the Commodore logo key as you type A. Our Commodore listings are in uppercase, so shifted symbols are underlined. A graphics heart symbol (SHIFT-S) would be listed as S.

If a number precedes a symbol, such as {5 RIGHT}, {6 S}, or [<8 Q>], you would enter five cursor rights, six shifted S's, or eight Commodore-Q's. On the Atari, inverse characters (printed in white on black) should be entered with the Atari logo key. Since spacing is sometimes important, any more than two spaces will be listed, for example, as: {6 SPACES}. A space is never left at the end of a line, but will be moved to the next printed line as {SPACE}. There are no special control characters found in our IBM PC/PCjr, TI-99/4A, and Apple program listings. For your convenience, we have prepared this quick-reference key for the Commodore and Atari special characters:

Atari 400/800/XL

When you see	Type	See
{CLEAR}	ESC SHIFT <	Clear Screen
{UP}	ESC CTRL -	Cursor Up
{DOWN}	ESC CTRL =	Cursor Down
{LEFT}	ESC CTRL +	Cursor Left
{RIGHT}	ESC CTRL *	Cursor Right
{BACK S}	ESC DELETE	Backspace
{DELETE}	ESC CTRL DELETE	Delete character
{INSERT}	ESC CTRL INSERT	Insert character
{DEL LINE}	ESC SHIFT DELETE	Delete line
{INS LINE}	ESC SHIFT INSERT	Insert line
{TAB}	ESC TAB	TAB key
{CLR TAB}	ESC CTRL TAB	Clear tab
{SET TAB}	ESC SHIFT TAB	Set tab stop
{BELL}	ESC CTRL 2	Ring buzzer
{ESC}	ESC ESC	ESCape key

Commodore PET/CBM/VIC/64

When You Read:	Press:	See:	When You Read:	Press:	See:
{CLR}	SHIFT + CLR/HOME		{GRN}	CTRL + 6	
{HOME}	CLR/HOME		{BLU}	CTRL + 7	
{UP}	SHIFT + CRSR ↑		{YEL}	CTRL + 8	
{DOWN}	CRSR ↓		{F1}	f1	
{LEFT}	SHIFT + CRSR ←		{F2}	f2	
{RIGHT}	CRSR →		{F3}	f3	
{RVS}	CTRL + 9		{F4}	f4	
{OFF}	CTRL + 0		{F5}	f5	
{BLK}	CTRL + 1		{F6}	f6	
{WHT}	CTRL + 2		{F7}	f7	
{RED}	CTRL + 3		{F8}	f8	
{CYN}	CTRL + 4		←	←	
{PUR}	CTRL + 5		↑	SHIFT + ↑	

The Automatic Proofreader

Also, we have developed a simple, yet effective program that can help check your typing. Type in the appropriate Proofreader program for your machine, then save it for future use. On the VIC, 64, or Atari, run the Proofreader to activate it, then enter NEW to erase the BASIC loader (the Proofreader will still be active, hidden in memory, as a machine language program). Pressing RUN/STOP–RESTORE or SYSTEM RESET deactivates the Proofreader. You can use SYS 886 to reactivate the VIC/64 Proofreader, or PRINT USR(1536) to reenable the Atari Proofreader. The IBM Proofreader is a BASIC program that lets you enter, edit, list, save, and load programs that you type. It simulates the IBM's BASIC line editor.

Using The Automatic Proofreader

Once the Proofreader is active, try typing in a line. As soon as you press RETURN, either a number (on the Commodore) or a pair of letters

(Atari or IBM) appears. The number or pair of letters is called a *checksum*. Try making a change in the line, and notice how the checksum changes.

All you need to do is compare the value provided by the Proofreader with the checksum printed in the program listing in the magazine. In Commodore listings, the checksum is a number from 0 to 255. It is set off from the rest of the line with *rem*. This prevents a syntax error if the checksum is typed in, but the REM statements and checksums need *not* be typed in. It is just there for your information.

In Atari and IBM listings, the checksum is given to the left of each line number. Just type in the program, a line at a time (without the printed checksum) and compare the checksum generated by the Proofreader to the checksum in the listing. If they match, go on to the next line. If not, check your typing: You've made a mistake. On the Commodore and Atari Proofreader, spaces are not counted as part of the checksum, and no check is made to see that you've typed in the characters in the right order. If characters are transposed, the checksum will still match the listing. Because of the checksum method used, do not use abbreviations, such as ? for PRINT. However, the Proofreader does catch the majority of typing errors most people make. The IBM Proofreader is even pickier; it *will* detect errors in spacing and transposition. Also, be sure you leave Caps Lock on, except when you need to enter lowercase characters.

Special Proofreader Notes For Commodore Cassette Users

The Proofreader resides in the cassette buffer, which is used during tape LOADs and SAVEs. Be sure to press RUN/STOP–RESTORE before you save or load a program, to get the Proofreader out of the way. If you want to use the Proofreader with tape, run the Proofreader, then enter these two lines *exactly* as shown, pressing RETURN after each one:

```
A$="PROOFREADER.T":B$="{10 SPACES}"
    :FORX=1TO4:A$=A$+B$:NEXT
FORX=886TO1018:A$=A$+CHR$(PEEK(X))
    :NEXT:OPEN 1,1,1,A$:CLOSE1
```

Then press RECORD and PLAY on a blank tape, and a special version of the Proofreader will be saved to tape. Anytime you need to reload the Proofreader after it has been erased, just rewind the tape, type OPEN1:CLOSE1, then press PLAY. When READY comes back, enter SYS 886.

IBM Proofreader Commands

Since the IBM Proofreader replaces the computer's normal BASIC line editor, it has to include many of the direct-mode IBM BASIC commands. The syntax is identical to IBM BASIC. Commands simulated are LIST, LLIST, NEW, FILES, SAVE, and LOAD. When listing your program, press any key (except Ctrl-Break) to stop the listing. If you enter NEW, the Proofreader will prompt you to press Y to be especially sure you mean yes.

Two new commands are BASIC and CHECK. BASIC exits the Proofreader back to IBM BASIC, leaving the Proofreader in memory. CHECK works just like LIST, but shows the checksums along with the listing. After you have typed in a program, save it to disk. Then exit the Proofreader with the BASIC command, and load the program into the normal BASIC environment (this will replace the Proofreader in memory). You can now run the program, but you may want to resave it to disk. This will shorten it on disk and make it load faster, but it can no longer be edited with the Proofreader. If you want to convert a program to Proofreader format, save it to disk with SAVE "filename",A.

Program 1: VIC/64 Proofreader

```
100 PRINT"{CLR}PLEASE WAIT...":FORI=886TO10
    18:READA:CK=CK+A:POKEI,A:NEXT
110 IF CK<>17539 THEN PRINT"{DOWN}YOU MADE
    {SPACE}AN ERROR":PRINT"IN DATA STATEMEN
    TS.":END
120 SYS886:PRINT"{CLR}{2 DOWN}PROOFREADER A
    CTIVATED.":NEW
886 DATA 173,036,003,201,150,208
892 DATA 001,096,141,151,003,173
898 DATA 037,003,141,152,003,169
904 DATA 150,141,036,003,169,003
910 DATA 141,037,003,169,000,133
916 DATA 254,096,032,087,241,133
922 DATA 251,134,252,132,253,008
928 DATA 201,013,240,017,201,032
934 DATA 240,005,024,101,254,133
940 DATA 254,165,251,166,252,164
946 DATA 253,040,096,169,013,032
952 DATA 210,255,165,214,141,251
958 DATA 003,206,251,003,169,000
964 DATA 133,216,169,019,032,210
970 DATA 255,169,018,032,210,255
976 DATA 169,058,032,210,255,166
982 DATA 254,169,000,133,254,172
988 DATA 151,003,192,087,208,006
994 DATA 032,205,189,076,235,003
1000 DATA 032,205,221,169,032,032
1006 DATA 210,255,032,210,255,173
1012 DATA 251,003,133,214,076,173
1018 DATA 003
```

Program 2: Atari Proofreader

```
100 GRAPHICS 0
110 FOR I=1536 TO 1700:READ A:POK
    E I,A:CK=CK+A:NEXT I
120 IF CK<>19072 THEN ? "ERROR IN
     DATA STATEMENTS   CHECK TYPI
    NG.":END
130 A=USR(1536)
140 ? :? "AUTOMATIC PROOFREADER N
    OW ACTIVATED."
150 END
```

```
1536 DATA 104,160,0,185,26,3
1542 DATA 201,69,240,7,200,200
1548 DATA 192,34,208,243,96,200
1554 DATA 169,74,153,26,3,200
1560 DATA 169,6,153,26,3,162
1566 DATA 0,189,0,228,157,74
1572 DATA 6,232,224,16,208,245
1578 DATA 169,93,141,78,6,169
1584 DATA 6,141,79,6,24,173
1590 DATA 4,228,105,1,141,95
1596 DATA 6,173,5,228,105,0
1602 DATA 141,96,6,169,0,133
1608 DATA 203,96,247,238,125,241
1614 DATA 93,6,244,241,115,241
1620 DATA 124,241,76,205,238,0
1626 DATA 0,0,0,0,32,62
1632 DATA 246,8,201,155,240,13
1638 DATA 201,32,240,7,72,24
1644 DATA 101,203,133,203,104,40
1650 DATA 96,72,152,72,138,72
1656 DATA 160,0,169,128,145,88
1662 DATA 200,192,40,208,249,165
1668 DATA 203,74,74,74,74,24
1674 DATA 105,161,160,3,145,88
1680 DATA 165,203,41,15,24,105
1686 DATA 161,200,145,88,169,0
1692 DATA 133,203,104,170,104,168
1698 DATA 104,40,96
```

Program 3: IBM Proofreader

```
100 DIM L$(500),LNUM(500):COLOR 0,7,7:K
    EY OFF:CLS:MAX=0:LNUM(0)=65536!
110 ON ERROR GOTO 120:KEY 15,CHR$(4)+CH
    R$(70):ON KEY(15) GOSUB 640:KEY (15
    ) ON:GOTO 130
120 RESUME 130
130 DEF SEG=&H40:W=PEEK(&H4A)
140 ON ERROR GOTO 650:PRINT:PRINT"Proof
    reader Ready."
150 LINE INPUT L$:Y=CSRLIN-INT(LEN(L$)/
    W)-1:LOCATE Y,1
160 DEF SEG=0:POKE 1050,30:POKE 1052,34
    :POKE 1054,0:POKE 1055,79:POKE 1056
    ,13:POKE 1057,28:LINE INPUT L$:DEF
    SEG:IF L$="" THEN 150
170 IF LEFT$(L$,1)=" " THEN L$=MID$(L$,
    2):GOTO 170
180 IF VAL(LEFT$(L$,2))=0 AND MID$(L$,3
    ,1)=" " THEN L$=MID$(L$,4)
190 LNUM=VAL(L$):TEXT$=MID$(L$,LEN(STR$
    (LNUM))+1)
200 IF ASC(L$)>57 THEN 260 'no line num
    ber, therefore command
210 IF TEXT$="" THEN GOSUB 540:IF LNUM=
    LNUM(P) THEN GOSUB 560:GOTO 150 ELS
    E 150 'delete line
220 CKSUM=0:FOR I=1 TO LEN(L$):CKSUM=(C
    KSUM+ASC(MID$(L$,I))*I) AND 255:NEX
    T:LOCATE Y,1:PRINT CHR$(65+CKSUM/16
    )+CHR$(65+(CKSUM AND 15))+" "+L$
230 GOSUB 540:IF LNUM(P)=LNUM THEN L$(P
    )=TEXT$:GOTO 150 'replace line
240 GOSUB 580:GOTO 150 'insert the line
250 'command processor.  step 1: conver
    t to uppercase
260 TEXT$="":FOR I=1 TO LEN(L$):A=ASC(M
    ID$(L$,I)):TEXT$=TEXT$+CHR$(A+32*(A
    >96 AND A<123)):NEXT
270 DELIMITER=INSTR(TEXT$," "):COMMAND$
    =TEXT$:ARG$="":IF DELIMITER THEN CO
    MMAND$=LEFT$(TEXT$,DELIMITER-1):ARG
    $=MID$(TEXT$,DELIMITER+1) 'separate
     command from argument
280 IF COMMAND$<>"LIST" THEN 410
290 OPEN "scrn:" FOR OUTPUT AS #1
300 IF ARG$="" THEN FIRST=0:P=MAX-1:GOT
    O 340
310 DELIMITER=INSTR(ARG$,"-"):IF DELIMI
    TER=0 THEN LNUM=VAL(ARG$):GOSUB 540
    :FIRST=P:GOTO 340
320 FIRST=VAL(LEFT$(ARG$,DELIMITER)):LA
    ST=VAL(MID$(ARG$,DELIMITER+1))
330 LNUM=FIRST:GOSUB 540:FIRST=P:LNUM=L
    AST:GOSUB 540:IF P=0 THEN P=MAX-1
340 FOR X=FIRST TO P:N$=MID$(STR$(LNUM(
    X)),2)+" "
350 IF CKFLAG=0 THEN A$="":GOTO 370
360 CKSUM=0:A$=N$+L$(X):FOR I=1 TO LEN(
    A$):CKSUM=(CKSUM+ASC(MID$(A$,I))*I)
     AND 255:NEXT:A$=CHR$(65+CKSUM/16)+
    CHR$(65+(CKSUM AND 15))+" "
370 PRINT #1,A$+N$+L$(X)
380 IF INKEY$<>"" THEN X=P
390 NEXT :CLOSE #1:CKFLAG=0
400 GOTO 130
410 IF COMMAND$="LLIST" THEN OPEN "lpt1
    :" FOR OUTPUT AS #1:GOTO 300
420 IF COMMAND$="CHECK" THEN CKFLAG=1:G
    OTO 290
430 IF COMMAND$<>"SAVE" THEN 450
440 GOSUB 600:OPEN ARG$ FOR OUTPUT AS #
    1:ARG$="":GOTO 300
450 IF COMMAND$<>"LOAD" THEN 490
460 GOSUB 600:OPEN ARG$ FOR INPUT AS #1
    :MAX=0:P=0
470 WHILE NOT EOF(1):LINE INPUT #1,L$:L
    NUM(P)=VAL(L$):L$(P)=MID$(L$,LEN(ST
    R$(VAL(L$)))+1):P=P+1:WEND
480 MAX=P:CLOSE #1:GOTO 130
490 IF COMMAND$="NEW" THEN INPUT "Erase
     program - Are you sure";L$:IF LEFT
    $(L$,1)="y" OR LEFT$(L$,1)="Y" THEN
     MAX=0:GOTO 130:ELSE 130
500 IF COMMAND$="BASIC" THEN COLOR 7,0,
    0:ON ERROR GOTO 0:CLS:END
510 IF COMMAND$="FILES" THEN FILES:GOTO
     130
520 PRINT"Syntax error":GOTO 130
530 'find line
540 P=0:WHILE LNUM>LNUM(P) AND P<MAX:P=
    P+1:WEND:RETURN
550 'delete line
560 MAX=MAX-1:FOR X=P TO MAX:LNUM(X)=LN
    UM(X+1):L$(X)=L$(X+1):NEXT:RETURN
570 'insert line
580 MAX=MAX+1:FOR X=MAX TO P+1 STEP -1:
    LNUM(X)=LNUM(X-1):L$(X)=L$(X-1):NEX
    T:L$(P)=TEXT$:LNUM(P)=LNUM:RETURN
590 'filename adjustments
600 IF LEFT$(ARG$,1)<>CHR$(34) THEN 520
     ELSE ARG$=MID$(ARG$,2)
610 IF RIGHT$(ARG$,1)=CHR$(34) THEN ARG
    $=LEFT$(ARG$,LEN(ARG$)-1)
620 IF INSTR(ARG$,".")=0 THEN ARG$=ARG$
    +".BAS"
630 RETURN
640 PRINT"Stopped.":RETURN 150
650 PRINT "Error #";ERR:RESUME 150
```

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MLX Machine Language Entry Program For Commodore 64 And Unexpanded VIC-20

Charles Brannon, Program Editor

MLX is a labor-saving utility that allows almost fail-safe entry of machine language programs published in COMPUTE!. You need to know nothing about machine language to use MLX—it was designed for everyone.

MLX is a new way to enter long machine language (ML) programs with a minimum of fuss. MLX lets you enter the numbers from a special list that looks similar to BASIC DATA statements. It checks your typing on a line-by-line basis. It won't let you enter illegal characters when you should be typing numbers. It won't let you enter numbers greater than 255 (forbidden in ML). It won't let you enter the wrong numbers on the wrong line. In addition, MLX creates a ready-to-use tape or disk file.

Using MLX

Type in and save the appropriate version of MLX (you'll want to use it in the future). When you're ready to type in an ML program, run MLX. MLX for the 64 asks you for two numbers: the starting address and the ending address. These numbers are given in the article accompanying the ML program. Tiny MLX for the unexpanded VIC *does not* ask for the starting and ending address of the program to be entered. Instead, this information must be included in line 210. The values in line 210 of Tiny MLX as listed here are for the "Spiders" program in this issue. Line 100 will also have to be adjusted for each program you type in with Tiny MLX. Refer to the program's article for details.

When you run MLX, you'll see a prompt corresponding to the starting address. The prompt is the current line you are entering from the listing. It increases by six each time you enter a line. That's because each line has seven numbers—six actual data numbers plus a *checksum number*. The checksum verifies that you typed the previous six numbers correctly. If you enter any of the six numbers wrong, or enter the checksum wrong, the computer rings a buzzer and prompts you to reenter the line. If you enter it correctly, a bell tone sounds and you continue to the next line.

MLX accepts only numbers as input. If you make a typing error, press the INST/DEL key; the entire number is deleted. You can press it as many times as necessary back to the start of the line. If you enter three-digit numbers as listed, the computer automatically prints the comma and goes on to accept the next number. If you enter less than three digits, you can press either the space bar or RETURN key to advance to the next number. The checksum automatically appears in inverse video for emphasis.

To simplify your typing, 64 MLX redefines part of the keyboard as a numeric keypad (lines 581–584):

```
  U I O          7 8 9
H J K L  become  0 4 5 6
  M , .          1 2 3
```

64 MLX Commands

When you finish typing an ML listing (assuming you type it all in one session), you can then save the completed program on tape or disk. Follow the screen instructions. If you get any errors while saving, you probably have a bad disk, or the disk is full, or you've made a typo when entering the MLX program itself.

You don't have to enter the whole ML program in one sitting. MLX lets you enter as much as you want, save it, and then reload the file from tape or disk later. 64 MLX recognizes these commands:

SHIFT-S: Save
SHIFT-L: Load
SHIFT-N: New Address
SHIFT-D: Display

When you enter a command, MLX jumps out of the line you've been typing, so we recommend you do it at a new prompt. Use the Save command to save what you've been working on. It will save on tape or disk as if you've finished, but the tape or disk won't work, of course, until you finish the typing. Remember what address you stop at. The next time you run MLX, answer all the prompts as you did before, then insert the disk or tape. When you get to the entry prompt, press SHIFT-L to reload the partly completed file into memory. Then use the New Address command to resume typing.

To use the New Address command, press SHIFT-N and enter the address where you previously stopped. The prompt will change, and

you can then continue typing. Always enter a New Address that matches up with one of the line numbers in the special listing, or else the checksum won't work. The Display command lets you display a section of your typing. After you press SHIFT-D, enter two addresses within the line number range of the listing. You can abort the listing by pressing any key.

Tiny MLX Commands

To squeeze Tiny MLX into the unexpanded VIC and still leave room for the ML program being entered, all the special commands of the 64 version had to be omitted, as well as the provision for the redefined keyboard. Since Tiny MLX has no provisions for reloading a partially completed program, you must enter all the ML data in one sitting. When you finish typing an ML listing, you can then save the completed program on tape or disk. Follow the screen instructions. If you get any errors while saving, you probably have a bad disk, or the disk is full, or you made a typo when entering the MLX program itself.

Program 1: 64 MLX

```
10 REM LINES CHANGED FROM MLX VERSION 2.00
   {SPACE}ARE 750,765,770 AND 860    :rem 50
20 REM LINE CHANGED FROM MLX VERSION 2.01 I
   S 300                             :rem 147
100 PRINT"{CLR}[6]";CHR$(142);CHR$(8);:POKE
    53281,1:POKE53280,1              :rem 67
101 POKE 788,52:REM DISABLE RUN/STOP
                                     :rem 119
110 PRINT"{RVS}{39 SPACES}";         :rem 176
120 PRINT"{RVS}{14 SPACES}{RIGHT}{OFF}[*]£
    {RVS}{RIGHT} {RIGHT}{2 SPACES}[*]{OFF}
    [*]£{RVS}£{RVS}{14 SPACES}"; :rem 250
130 PRINT"{RVS}{14 SPACES}{RIGHT} [G]
    {RIGHT} {2 RIGHT} {OFF}£{RVS}£[*]
    {OFF}[*]{RVS}{14 SPACES}";       :rem 35
140 PRINT"{RVS}{41 SPACES}"          :rem 120
200 PRINT"{2 DOWN}{PUR}{BLK} MACHINE LANGUA
    GE EDITOR VERSION 2.02{5 DOWN}":rem 238
210 PRINT"[5]{2 UP}STARTING ADDRESS?
    {8 SPACES}{9 LEFT}";             :rem 143
215 INPUTS:F=1-F:C$=CHR$(31+119*F) :rem 166
220 IFS<256OR(S>40960ANDS<49152)ORS>53247TH
    ENGOSUB3000:GOTO210              :rem 235
225 PRINT:PRINT:PRINT                :rem 180
230 PRINT"[5]{2 UP}ENDING ADDRESS?
    {8 SPACES}{9 LEFT}";:INPUTE:F=1-F:C$=CH
    R$(31+119*F)                     :rem 20
240 IFE<256OR(E>40960ANDE<49152)ORE>53247TH
    ENGOSUB3000:GOTO230              :rem 183
250 IFE<STHENPRINTC$;"{RVS}ENDING < START
    {2 SPACES}":GOSUB1000:GOTO 230 :rem 176
260 PRINT:PRINT:PRINT                :rem 179
300 PRINT"{CLR}";CHR$(14):AD=S       :rem 56
310 A=1:PRINTRIGHT$("0000"+MID$(STR$(AD),2)
    ,5);":";                         :rem 33
315 FORJ=ATO6                        :rem 33
320 GOSUB570:IFN=-1THENJ=J+N:GOTO320
                                     :rem 228
390 IFN=-211THEN 710                 :rem 62
400 IFN=-204THEN 790                 :rem 64
410 IFN=-206THENPRINT:INPUT"{DOWN}ENTER NEW
    ADDRESS";ZZ                      :rem 44
415 IFN=-206THENIFZZ<SORZZ>ETHENPRINT"{RVS}
    OUT OF RANGE":GOSUB1000:GOTO410:rem 225
417 IFN=-206THENAD=ZZ:PRINT:GOTO310:rem 238
420 IF N<>-196 THEN 480              :rem 133
430 PRINT:INPUT"DISPLAY:FROM";F:PRINT,"TO";
    :INPUTT                          :rem 234
440 IFF<SORF>EORT<SORT>ETHENPRINT"AT LEAST"
    ;S;"{LEFT}, NOT MORE THAN";E:GOTO430
                                     :rem 159
450 FORI=FTOTSTEP6:PRINT:PRINTRIGHT$("0000"
    +MID$(STR$(I),2),5);":";         :rem 30
451 FORK=0TO5:N=PEEK(I+K):PRINTRIGHT$("00"+
    MID$(STR$(N),2),3);",";          :rem 66
460 GETA$:IFA$>""THENPRINT:PRINT:GOTO310
                                     :rem 25
470 NEXTK:PRINTCHR$(20);:NEXTI:PRINT:PRINT:
    GOTO310                          :rem 50
480 IFN<0 THEN PRINT:GOTO310         :rem 168
490 A(J)=N:NEXTJ                     :rem 199
500 CKSUM=AD-INT(AD/256)*256:FORI=1TO6:CKSU
    M=(CKSUM+A(I))AND255:NEXT        :rem 200
510 PRINTCHR$(18);:GOSUB570:PRINTCHR$(146);
                                     :rem 94
511 IFN=-1THENA=6:GOTO315            :rem 254
515 PRINTCHR$(20):IFN=CKSUMTHEN530 :rem 122
520 PRINT:PRINT"LINE ENTERED WRONG : RE-ENT
    ER":PRINT:GOSUB1000:GOTO310      :rem 176
530 GOSUB2000                        :rem 218
540 FORI=1TO6:POKEAD+I-1,A(I):NEXT:POKE5427
    2,0:POKE54273,0                  :rem 227
550 AD=AD+6:IF AD<E THEN 310         :rem 212
560 GOTO 710                         :rem 108
570 N=0:Z=0                           :rem 88
580 PRINT"[£]";                      :rem 81
581 GETA$:IFA$=""THEN581              :rem 95
582 AV=-(A$="M")-2*(A$=",")-3*(A$=".")-4*(A
    $="J")-5*(A$="K")-6*(A$="L")     :rem 41
583 AV=AV-7*(A$="U")-8*(A$="I")-9*(A$="O"):
    IFA$="H"THENA$="0"               :rem 134
584 IFAV>0THENA$=CHR$(48+AV)         :rem 134
585 PRINTCHR$(20);:A=ASC(A$):IFA=13ORA=44OR
    A=32THEN670                      :rem 229
590 IFA>128THENN=-A:RETURN           :rem 137
600 IFA<>20 THEN 630                  :rem 10
610 GOSUB690:IFI=1ANDT=44THENN=-1:PRINT"
    {OFF}{LEFT} {LEFT}";:GOTO690     :rem 62
620 GOTO570                          :rem 109
630 IFA<48ORA>57THEN580              :rem 105
640 PRINTA$;:N=N*10+A-48             :rem 106
650 IFN>255 THEN A=20:GOSUB1000:GOTO600
                                     :rem 229
660 Z=Z+1:IFZ<3THEN580                :rem 71
670 IFZ=0THENGOSUB1000:GOTO570       :rem 114
680 PRINT",";:RETURN                 :rem 240
690 S%=PEEK(209)+256*PEEK(210)+PEEK(211)
                                     :rem 149
691 FORI=1TO3:T=PEEK(S%-I)            :rem 67
695 IFT<>44ANDT<>58THENPOKES%-I,32:NEXT
                                     :rem 205
700 PRINTLEFT$("{3 LEFT}",I-1);:RETURN
                                      :rem 7
710 PRINT"{CLR}{RVS}*** SAVE ***{3 DOWN}"
                                     :rem 236
715 PRINT"{2 DOWN}(PRESS {RVS}RETURN{OFF} A
    LONE TO CANCEL SAVE){DOWN}"      :rem 106
720 F$="":INPUT"{DOWN} FILENAME";F$:IFF$=""
    THENPRINT:PRINT:GOTO310          :rem 71
730 PRINT:PRINT"{2 DOWN}{RVS}T{OFF}APE OR
    {RVS}D{OFF}ISK: (T/D)"           :rem 228
740 GETA$:IFA$<>"T"ANDA$<>"D"THEN740:rem 36
```

```
750 DV=1-7*(A$="D"):IFDV=8THENF$="0:"+F$:OP
    EN15,8,15,"S"+F$:CLOSE15          :rem 212
760 T$=F$:ZK=PEEK(53)+256*PEEK(54)-LEN(T$):
    POKE782,ZK/256                    :rem 3
762 POKE781,ZK-PEEK(782)*256:POKE780,LEN(T$
    ):SYS65469                        :rem 109
763 POKE780,1:POKE781,DV:POKE782,1:SYS65466
                                      :rem 69
765 K=S:POKE254,K/256:POKE253,K-PEEK(254)*2
    56:POKE780,253                    :rem 17
766 K=E+1:POKE782,K/256:POKE781,K-PEEK(782)
    *256:SYS65496                     :rem 235
770 IF(PEEK(783)AND1)OR(191ANDST)THEN780
                                      :rem 111
775 PRINT"{DOWN}DONE.{DOWN}":GOTO310
                                      :rem 113
780 PRINT"{DOWN}ERROR ON SAVE.{2 SPACES}TRY
     AGAIN.":IFDV=1THEN720            :rem 171
781 OPEN15,8,15:INPUT#15,E1$,E2$:PRINTE1$;E
    2$:CLOSE15:GOTO720                :rem 103
790 PRINT"{CLR}{RVS}*** LOAD ***{2 DOWN}"
                                      :rem 212
795 PRINT"{2 DOWN}(PRESS {RVS}RETURN{OFF} A
    LONE TO CANCEL LOAD)"             :rem 82
800 F$="":INPUT"{2 DOWN} FILENAME";F$:IFF$=
    ""THENPRINT:GOTO310               :rem 144
810 PRINT:PRINT"{2 DOWN}{RVS}T{OFF}APE OR
    {RVS}D{OFF}ISK: (T/D)"            :rem 227
820 GETA$:IFA$<>"T"ANDA$<>"D"THEN820:rem 34
830 DV=1-7*(A$="D"):IFDV=8THENF$="0:"+F$
                                      :rem 157
840 T$=F$:ZK=PEEK(53)+256*PEEK(54)-LEN(T$):
    POKE782,ZK/256                    :rem 2
841 POKE781,ZK-PEEK(782)*256:POKE780,LEN(T$
    ):SYS65469                        :rem 107
845 POKE780,1:POKE781,DV:POKE782,1:SYS65466
                                      :rem 70
850 POKE780,0:SYS65493                :rem 11
860 IF(PEEK(783)AND1)OR(191ANDST)THEN870
                                      :rem 111
865 PRINT"{DOWN}DONE.":GOTO310        :rem 96
870 PRINT"{DOWN}ERROR ON LOAD.{2 SPACES}TRY
     AGAIN.{DOWN}":IFDV=1THEN800      :rem 172
880 OPEN15,8,15:INPUT#15,E1$,E2$:PRINTE1$;E
    2$:CLOSE15:GOTO800                :rem 102
1000 REM BUZZER                       :rem 135
1001 POKE54296,15:POKE54277,45:POKE54278,16
    5                                 :rem 207
1002 POKE54276,33:POKE 54273,6:POKE54272,5
                                      :rem 42
1003 FORT=1TO200:NEXT:POKE54276,32:POKE5427
    3,0:POKE54272,0:RETURN            :rem 202
2000 REM BELL SOUND                   :rem 78
2001 POKE54296,15:POKE54277,0:POKE54278,247
                                      :rem 152
2002 POKE 54276,17:POKE54273,40:POKE54272,0
                                      :rem 86
2003 FORT=1TO100:NEXT:POKE54276,16:RETURN
                                      :rem 57
3000 PRINTC$;"{RVS}NOT ZERO PAGE OR ROM":GO
    TO1000                            :rem 89
```

Program 2: VIC Tiny MLX

```
100 POKE55,0:POKE56,25:CLR            :rem 8
210 S=6405:E=7676                     :rem 136
300 PRINT"{CLR}";CHR$(14):AD=S        :rem 56
310 PRINTRIGHT$("0000"+MID$(STR$(AD),2),5);
    ":";:FORJ=1TO6                    :rem 234
320 GOSUB570:IFN=-1THENJ=J+N:GOTO320
                                      :rem 228
480 IFN<0THENPRINT:GOTO310            :rem 168
490 A(J)=N:NEXTJ                      :rem 199
500 CKSUM=AD-INT(AD/256)*256:FORI=1TO6:CKSU
    M=(CKSUM+A(I))AND255:NEXT         :rem 200
510 PRINTCHR$(18);:GOSUB570:PRINTCHR$(20)
                                      :rem 234
515 IFN=CKSUMTHEN530                  :rem 255
520 PRINT:PRINT"LINE ENTERED WRONG":PRINT"R
    E-ENTER":PRINT:GOSUB1000:GOTO310
                                      :rem 129
530 GOSUB2000                         :rem 218
540 FORI=1TO6:POKEAD+I-1,A(I):NEXT    :rem 80
550 AD=AD+6:IFAD<ETHEN310             :rem 212
560 GOTO710                           :rem 108
570 N=0:Z=0                           :rem 88
580 PRINT"{+}";                       :rem 79
581 GETA$:IFA$=""THEN581              :rem 95
585 PRINTCHR$(20);:A=ASC(A$):IFA=13ORA=44OR
    A=32THEN670                       :rem 229
590 IFA>128THENN=-A:RETURN            :rem 137
600 IFA<>20 THEN 630                  :rem 10
610 GOSUB690:IFI=1ANDT=44THENN=-1:PRINT"
    {LEFT} {LEFT}";:GOTO690           :rem 172
620 GOTO570                           :rem 109
630 IFA<48ORA>57THEN580               :rem 105
640 PRINTA$;:N=N*10+A-48              :rem 106
650 IFN>255 THEN A=20:GOSUB1000:GOTO600
                                      :rem 229
660 Z=Z+1:IFZ<3THEN580                :rem 71
670 IFZ=0THENGOSUB1000:GOTO570        :rem 114
680 PRINT",";:RETURN                  :rem 240
690 S%=PEEK(209)+256*PEEK(210)+PEEK(211)
                                      :rem 149
692 FORI=1TO3:T=PEEK(S%-I)            :rem 68
695 IFT<>44ANDT<>58THENPOKES%-I,32:NEXT
                                      :rem 205
700 PRINTLEFT$("{3 LEFT}",I-1);:RETURN
                                      :rem 7
710 PRINT"{CLR}{RVS}*** SAVE ***{3 DOWN}"
                                      :rem 236
720 INPUT"{DOWN} FILENAME";F$         :rem 228
730 PRINT:PRINT"{2 DOWN}{RVS}T{OFF}APE OR
    {RVS}D{OFF}ISK: (T/D)"            :rem 228
740 GETA$:IFA$<>"T"ANDA$<>"D"THEN740:rem 36
750 DV=1-7*(A$="D"):IFDV=8THENF$="0:"+F$
                                      :rem 158
760 T$=F$:ZK=PEEK(53)+256*PEEK(54)-LEN(T$):
    POKE782,ZK/256                    :rem 3
762 POKE781,ZK-PEEK(782)*256:POKE780,LEN(T$
    ):SYS65469                        :rem 109
763 POKE780,1:POKE781,DV:POKE782,1:SYS65466
                                      :rem 69
765 POKE254,S/256:POKE253,S-PEEK(254)*256:P
    OKE780,253                        :rem 12
766 POKE782,E/256:POKE781,E-PEEK(782)*256:S
    YS65496                           :rem 124
770 IF(PEEK(783)AND1)OR(ST AND191)THEN780
                                      :rem 111
775 PRINT"{DOWN}DONE.":END            :rem 106
780 PRINT"{DOWN}ERROR ON SAVE.{2 SPACES}TRY
     AGAIN.":IFDV=1THEN720            :rem 171
781 OPEN15,8,15:INPUT#15,E1$,E2$:PRINTE1$;E
    2$:CLOSE15:GOTO720                :rem 103
782 GOTO720                           :rem 115
845 POKE780,1:POKE781,DV:POKE782,1:SYS65466
                                      :rem 70
1000 REM BELL TONE                    :rem 250
1001 POKE36878,15:POKE36874,190       :rem 206
1002 FORW=1TO300:NEXTW                :rem 117
1003 POKE36878,0:POKE36874,0:RETURN   :rem 74
2000 REM BELL SOUND                   :rem 78
2001 FORW=15TO0STEP-1:POKE36878,W:POKE36876
    ,240:NEXTW                        :rem 22
2002 POKE36876,0:RETURN               :rem 119
```

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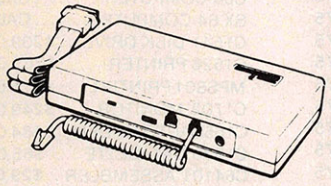
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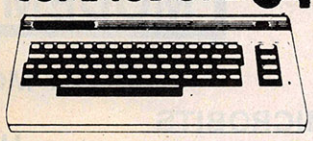


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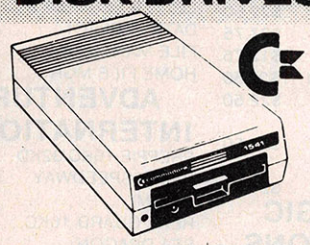
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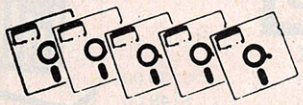
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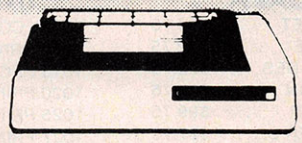
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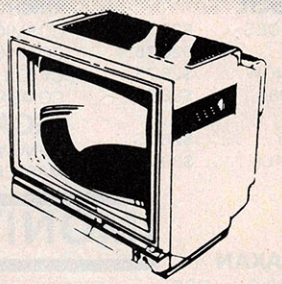
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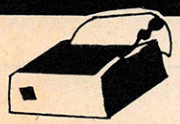
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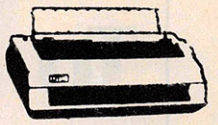
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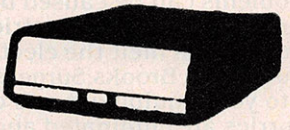
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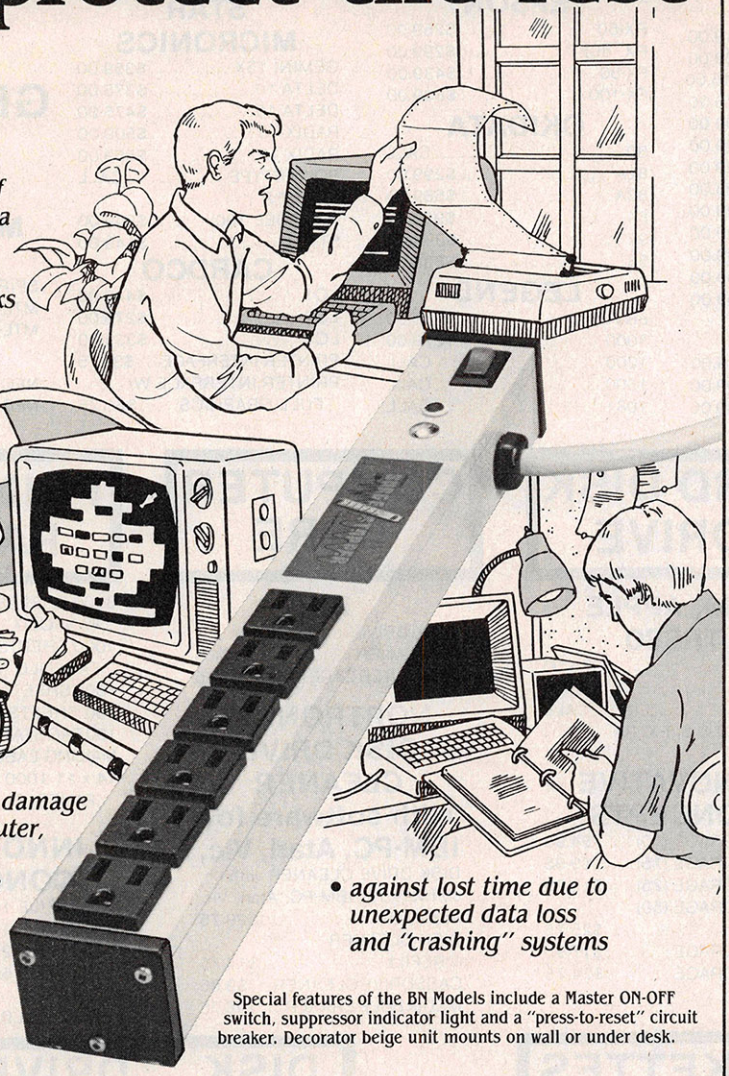
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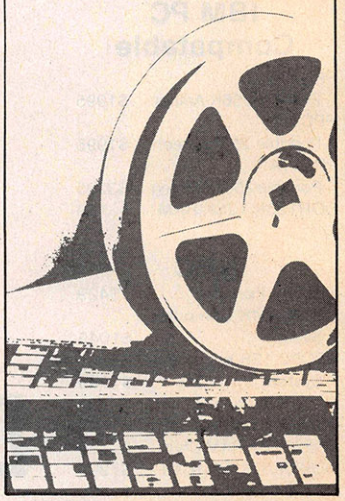
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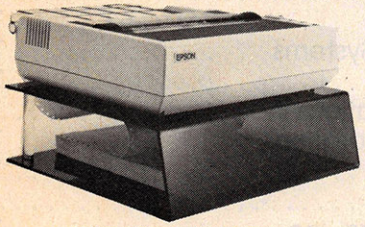
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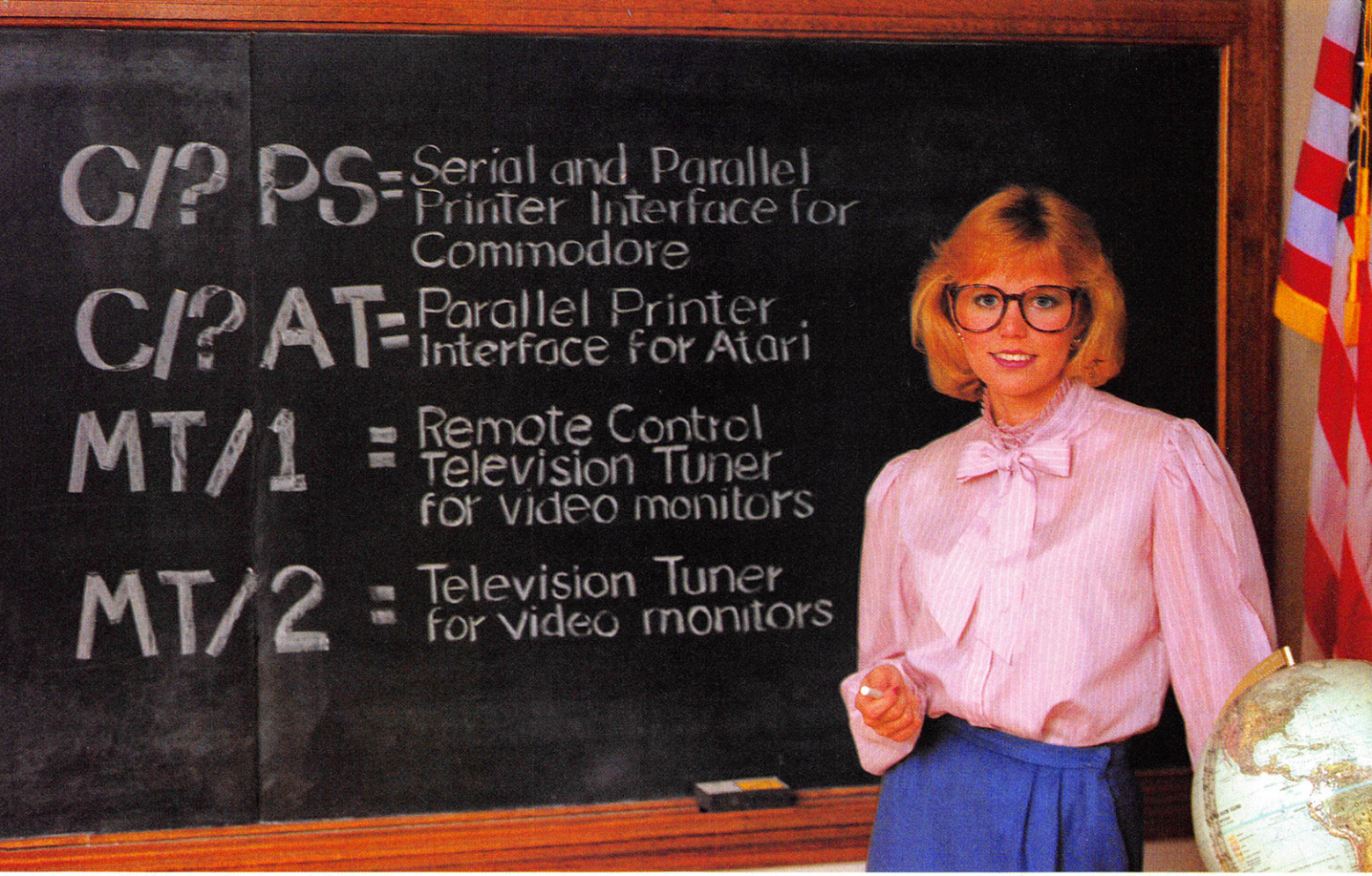
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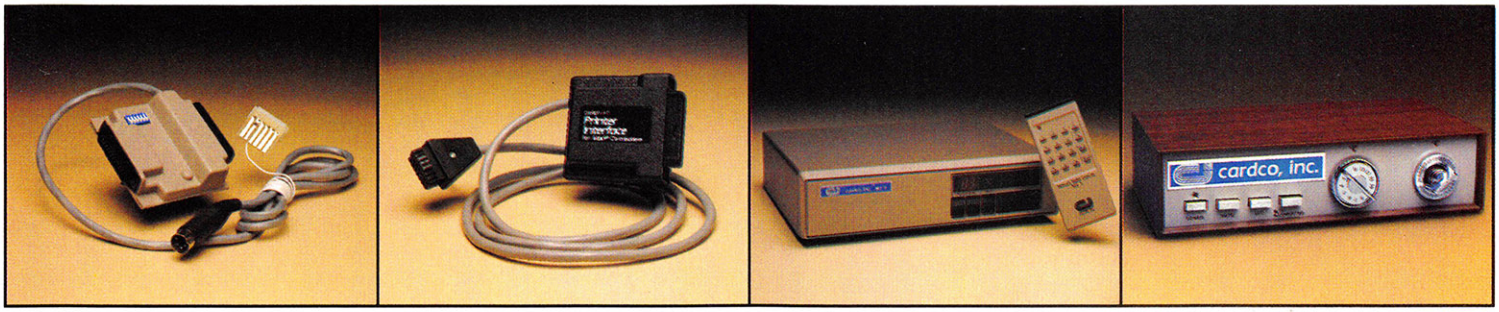
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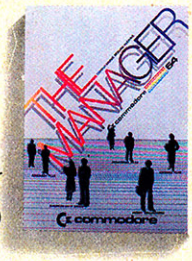


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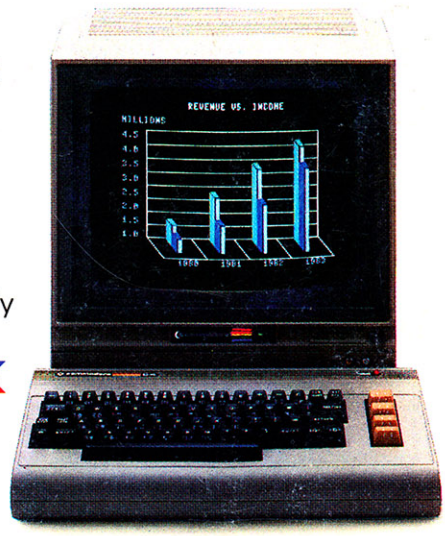
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