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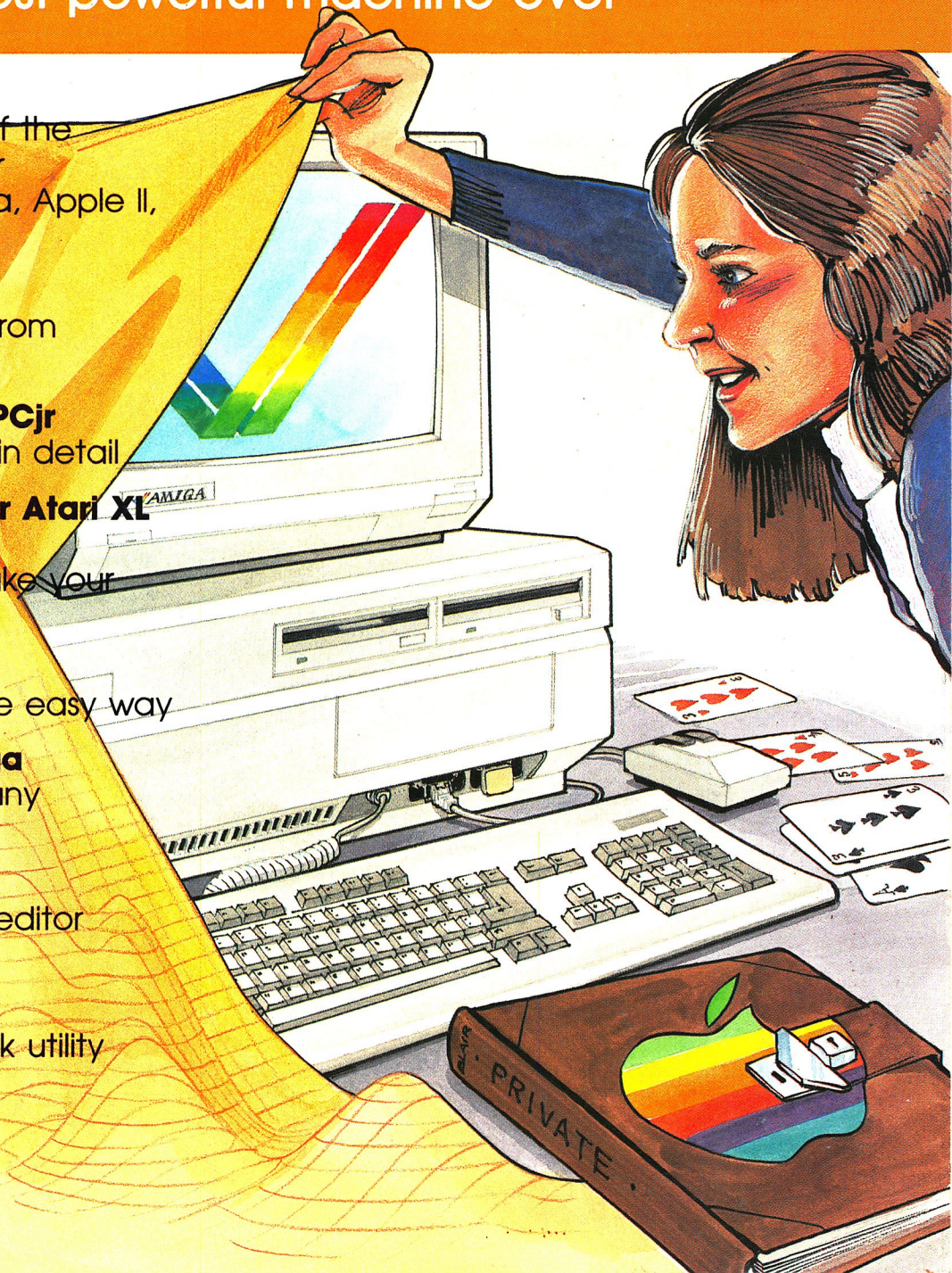
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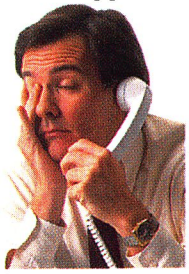


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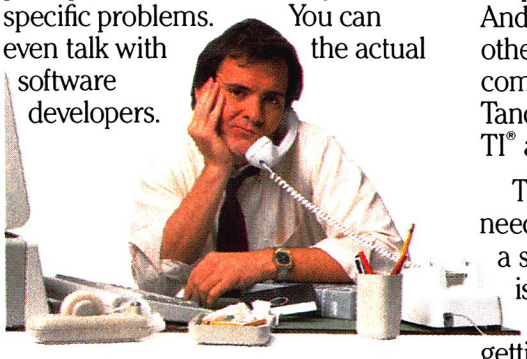
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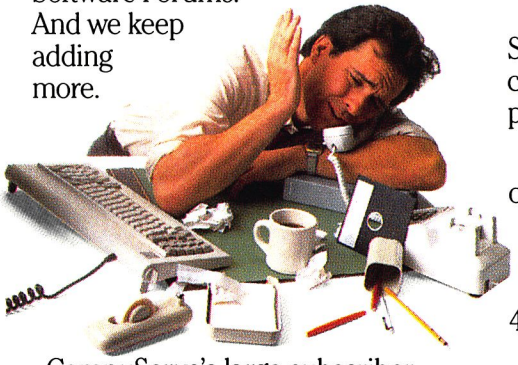


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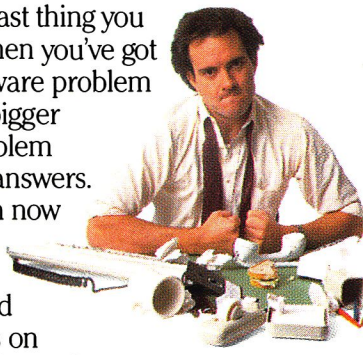
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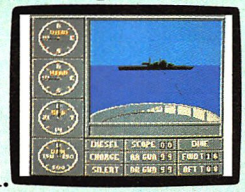
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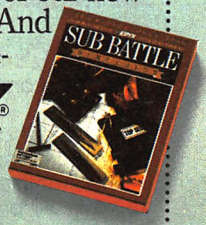
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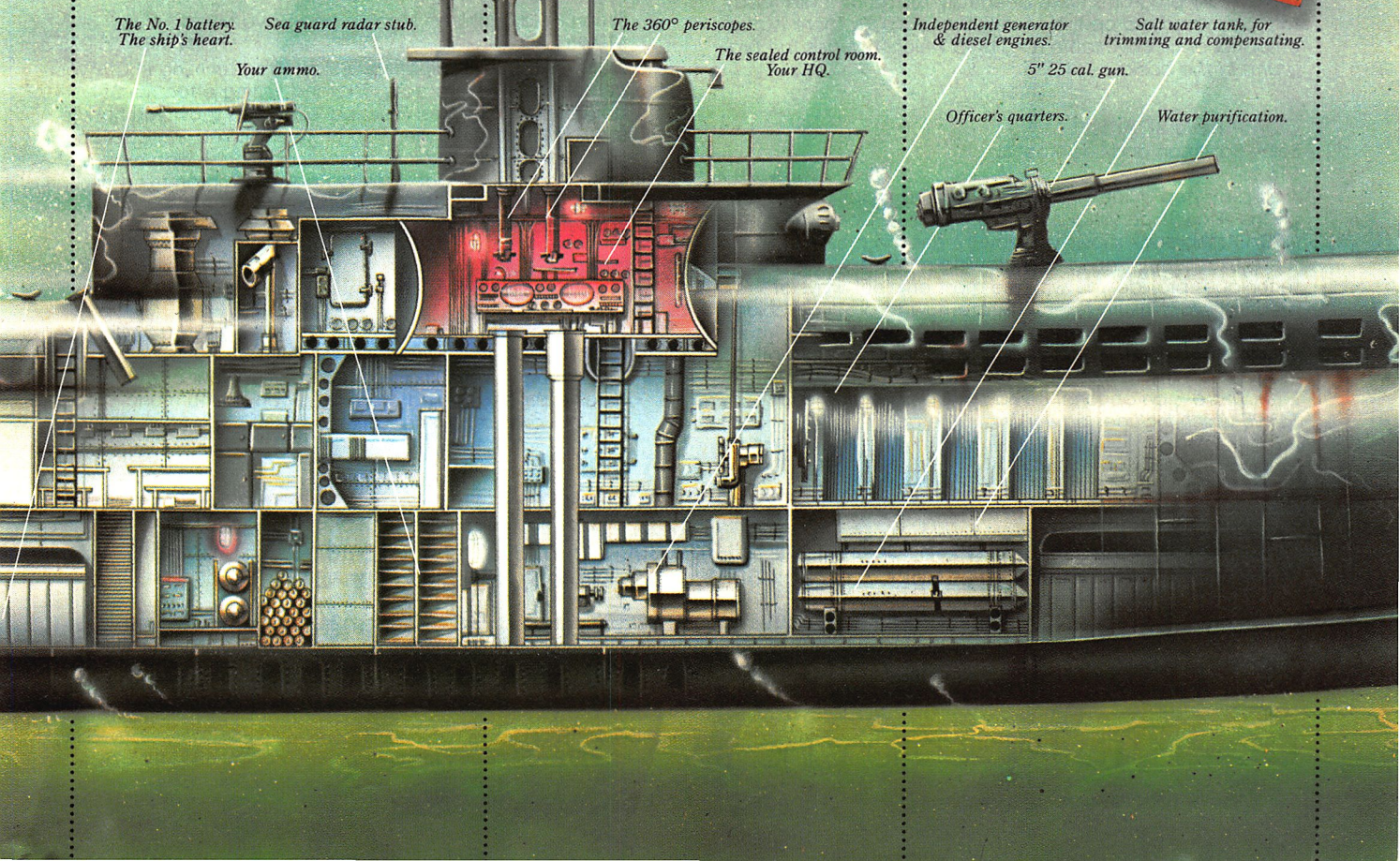
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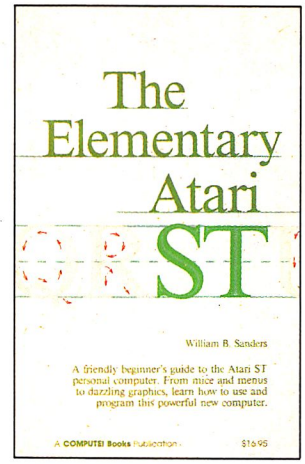
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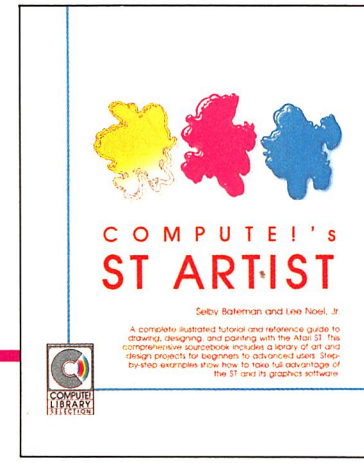


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Editor's Notes

As microprocessors, computer chips, become increasingly a fact of modern life—stamped into everything from coffeemakers to greeting cards—we can expect the things around us to grow ever smarter and, consequently, more useful. Madison Avenue seems to follow a predictable pattern when describing the various levels of appliance intelligence. It's most obvious with communications appliances like stereos and TVs. What was just a radio suddenly becomes a *digital* radio. A year or two later, and some additional RAM and ROM chips, and it's *computerized* (or *microprocessor controlled*). Eventually, when the device is finally more computer than radio, it's called *programmable*.

Although there's considerable imprecision and variability in the use of these terms, there *is* a profound change taking place.

You can see it happening now with television sets. A year ago we were introduced to the first "digital" TV. All this amounted to was "picture within picture": You could cause a frame to appear on the screen holding an image that differed from the larger, normal TV image. Now, however, newer "digital" TVs use special sampling techniques to improve picture quality by creating more lines than were originally broadcast. In other words, the TV is smart enough to infer what would have been sent if the TV studio or videotape were transmitting roughly twice as much picture as either is currently able to. The result is a sharper, more detailed picture, and you cannot see the fine horizontal lines which are visible on most TV images.

With this we have moved closer to high-definition, theater-quality home entertainment. However, there is a clear line of progress yet to come, from these early steps to the ultimate TV. For one thing, even intelligently enhanced images are not, themselves, digital. To see why, we need to briefly define the important distinction between analog and digital.

There are only two ways to transmit, store, or manipulate information: analogously or digitally. Analog information is an *imitation*, where digital information is a *numeric code*. Cavemen used both forms: If an advance scout needed to tell the hunting party that he saw two elephants, he could either imitate them by sketching two elephant figures on a tree, or simply poke two sticks into the ground. (Digital, being a code, depends on a prior agreement—for instance, that sticks in the ground represent elephants.)

But an even more fundamental distinction between digital and analog rests on whether the information is continuous or separated into abrupt steps. Again, this can be seen in the earliest cave paintings: A drawing of an elephant is a unit, a whole unto itself, sometimes even drawn with a continuous single line. A series of straight lines, however, perhaps representing a herd of elephants, is discontinuous, separated into symbols, and bears no real resemblance to the thing it communicates. Thus, when you call someone on the telephone, the rise and fall of your words is reproduced, imitated by the little speaker in the earpiece of the telephone on the other end. The information is continuous, a flow of sound. Were you to communicate via smoke signals or Morse code, the information would be broken into distinct steps or pulses and would bear no resemblance to the spoken word. In the modern sense of the term, digital communication means frequently sampling a continually varying event to reduce it to a series of numbers. The numbers, then, can be easily stored or transmitted. They are also easy to manipulate: To make a louder sound, just multiply the numbers.

Nevertheless, analog has been the primary method of communication for most of man's history simply because it's generally easier to accomplish without computer assistance. For example, the traditional phonograph record is made by a little needle which vibrates a pathway into soft vinyl. When recording a trumpet, the needle digs a vinyl pathway which is a direct imitation of the vibrations in the air caused by the trumpet. Then, when you want to listen to it, the needle on your record player sends the same vibrations to your speaker, which, in turn, vibrates the air as the trumpet originally did. All the way along, from Doc Severinsen's horn to your ear, the information is passed in the form of various analogies to the vibrations of air we recognize as the sound of a trumpet.

To digitize this sound requires enormous amounts of computer power, and it was only a few years ago, with advances in microprocessing, that digital music, in the form of the compact disc, became possible. Whereas analog is easy (the needle and vinyl and speakers transmit vibrations to each other pretty much unassisted), digital requires that the sound be turned into a code, into numbers to be stored on the disc. Then, in order for you to listen to it, those numbers have to be translated back into vibrations by a compact disc player through a process known as digital-to-analog conversion. And to get accurate sound, you need lots of numbers: 44,000 per second. A single minute of music on a compact disc requires more than 2.5 million numbers.

A video event requires far more information than audio. So we can expect to wait years before TV images are thoroughly digitized all through the chain from network camera to home TV screen. Some few studios are just now beginning to add digital capabilities, but the cost is as yet far beyond the consumer market. As usual, the consumer must wait for lower chip costs and higher chip speeds before the manifest benefits of digital TV will be everywhere available.

The latest home video recorders do have enough memory to capture a single still image and display it, rock steady, as a freeze frame. We can also expect digital signal enhancement for VCRs soon. But the most dramatic changes will come in the next stage, the *computerization* phase. At that point, the home television will start to make some decisions all by itself.

To get a hint of what's possible, we can look at a couple of recent developments in the satellite TV world: constant database broadcasting and intelligent receivers.

There's now a service which acts like a smart *TV Guide*. You interact with it when you tune it in. You can request a list of sports events only, or reviews of

all of tonight's movies. In other words, it works like a typical computer database where the user is able to search and filter the information, to tailor it to his or her needs or tastes.

In a related development, if you want to watch scrambled satellite broadcasts like HBO, you purchase a "descrambler," a unit that looks something like a hi-fi receiver, but which is really a sophisticated computer in disguise. You plug it in between your satellite dish and your TV and it mostly just passes the pictures and sound right through. It sits there and does nothing more than pretend it's just a wire, since most satellite signals are unscrambled. But when you change to HBO, it recognizes the scrambling and blanks out the picture with the message "No Subscription."

If you choose to subscribe, you can call HBO directly and give them your credit card number and the serial number of your descrambler. Within 30 minutes, the HBO movies are coming through the descrambler. What's startling about this, and also predictive, is that HBO turns on your particular descrambler from its central offices *via the satellite signal* which is beaming all across the country. Within that signal, for a brief time, is a special message to your individual descrambler. This facility for pinpoint targeting is also now giving rise to pay-per-view services and individualized messages sent between the normal pictures.

And there is a lot of space between the normal pictures. The vertical blank interrupt, that black line you see if your picture rolls, can contain considerable additional information. Bilingual or captioned movies; stereo audio; teletext and other printed data; and dozens of other kinds of communications can fit in that extra space. But none of this would have been possible without the advent of computers and their capacity for blazingly fast digital manipulation.

One major byproduct of computerization is increased personalization, increased interactivity with the appliances around us. We can expect to see TV sets which will allow us to customize them to a degree previously impossible. Not only will we be able to establish passwords for channels considered inappropriate for younger members of the family, but we'll also be able to tell the TV to always turn to our favorite news broadcast, or even to recognize and record any W. C. Fields movies.

Further, the media itself can become more personalized. There can be more shows on less popular topics; more foreign movies; more special interest broadcasts—all because a small audience can support such narrowcasting through pay-per-view.

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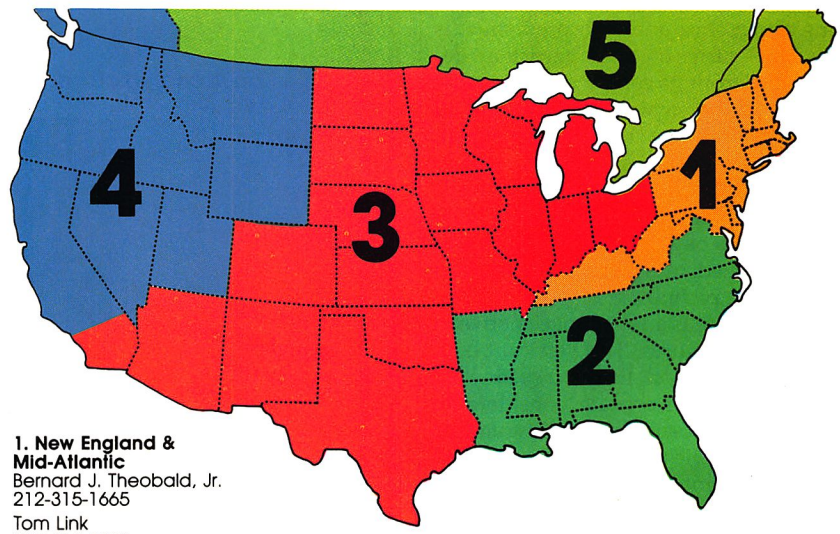
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It's not impossible to imagine TV eventually becoming so specialized that there would be channels devoted to, say, showing only Kubrick films. If that happened, whatever you might want to see or hear would always be on.

Eventually, perhaps within the next five years, television will enter the third stage of its computerization: programmability. When TV is sufficiently integrated with the VCR and other entertainment appliances, it will be possible to teach the machines to work together for the viewer's benefit and to suit the viewer's personal tastes. One early example is the generalized remote control brought out by GE last year. You put it face to face with all your other remotes and simultaneously press the same buttons on each. The GE then memorizes all the codes and can be used in place of all your other remotes.

Plans have been announced to introduce this year a controller with macro capabilities. Not only does this device know what time it is; it can also learn a complicated series of keystrokes and be programmed to repeat them. Among the many uses for a macro controller will be its ability to act as if it were a well-trained servant performing a complex series of tasks—before you arrive at breakfast, for example. Assume that you want to see the weather report first thing. Before you awake, the macro will be able to turn on the TV, change channels to the weather report, precisely adjust the volume, rewind your VCR, wait until the weather comes on, record just that part of the program, and then rewind again, waiting for your arrival.

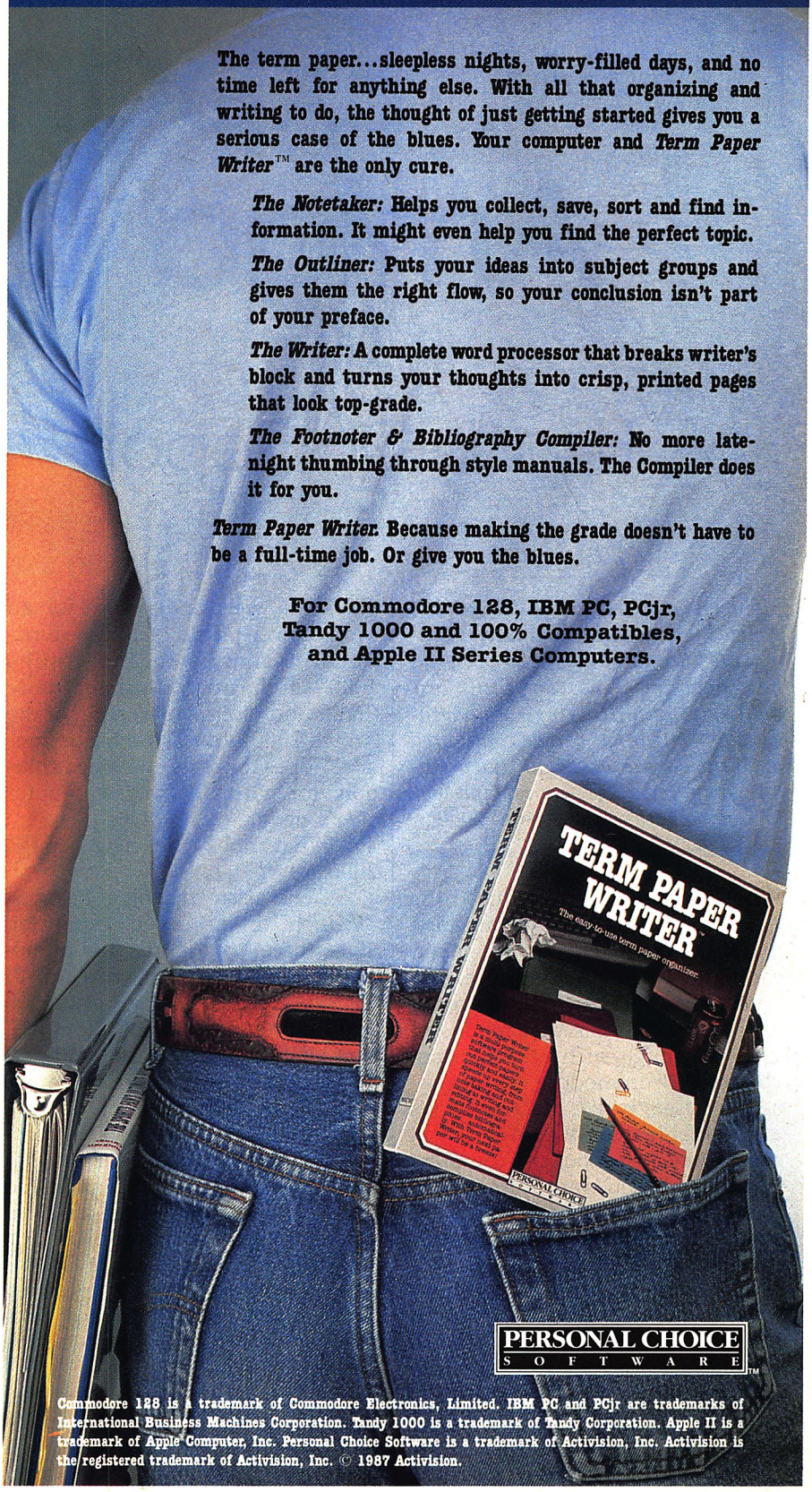
Such controllers could contain hundreds of personal macros, and the macros themselves could be chained together into a highly complicated series of actions. Macro programming is just another word for computer programming.

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COMMODORE'S

New, Expandable Amiga 2000

A Hands-On Report

Philip I. Nelson, Assistant Editor

Eighteen months after the debut of the Amiga 1000 personal computer, Commodore is introducing a powerful next-stage machine: an easily expandable, multitasking, multiprocessing Amiga that can be configured by users in more ways than any previous computer. Here's a firsthand look at Commodore's new Amiga 2000.

When Commodore introduced the Amiga in mid-1985, the machine was rightly hailed as a breakthrough in power, ease of use, and versatility. Without taking away any of the features that made the original Amiga such an important computer, Commodore is now presenting users with a machine that's a remarkable hybrid: an Amiga that can become just about any computer combination you want it to be.

In this way, Commodore answers those critics who have said that the original Amiga was too expensive to be a home computer and not powerful enough for a business machine. The Amiga 2000 can, in fact, bridge many different markets—from the under-$1,500 entry-level to the multi-thousand-dollar powerhouse machines.

On a related note, Commodore officials have also admitted that plans are well under way for an even lower-priced Amiga—functionally similar to the Amiga 1000—in the not-too-distant future (in addition to the marketing of the Amiga 2000). In this way, Commodore hopes to create an Amiga solution for virtually any computer user's need.

What does the new Amiga 2000 offer?

"The basic machine has one 3½-inch drive, seven expansion slots, three drive ports, and a 200-watt power supply, for under $1,500—plus a choice between a $300 monitor or a $500 monitor," says Clive Smith, Commodore's general manager for product marketing and development. He also notes that the Amiga 2000 is completely software-compatible with the existing Amiga 1000, provided the software complies, as all commercial programs should, with the standards for version 1.2 of the operating system. (The 1.2 operating system fixes some bugs and adds many new features to the previous operating system.)

"What you have," Smith adds, "is a machine with a low entry point [in terms of price], but which is more expandable than any other machine in the marketplace. Do you want eight megabytes of extra memory? Plug it in. If you want a 5¼-inch drive, an 80-megabyte hard drive, you plug them in. What we have is a coprocessing environment with the Amiga's 68000 chip and the IBM's 8088. If you want math coprocessors [an Intel 8087 or Motorola 68881], a video digitizer, a multifunction card next to your IBM card, you just plug them in. What we're saying is that you've got a coprocessing, multitasking environment. It's a low-price machine that you can easily upgrade to whatever level you want."

Low Price And Expandability

Two of the keys to expandability at low cost are the optional Amiga Bridge card, which allows the Amiga to run IBM PC software (see below), and PC-compatible expansion slots on the machine's main circuit board. The fierce competition among PC-clone manufacturers has driven the price of IBM peripherals and enhancement cards to amazingly low levels. PC-compatible 5¼-inch floppy drives can be found for less than $100, and you can buy a high-quality ten-megabyte hard card (hard disk drive on a single plug-in card) for less than $400.

Other PC enhancements such as enhanced graphics adapter (EGA) cards follow similar pricing patterns. The ability to install an inexpensive hard disk is especially attractive because you can use it for

Amiga files as well as IBM files. Even including the cost of the Bridge card, that gives you a fast, large-capacity hard drive for less than you might pay for an Amiga-specific stand-alone unit (not to mention the fact that the drive goes inside the case rather than taking up precious desk space).

"Everything we said about the original Amiga [1000] is true," says Gail Wellington, director of product marketing and development. "It is an expandable machine with an open architecture. However, for expanding the machine in a practical sense—in terms of how much space it requires and where you can get the items you need—the original design is not the optimum solution. For the Amiga 2000, we were looking for a machine that could be expanded and upgraded in a practical way, both ergonomically and in terms of sources [for hardware]. We wanted people to be able to configure the system easily to meet their own requirements."

The immediate market for the Amiga 2000 is obvious. It appeals to anyone who likes the Amiga for its fast processing speed and superlative graphics, but who also wants the ability to run IBM PC software. Since IBM and its workalikes still dominate the office environment, the 2000 will be attractive to professionals who bring work home. And PC compatibility helps Commodore fill some Amiga software gaps. Many Amiga software titles are now available, but the machine is still somewhat weak in the area of mature business and professional software. With a Bridge card, you can take immediate advantage of the large library of existing IBM PC software.

There are some applications where an Amiga-PC combination simply makes excellent sense. For example, the Amiga 2000's large memory and powerful graphics make it a natural for desktop publishing applications. But many of the documents published in a business environment would be generated on PC systems. With a Bridge-equipped Amiga 2000, you could read the documents directly from an IBM floppy disk and process them for publishing on the Amiga end of the system.

But the Amiga 2000 can give you more than the equivalent of an IBM PC and an Amiga sitting on the same desk, since the two processors communicate over a shared memory area. In fact, Commodore sees the opportunity for new hybrid programs that exploit the best features of both machines. An application, for instance, might use the PC's 8088/8087 combination for number crunching and pass the results to the Amiga to be displayed in high-quality color graphics. Admittedly, this category of software has yet to be created. But given the Amiga's ability to multitask (run more than one program at a time) and the open design of the 2000, it may be only a matter of time before such applications emerge.

Externals

The Amiga 2000 is instantly recognizable as a different machine from the 1000. Although its footprint (the physical shape and size) is about the same, the case is considerably taller to make room for extra internal hardware and expansion slots. The front panel has room to mount three disk drives: two 3½-inch drives and one half-height 5¼-



The Amiga 2000 takes up about the same amount of desk space as the Amiga 1000, but its case is taller to hold additional disk drives and internal expansion cards. The front panel can hold two 3½-inch disk drives and one 5¼-inch drive. This particular model has two 3½-inch floppy drives and an internally mounted hard disk. A 5¼-inch drive can be installed in the slot below the two smaller drives.

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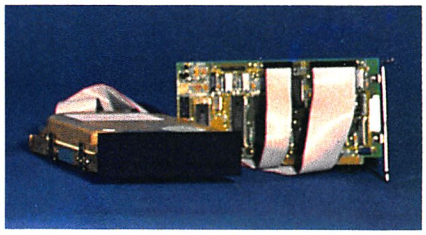
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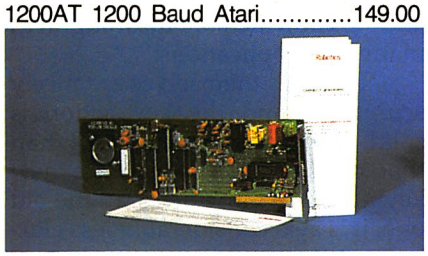
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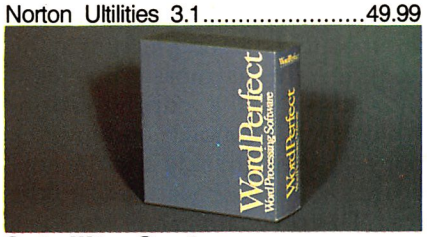
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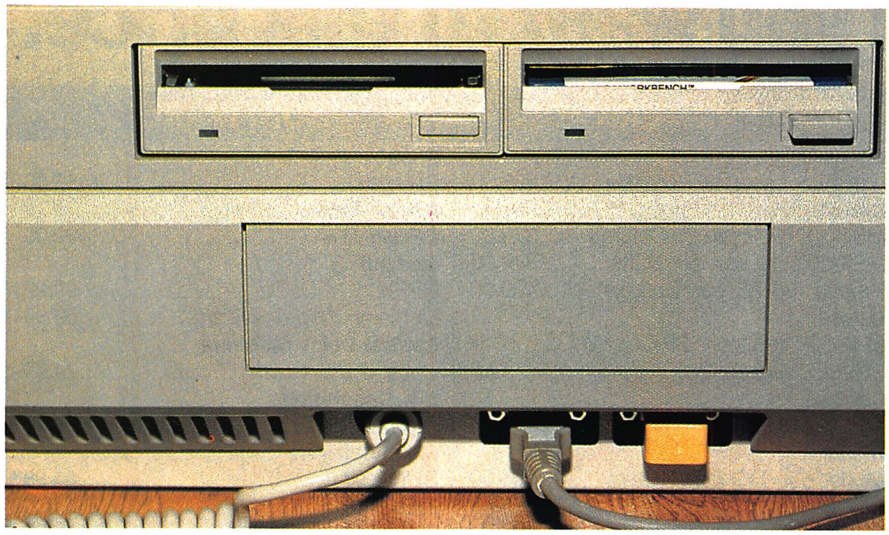
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The Amiga 2000's keyboard, mouse, and joystick cables plug into the front panel of the computer. In this photo, the joystick port is occupied by a security device ("dongle") for running a copy-protected commercial program.

inch-drive (see photo).

The basic machine includes one 3½-inch floppy disk with a capacity of 880K, just as on the Amiga 1000. The front panel also has space to mount one extra 3½-inch drive and a half-height PC-compatible 5¼-inch drive. This arrangement is not only compact, but it also provides a number of storage options, since the extra drive spaces can hold either floppy or hard drives, and the Bridge card allows a hard drive to be shared by both the PC and the Amiga.

The 2000's mouse, joystick, and keyboard ports are now grouped together on the front of the housing. This is more convenient than the 1000's configuration, which puts the mouse and joystick ports on the right side and the keyboard cable underneath and to the rear. The keyboard cable also has a sturdier connector than the cable on the 1000, which uses a modular telephone–type connector.

The rear panel of the new Amiga looks something like the back end of an IBM PC, with vertical slots that can be opened up for connectors of various types. Unlike the original Amiga, which has nonstandard connector configurations for the printer and serial ports, the 2000 has the same parallel printer port and RS-232 serial port connectors as the IBM PC. The industry-standard ports permit you to use non-Commodore printer, modem, and cables if you wish—an important consideration for IBM compatibility.

Video And Sound

As on the 1000, the Amiga 2000's graphics and sound are controlled by a triumvirate of custom chips code-named Agnes, Denise, and Paula. The basic graphics and sound capabilities of the two machines are identical: The 2000 has all the screen modes of the 1000 and includes the same four-channel sound system and software-based speech synthesizer.

Commodore is offering two new monitors for use with the Amiga 1000 or 2000. The A2002 monitor is switchable between RGB and composite video, like the current 1080 monitor. The A2080 is a special long-persistence display unit designed specifically for the highest resolution graphics modes. The screen phosphors in a long-persistence monitor hold their glow longer than ordinary phosphors, a feature which overcomes the problem of video jitter in the Amiga's special screen modes.

Composite video output is not standard on the 2000. If you wish to use a composite monitor or television, you must purchase the A2060 composite/RF modulator board, which goes into a special video slot on the motherboard. This interface mounts internally to reduce problems with radio frequency interference (RFI).

For music enthusiasts, Commodore will offer the A1400 MIDI Interface as an option. Unlike the Atari ST's built-in MIDI interface, which includes only MIDI IN and OUT, the A1400 interface supports MIDI IN, OUT, and THROUGH.

Keyboard

A number of changes are visible in the 2000's larger 95-key keyboard (see keyboard photo). The main keyboard cluster is nearly identical to the 1000 keyboard, except that the Shift, Tab, Backspace, and Return keys have been enlarged and labeled with PC-like arrows rather than words. On the Amiga 1000 keyboard, the Delete and Help keys are easy to hit by accident, since they're sandwiched very close to the Return key. The 2000's keyboard solves this problem by relocating Delete and Help away from the main cluster.

The four cursor keys have been relocated and moved into a T configuration. The numeric keypad follows the standard Teletext configuration and has also been moved somewhat to the right. The forward faces of some keypad keys contain legends such as Num Lock and Pg Dn which are meaningful in many PC applications.

The keys themselves are nicely sculptured and the key action is solid, with a more positive feel than that of the 1000. While the new keyboard is a bit wider than the old one, it is also considerably less clut-



The keyboard of the Amiga 2000 has been enlarged and redesigned for keyboard-intensive applications such as word processing. Some of the keycaps contain legends for IBM PC applications.

tered. All in all, the modifications make the Amiga 2000 keyboard substantially more efficient for word processing and other keyboard-intensive uses.

Inside The 2000

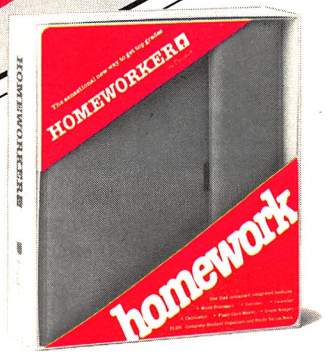
Internally, the Amiga 2000 has exactly the same microprocessor as the 1000 model: a 16/32-bit Motorola 68000, running at a clock speed of 7.14 megahertz. However, the system can be easily upgraded for even greater speeds or number-crunching power. Commodore intends to market an optional accelerator board which contains a 32-bit Motorola 68020 processor running at 14 MHz, a memory management unit (MMU), and cache memory. This processor could work either in parallel with the resident 68000 or as a replacement for it. The machine can also accept a Motorola 68881 math coprocessor to speed up math operations. The Bridge card allows coprocessing with an Intel 8088 8-bit processor and optional 8087 math coprocessor, as well. (A math coprocessor, of course, depends on software that takes advantage of its special capabilities. Many calculation-intensive programs for the PC check for the presence of an 8087 coprocessor and use it if it's available. Since the 68881 is newer than the 8087, it may be a while before you can buy Amiga software that exploits the Motorola math chip.)

The 2000 comes with a full megabyte (over one million characters) of memory, and it offers a choice of two different memory expansion boards. The A2050 RAM expansion board can be supplied with an extra half-megabyte, one megabyte, or two megabytes of RAM. If that doesn't sound like enough, you'll be able to buy a bigger memory board populated with either four, six, or eight megabytes of extra RAM. The system is designed to handle a maximum of nine megabytes of memory.

Another welcome improvement is the elimination of the Kickstart disk. The 2000 has 256K of ROM containing the operating system software which the Amiga 1000 has to load from disk. This simplifies and speeds up the process of booting the system, since you now need to insert only one

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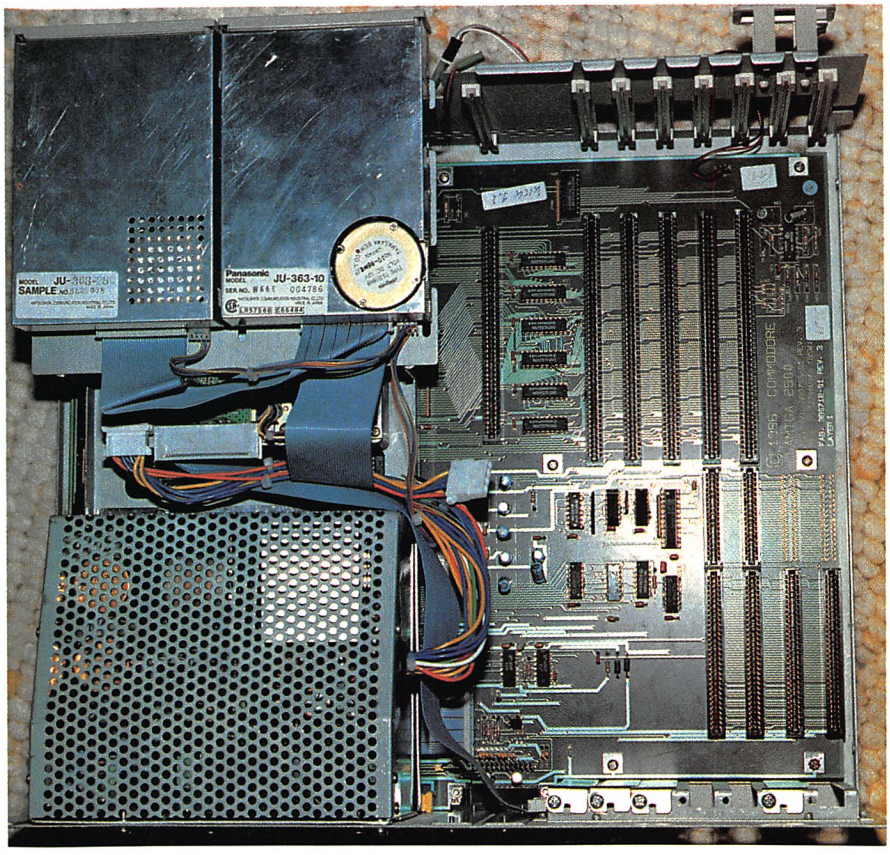
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An overhead look at the inside of an Amiga 2000, showing the expansion area to the left and the power supply and internal floppy drives to the right. The bulk of the Amiga's internal circuitry, including its 68000 microprocessor, is not visible from this angle.

disk rather than two.

There's a second reason, apart from the convenience factor, why Amiga owners and software developers should rejoice at the demise of Kickstart. A computer manufacturer ordinarily doesn't move an operating system into ROM until it is satisfied that the system has reached final, debugged form; system software is more difficult to update once it has been "graven in stone" in ROM. The fact that Commodore has taken this step should increase everyone's confidence in the reliability of the system as a whole.

The accompanying photo shows the Amiga in an overhead view with its entire housing removed except for the backplate. (The front of the machine faces the bottom of the page.) In the lower right corner are two heavily shielded 3½-inch floppy drives. The metal cage at the upper right houses the machine's power supply, and the left area contains expansion slots.

Commodore is offering an optional hard disk/ SCSI controller board for the Amiga 2000. The card includes two hard disk interfaces: The ST 506-compatible interface allows you to connect up to two PC/XT hard drives, and the SCSI interface will accept SCSI-standard devices on either a 50-pin SCSI connector or a 25-pin Macintosh Plus–compatible connector. In addition to hard disk drives, this card lets you add a high-speed tape drive for backing up a hard drive's contents.

To insure adequate power for extra drives and cards, the Amiga 2000 provides a hefty 200-watt power supply. Computerists who like time- and date-stamping will be glad to learn that the 2000 also includes a built-in clock/calendar with battery backup.

Slots Galore

Inside the case of an Amiga 2000 are nine different expansion slots, some of which can serve a dual function. An 86-pin expansion slot extends the Amiga's CPU (Central Processing Unit) bus; if you upgrade to a faster 68020 processor, this slot holds the CPU card. The video slot can hold an interface for the optional composite/RF modulator or other video hardware such as the Genlock video mixing system.

The remaining seven slots extend the Amiga's system bus and provide slots for IBM PC cards. Five of these are 100-pin Amiga slots and two are PC-specific. However, two of the 100-pin slots can also be used as PC slots, so you have the equivalent of four PC slots in all.

The overhead photo illustrates the slot layout inside the Amiga's housing. The Amiga CPU slot is the long connector just below the center of the board. To its left are the five 100-pin Amiga slots, the longest slots in the system. Two of these are shared with the four PC slots, which are grouped in the upper left corner from this view.

The two innermost PC slots are PC/AT–compatible, while the shorter, outermost PC slots are PC/XT–compatible. For those who aren't familiar with the latest IBM acronyms, a PC/XT is essentially the familiar IBM PC with some ROM upgrades and a built-in hard disk drive. A PC/AT is a significantly different machine, with a true 16-bit microprocessor (the 80286), a much faster hard disk drive, and some additional expansion slots to take advantage of the 80286 processor's greater addressing range. The Amiga's circuit board is drilled for AT connectors in the outer PC slot positions, implying that you can upgrade all the PC slots to the AT level just by installing two more connectors.

Plug-In IBM PC

As you've undoubtedly surmised, the reason the Amiga 2000 has slots for IBM PC hardware is that it can run PC software with the aid of an optional Amiga card known as the Bridge. This card, which contains an 8088 processor, is functionally very similar to the Sidecar accessory now available for the Amiga 1000. (Sheldon Leemon's "AmigaView" column in this issue has a hands-on description of the Sidecar.) There are two main differences between the two accessories. The Sidecar lives in a box that connects to the side of the Amiga 1000, and it includes a built-in 5¼-inch disk drive. The Bridge plugs into an internal slot in the Amiga 2000, and it does not include a 5¼-inch drive

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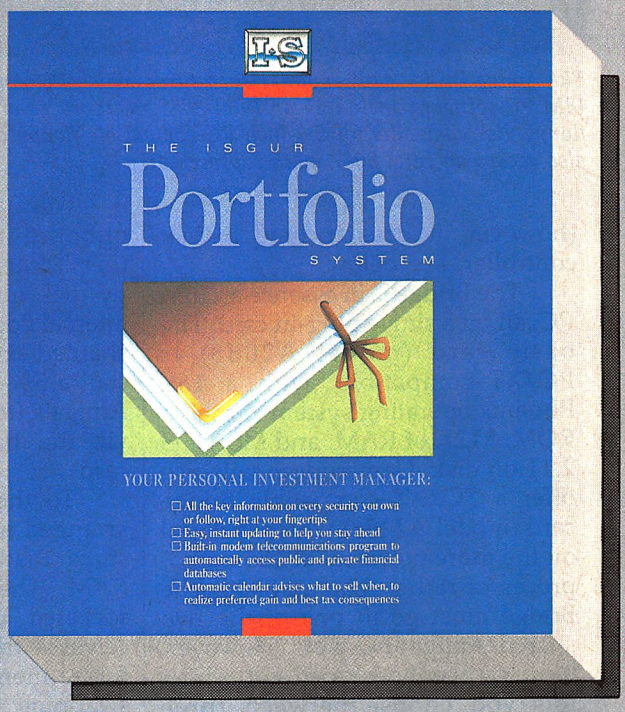
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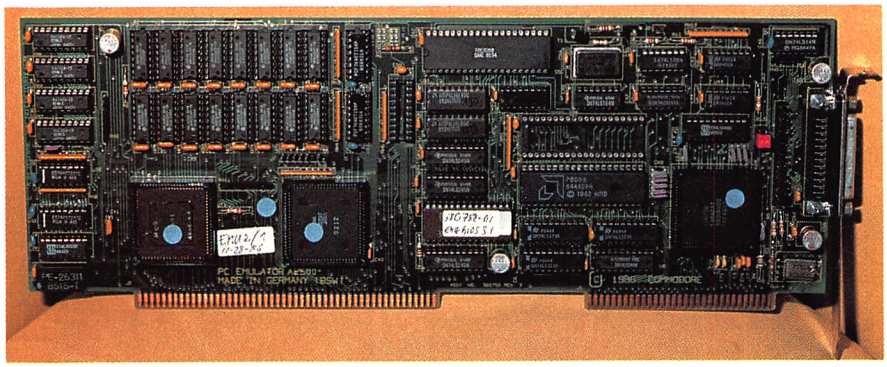
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I·S Integral Solutions



The Amiga Bridge card supplies everything which the Amiga 2000 needs to run IBM PC software, including an Intel 8088 microprocessor, 512K of RAM, and a floppy disk controller for 5¼-inch PC-compatible floppy disk drives. The board can also accept an Intel 8087 math coprocessor.

(however, it does include a disk controller; see below).

The Bridge is in essence an IBM PC, all on a single plug-in card. The basic card (model A2088) is PC/XT-compatible, with a 16K Phoenix operating system kernel in ROM, 512K of RAM, and MS-DOS 2.11 on disk. Commodore will also offer a PC/AT-compatible Bridge card (model A2286) which is based on the more powerful 80286 microprocessor rather than an 8088. The Bridge must go in one of the two shared Amiga/PC slots. However, it can go in either shared slot, which lets you choose between three Amiga slots and three PC slots, or four Amiga slots and two PC slots. Incidentally, both the Bridge card and the Amiga's motherboard have the appearance of finished, debugged products; neither circuit board contains any jumper wires or other evidence of last-minute modifications.

The accompanying photo shows the layout of the basic Amiga Bridge card. Just to the right of the board's center is the 8088 microprocessor. The empty socket above the 8088 is where you would plug in an 8087 math coprocessor.

The three large, square components on the Bridge card are custom chips which presumably perform address decoding and other "glue" functions needed to make the Bridge work as a whole. Commodore owns the MOS Technologies company, which enables it to develop and manufacture custom chips of this type more inexpensively than other personal computer companies.

The large chip at the top of the board is the main component in the onboard floppy disk controller (FDC) interface. The Bridge's floppy disk interface can support one internal floppy and up to three daisy-chained external floppies. If you install a 5¼-inch floppy drive in the Amiga's front panel, it is controlled via the hardware on the Bridge card.

To the left of the FDC chip, arranged in two rows of 8, are 16 chips that yield a total of 512K RAM. These chips appear to be socketed, by the way, so it's conceivable that you could perform a future memory upgrade by simply swapping in larger-capacity RAM chips.

The rest of the PC system is emulated on the Amiga side. To run a PC application, the Amiga reconfigures its keyboard as a PC/XT keyboard, emulates the PC printer port on its own Centronics port, and displays the PC's video output in both monochrome and color. Supplying these services through software allows Commodore to keep the Bridge's chip count—and thus, its manufacturing cost—impressively low. The Bridge contains only about 50 chips, compared to well over 200 chips on any reasonably configured IBM PC.

If you're interested in how such feats are achieved, the technical documentation for the Bridge card makes fascinating reading. For communications between the two processors, 128K of dual-ported, or shared, memory is used. Dual-ported memory can be "seen" in the address spaces of both processors, although not all of it is accessible by both the 8088 and the 68000. The 2000 uses 64K of this RAM for general data exchange, 32K for the PC's color video display, 8K for the monochrome display, and 8K for emulating PC input/output registers. The remaining 16K is used to orchestrate the whole process.

Does It Work?

In the world of PC clones, one of the toughest tests of IBM compatibility is to run *Flight Simulator*. At Commodore, we saw an expanded-memory Amiga 2000 run *Flight Simulator* for the IBM PC on one screen while it ran *Superbase* on a second screen and ran two copies of *Aegis Draw Plus* on third and fourth screens. That's three full-blown Amiga applications plus a processor-intensive PC application, all running at the same time. Running from the Bridge, the flight simulator program took off, flew the plane, and updated the scenery as fast as it would on an ordinary PC.

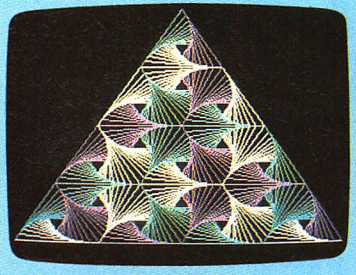
To the Amiga's multitasking operating system, the PC application is just another task to run. Of course, since the PC's MS-DOS operating system cannot multitask, and the Bridge card has only a single 8088 processor, you're limited to running one PC application at a time. A PC screen can be "frozen," however, for reference from another PC application.

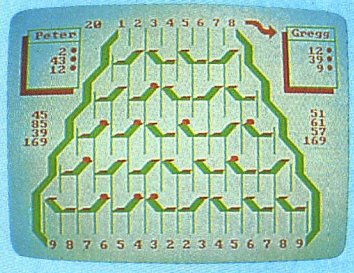
Who will buy the Amiga 2000? For anyone who uses an IBM PC at work, or who prefers not to give up the vast base of available PC software, the Amiga 2000 may well represent the best of both worlds. The Amiga end of the system offers speedy processing and excellent graphics and sound, while the Bridge card can run anything that runs on an IBM PC. But the design of the 2000 shows that Commodore has more in mind than simply exploiting an immediate market niche.

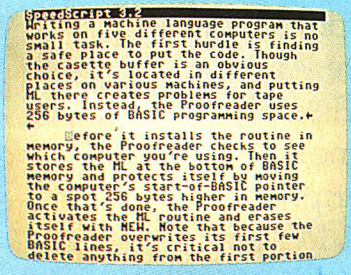
The flexible, completely open design of the Amiga 2000 puts it in a strong competitive position for the future. In contrast to a closed-architecture machine such as the Atari ST, the 2000 can be not only reconfigured, but easily upgraded. The Amiga's multitasking operating system already makes it unique in the 16-bit arena. By allowing a plug-in upgrade to a processor like the 68020, Commodore has enabled the Amiga to survive through the next, even more powerful generation of 32-bit computers as well. ©

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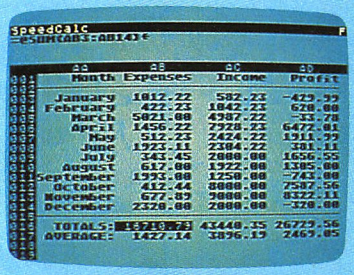
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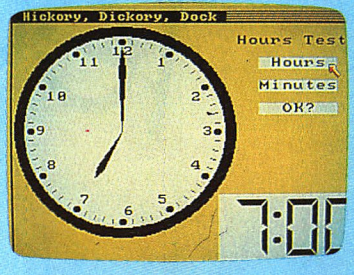
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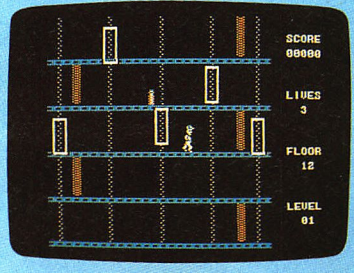
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On the following pages you'll find overviews of three of the most important developments occurring in computer peripheral technology today and during the next several years. New capabilities for dot-matrix printers, lower-priced hard disk drives, and computer screens with far greater resolutions will be affecting how we print, store, and look at computer information. And the changes will likely be occurring at a faster rate than many of us realize.

An Introduction To Hard Disk Drives

Philip I. Nelson, Assistant Editor

More and more personal computer owners are bringing home hard disk drives—those mysterious "black boxes" that can hold vast quantities of information and transfer data at amazing speed. In this article, we'll look at what's inside a typical hard drive and what makes this device so attractive to home users as well as to businesses and software developers.

Hard disk drives have long been popular with computer professionals. But until recently, they were simply too expensive to tempt most home users. That picture has changed dramatically within the last year. Comparatively inexpensive units are now available for the Atari ST, Amiga, and Macintosh, as well as for the increasingly important IBM PC workalike market. And you can even buy hard disk drives for eight-bit machines such as the Commodore 64 and eight-bit Ataris.

The Proverbial Black Box

Hard drives are deceptively simple in appearance. The typical unit is a rectangular box adorned with nothing but a power switch, a cable to the computer, and a light that indicates when the drive is busy. A few are even functionally invisible: The latest development in the IBM PC market is the *hard card*—a complete hard disk drive mounted on a card that plugs into the computer's internal expansion box.

Hard disk drives go by various names: hard disk, rigid disk, fixed disk, or even Winchester disk, a holdover from early days when the market was dominated by a manufacturer of that name. The first two names refer to the fact that the disk platter is made of hard, rigid material (often aluminum) rather than the flexible plastic used for floppy disks or tapes. The term fixed disk refers to the fact that the platter is permanently installed, unlike a removable medium such as a floppy disk.

Bigger And Faster

The basic function of any mass storage device—a tape drive, disk drive, bubble memory, or whatever—is to let you move information from the computer's memory into permanent storage, and vice versa. The advantage of a hard drive can be summed up in two words: capacity and speed. Let's look at capacity first.

An IBM PC floppy disk has 362,496 bytes (354K) of total space. By comparison, the smallest available hard drive stores 10 megabytes of information—the equivalent of 10 million characters of text. Larger hard drives store 20, 40, 60, even as much as 140 megabytes of data. Thus, a 10-megabyte hard drive holds roughly the same amount of data as 27 IBM PC floppies, and it takes something like 386 PC floppy disks to hold as much information as a single 140-megabyte hard drive. Currently, the most popular units for personal use are 10-megabyte and 20-megabyte hard drives.

Hard drives are a great deal faster than floppy drives. To demonstrate the speed difference, I wrote a simple program in C for the Atari ST. The test program writes ten 10,000-byte files and one 200,000-byte file to disk (a total of 300,000 bytes), and then reads the same files back. All in all, the system has to move 600,000 bytes in the course of a program run. The elapsed time was calculated using the ST's internal timer, which counts time in two-second increments. Here are the results from running the program with a single-sided floppy Atari drive, a 20-megabyte Atari hard drive, and a commercial RAMdisk utility which emulates a disk drive entirely in RAM:

Floppy	Hard Disk	RAMdisk
16:24	9:46	8:24

The outcome of the race is a foregone conclusion: We expect the RAMdisk to win because it doesn't have to perform any mechanical operations at all. The hard drive, however, compares very favorably to the RAMdisk, performing the test several minutes faster than the floppy drive. (Please keep in mind that these results are provided only as a rough-and-ready demonstration, not as a scientific benchmark of any sort. Different computer systems, using a different microprocessor and DOS, or disk operating system, would produce quite different results. However, it's safe to say that a hard drive usually operates considerably faster than a floppy disk on the same system.)

There are several reasons why hard drives move data so much faster than floppy drives. The first has to do with rotation speed. Hard disks spin up to 3600 revolutions per minute (rpm), about 12 times as fast as floppies, which usually spin at about 300 rpm.

Hard disk sectors are also

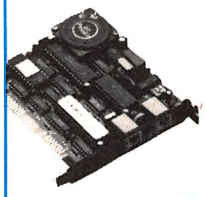
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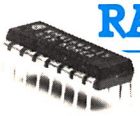
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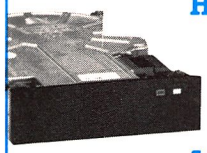
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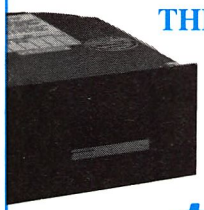
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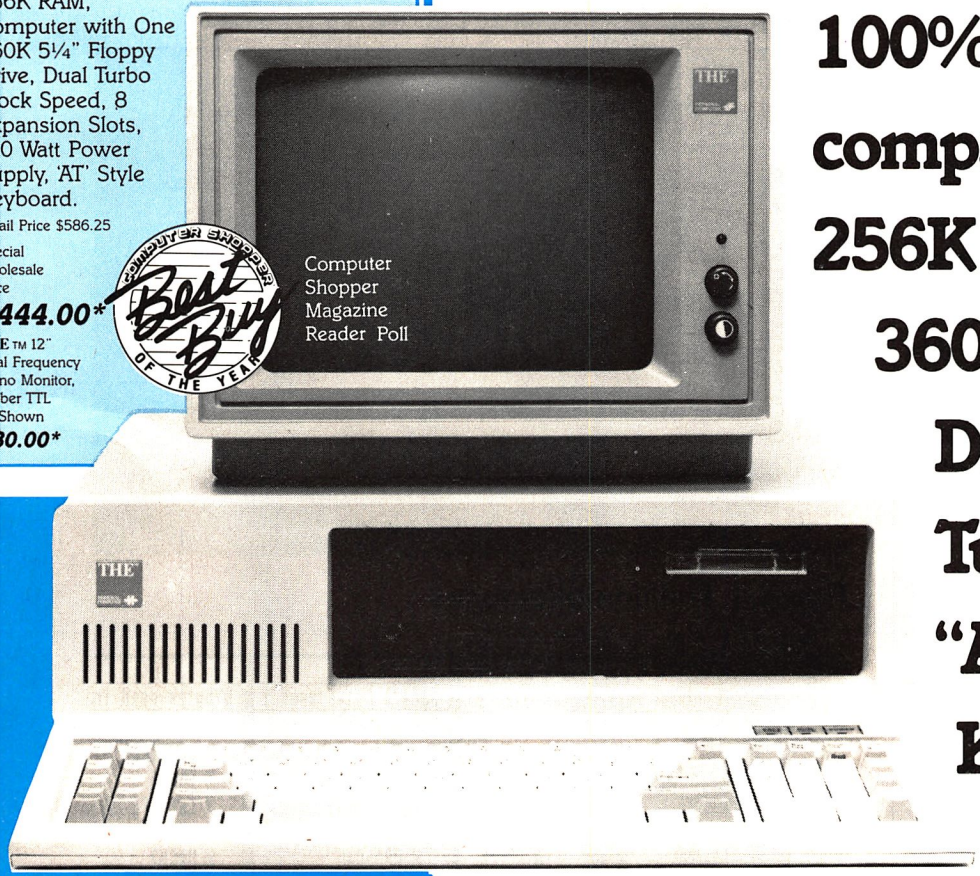
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located closer together than floppy disk sectors, and the data on each sector is packed more densely. Locating sectors close together reduces *access time*, the average amount of time it takes the read/write head to find a sector. This factor, together with the dense data format and fast rotation speed, allows the hard drive to access much more data than a floppy for a given amount of time.

Performance of this type requires advanced technology. To eliminate friction, the drive's read/write head actually flies above the surface of the disk, supported by a microscopic (about .00015-inch) layer of trapped gas. The gap between the read/write head and the disk is so small that a tiny speck of airborne dirt—or even a particle of tobacco smoke—can scratch the delicate disk surface. To prevent contamination accidents, the disk and read/write machinery are sealed in a housing filled with clean, inert gas or carefully filtered air.

Another key factor in hard drive technology is the interface between the drive and the computer. It doesn't matter how fast a drive can read or write if it can't move data to the computer with commensurate speed. Most floppy drives use a comparatively slow serial interface which transmits one bit (binary digit, a one or zero value) of data at a time. Hard drives typically use a variation of SCSI (Small Computer Systems Interface, pronounced *scuzzy*), an interface that supports much faster transfers.

Subdirectories And Partitions

Hard drives can store hundreds, even thousands of files. If you think it's difficult to find a file on a floppy disk that has dozens of files, imagine searching through a disk directory that contains thousands of filenames. Without some way to organize the drive's contents, simply finding a file could be a nightmare. Hard drives can be organized in two fundamental ways: with partitions and with subdirectories.

Like floppy disks, hard disks need to be formatted before you use them for the first time. After formatting, most hard disks are then compartmentalized into two or more separate *partitions*. If you visualize the entire hard drive as a conventional filing cabinet, then a partition is the equivalent of a drawer. Each partition is logically distinct and can be used, for practical purposes, as if it were a physically separate drive. Figure 1 illustrates the partitioning of a 20-megabyte drive for the Atari ST. Drives A: and B: always refer to floppy drives. In this case, drives C:, D:, and E: are all partitions, or logical drives, contained in a single hard drive unit.

If a partition is equivalent to a file drawer, then a *subdirectory* is equivalent to a folder within the drawer. Related files are usually grouped together in the same subdirectory: You might store word processing files in one subdirectory, database files in another, and so forth. Figure 2 shows the directories for drives C:, D:, and E: (on the ST's desktop, subdirectory entries are marked with a graphics symbol and appear at the top of the main directory).

In addition to files, a subdirectory can contain other subdirectories. Figure 3 shows the partial contents of the DEGAS subdirectory on drive C: of this particular system. Notice that this subdirectory contains several subdirectories. A well-organized hard drive may contain subdirectories nested several levels deep.

Using A Hard Drive

Hard drives are reliable, but they're still susceptible to misuse and accidents of nature. In the worst case—for instance, if you suffer a power failure in the midst of a massive file update—an accident can garble the

Figure 1: Hard Drive Partitions

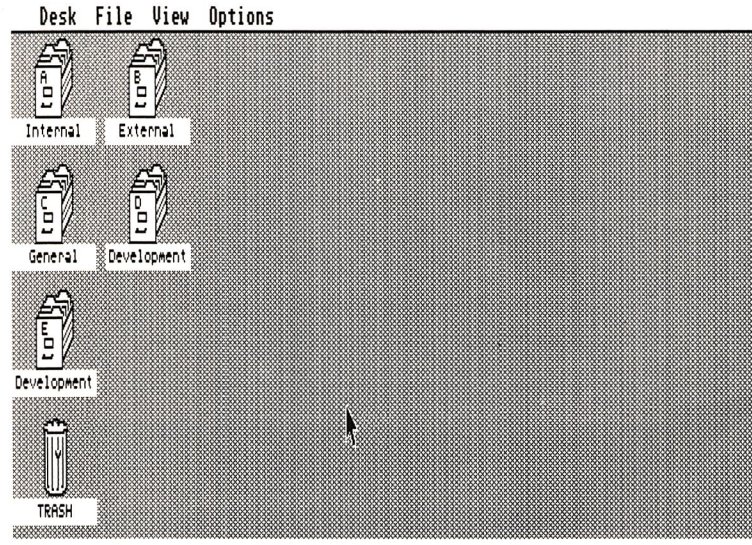


Figure 2: Partition Directories

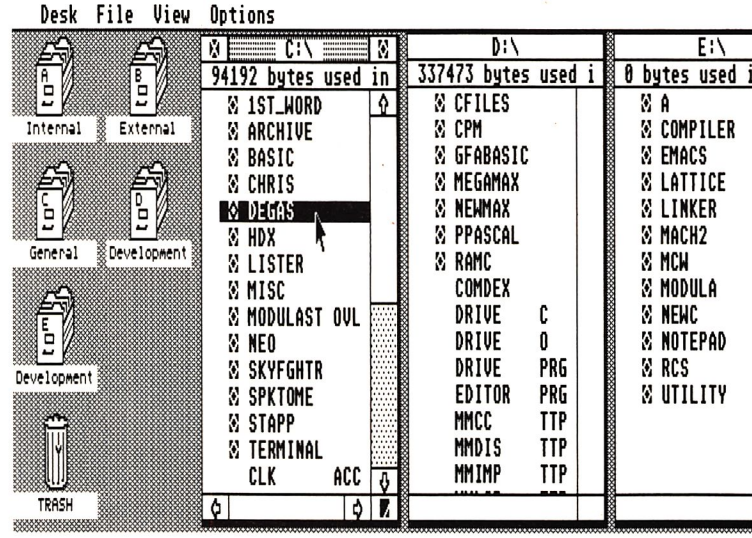
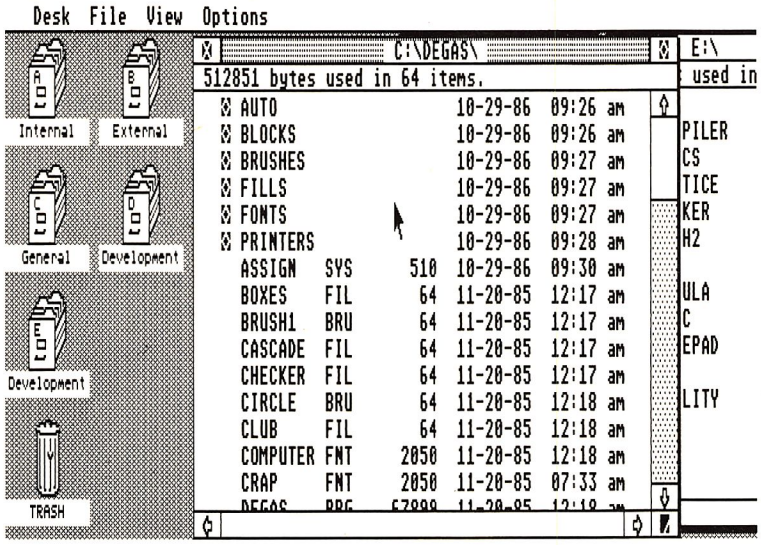


Figure 3: Subdirectories



entire contents of the drive. Because the read/write head floats so close to the rapidly spinning disk, hard drives are especially sensitive to being bumped or jostled during operation. If you need to move the drive, you must run a special program to "park" the read/write head in a safe landing zone on the disk surface.

The enormous capacity of a hard drive makes regular backups an absolute necessity. The more data you put on a drive, the more vulnerable it becomes to a single accident. Many hard drive owners copy critical data onto floppy disks; there are a number of utility programs to make this process relatively painless. You can also buy high-speed tape drives for the same purpose, although these units sometimes cost more than the unit they're designed to serve.

Hard drives have also added a new wrinkle to the copy-protection controversy. Some hard disk owners have become foes of copy-protection—not because they condone piracy, but because a copy-protection scheme that prevents a program from running on a hard drive defeats the purpose of buying a hard drive in the first place. Any copy-protection that keeps you from making illegal copies on a floppy will probably prevent you from storing the program on a hard drive, as well. If you're forced to load the program from a copy-protected floppy disk, you lose the time savings of loading it from the much faster hard drive. In the worst case, the software might take control of the system when it boots and prevent you from storing data files on the hard drive, making its large storage capacity useless.

Partly in response to such concerns, some software companies are removing copy-protection completely. A compromise solution is to allow the software to run on a hard drive, but only if you plug in a dongle or boot up with a key disk in the floppy drive. Once the program has determined that you are using a legal copy, it can allow you to store and retrieve data files from the hard drive.

The Sludge Factor

New hard disk owners are often tempted to put their entire software libraries on the hard drive, but that's usually not a good idea. Clogging the drive with a multitude of files and subdirectories makes the disk's organization more complex. In such an environment, files tend to become fragmented—located in scattered, noncontiguous disk sectors. The more fragmented the file structure, the longer it takes the drive to access the file.

There's no question that a heavily loaded drive runs slower than one that's comparatively empty. At the time this article was being written, we happened to receive a new 20-meg hard drive for evaluation. To confirm that the "sludge factor" is real, I ran the test program just after formatting the new drive, when it was still completely empty. The time was a sparkling 8:58, significantly faster than the result from our other hard drive, which had only 380,000 bytes free on the partition where I ran the test. Then I loaded the new drive with files until the current partition had only 380,000 bytes free, and I ran the test again. The result was a time of 10:56, a full minute and a half slower than when the drive was empty.

Not surprisingly, the increased use of hard disk drives has led to a whole new category of software. Two of the most popular hard drive utilities are catalog programs, which print a comprehensive catalog of everything on a drive, and file finders, which sift through every subdirectory on the drive and tell you exactly where a designated file resides.

Who Needs One?

Should you buy a hard disk drive? If your major use of a computer is to play "Laser Blasters" two or three times a week, the answer is probably no. Entertainment programs often use copy-protection schemes that take over the system completely and run only from a floppy disk. Many games don't access the disk while running, anyway, so you have little to gain by shaving, say, ten seconds off the time it takes to load the game.

On the other hand, a hard disk drive may be a necessity for a business or a software developer. Developers use them to speed the process of compiling new programs, and businesses are always looking for ways to enhance productivity. A hard drive is also a boon to anyone who operates a computer bulletin board: A large-capacity hard drive can provide fast, ready access to thousands of archive files. If you're a heavy user of bulletin boards or commercial information services, a hard drive can make life easier, too: Disk-related delays become a thing of the past, and you can capture enormous files without any fear of running out of disk space.

What these groups have in common is that they tend to use software that's highly disk-dependent. If you regularly deal with large quantities of data or a great number of disk files, a hard drive might be a useful acquisition. The more disk-intensive the activity, the more you stand to benefit from the large capacity and fast access time of this device. ©

The New, High-Quality Dot-Matrix Printers

Kathy Yakal, Assistant Features Editor

New laser printers may be getting most of the high-technology headlines these days, but the marked improvement in dot-matrix printer capabilities is the most important news for many computer users. The emergence of near-letter-quality (NLQ) and even letter-quality (LQ) dot-matrix printers at reasonable prices is a trend that's offering computer users better printing at lower costs than ever before.

In the early days of personal computing, choices were limited when it came to picking a printer. Even dot-matrix printers with relatively few features and rough printing capabilities could be expensive and unwieldy. Of course, personal computers were also significantly more expensive then, so it didn't seem unreasonable that peripherals would also be a major expense.

When the home computer market exploded in the early 1980s, manufacturing costs for both computers and peripherals started to decrease. Numerous small companies began to manufacture printers for personal computers, and many existing consumer electronics companies added printers to their product lines.

Dot-matrix and thermal printers have been the most popular among personal computer owners, chiefly because their prices have been within the budget of many consumers. The first dot-matrix printers used a printhead consisting of a vertical row of stacked wires, usually in a 5 × 7 or 8 × 8 matrix pattern. These wires are hammered into an inked ribbon which then strikes the paper in various patterns to form different characters.

Thermal printers, which use heated wires to burn off a coating on special thermal paper, have also been relatively inexpensive, but require special paper that is flimsy and smears easily.

For many computer users, daisywheel printers have traditionally been too expensive, and their inability to print graphics characters has further limited their popularity in the home and educational markets. A daisywheel printer has a printhead composed of formed characters located on the ends of spokes—or petals—that emanate from a central, spinnable hub. Shaped much like a daisy, these printers give the most professional look to alphanumeric characters and have been popular—and affordable—in business.

Over the last couple of years, however, printing capabilities for personal computer owners have continued to improve. Dot-matrix printers today, even the least expensive, generally offer more features, faster speeds, and better quality. At the same time, dot-matrix printers using 24-pin printheads, previously considered a tool for business applications, have started to move downward in price and are now almost within the financial reach of home computer owners. Offering more features and flexibility, these high-quality dot-matrix printers are starting to compete for the consumer's attention. And they even threaten to make daisywheel printers obsolete for business purposes in the future.

A Good Business Tool

For now, however, the newest high-end dot-matrix printers have yet to become household items. "Twenty-four-pin printers at this time are going into the busi-

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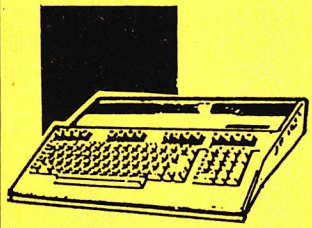
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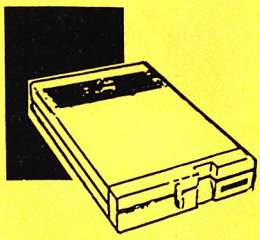
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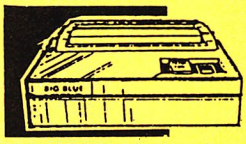
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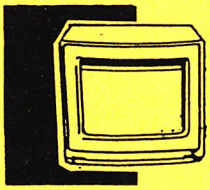
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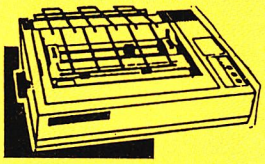
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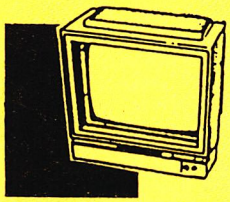


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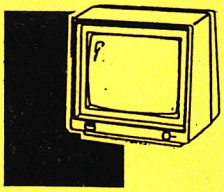


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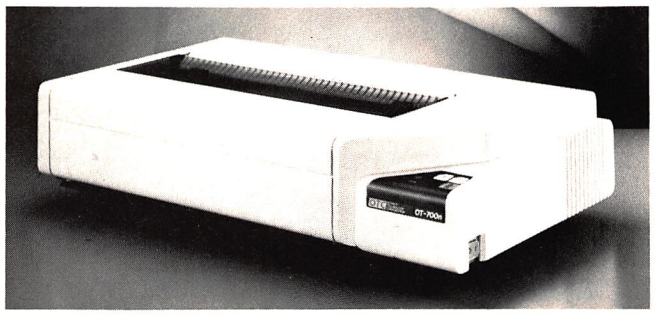
ness market," says Brian Kennedy, marketing manager for Star Micronics, a major printer manufacturer. "This is determined by the price. In general, they start at $900–$1,000, so this is not going to penetrate the consumer market too much."

Kennedy sees three strong points for these new dot-matrix models that make them competitive with daisywheel printers. First, for business correspondence, which has traditionally been geared toward a daisywheel printer, the new 24-pin printers have a letter-quality mode (as opposed to near-letter-quality mode on 9-pin printers) that is virtually indistinguishable from daisywheel print. In 99 percent of the cases, says Kennedy, people would accept it as a good vehicle for business correspondence.

Second, these new dot-matrix models offer the high speed that a daisywheel cannot provide. The average speed of a daisywheel is between 30 and 40 characters per second (cps), while 24-pin printers in letter-quality mode run around 100 cps. Plus, they offer higher speed draft printing for documents not requiring letter-quality type. Draft mode on some 24-pin printers can operate as fast as 300 cps.

Third, 24-pin printers offer high-resolution graphics. Daisywheels are limited to the characters on the printwheel.

Beyond those advantages, many 24-pin printers provide additional flexibility to the user. Juki Office Machines, which targets its 24-pin printers primarily to the business and government users, has printers that let you load and print sheets and envelopes at the same time. For example, the Juki Model 7200 also offers extremely high-resolution graphics (360 × 360), can print on forms as small as a business card or as large as 17 × 24–inch paper, and can operate under adverse conditions like high humidity. These capabilities make it competition not for 9-pin dot-matrix printers or daisywheels, but for highly sophisticated laser printers.

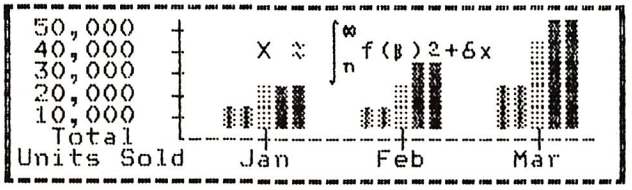


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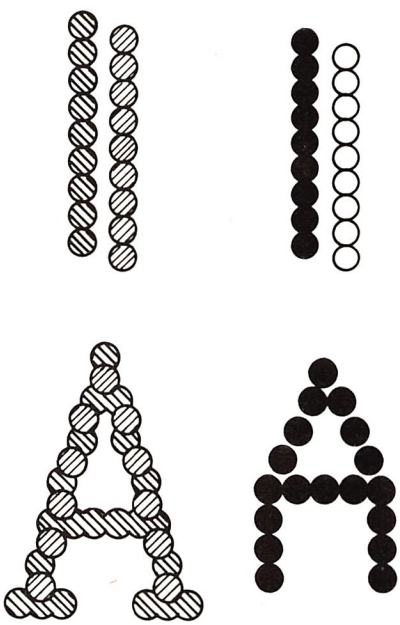
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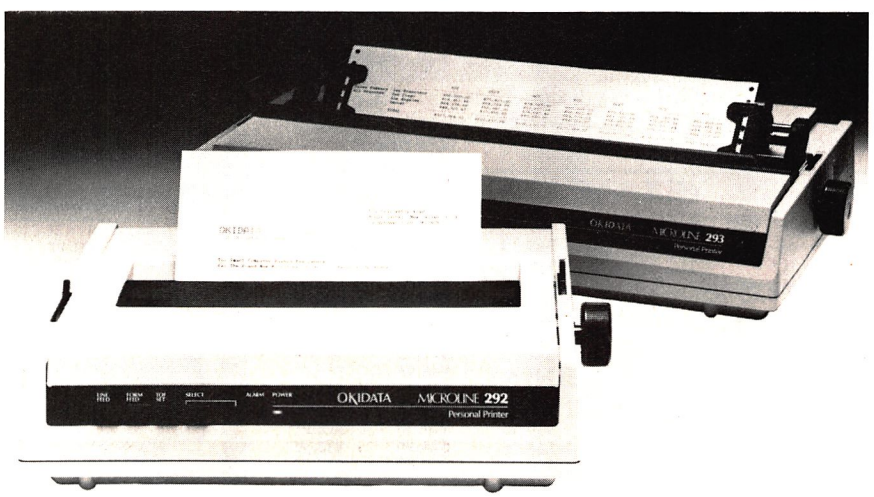
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The secret to Output Technologies' 700 series of printers is the unique Tri-Head printing mechanism. By using three nine-pin printheads that operate simultaneously, these printers can run at speeds of up to 700 characters per second. Prices begin at $1,995.



NLQ Mode

Utility Mode



Okidata's dot-matrix business printers offer high print quality using a dual nine-pin printhead. In NLQ mode, both columns of staggered print wires strike the ribbon to create overlapping dots and develop a fully formed character. Characters are formed in a single pass of the print line at one-half the rate of utility mode (100 cps). In utility mode, twice as many characters are formed in the same amount of time (200 cps). Only one column of print wires operates per print line to form draft characters without overlapping dots.

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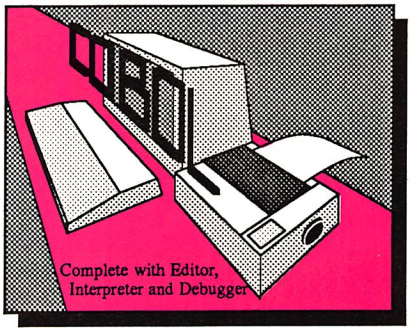
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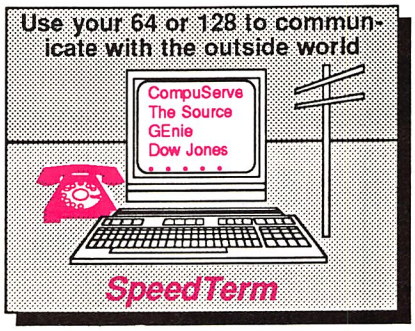
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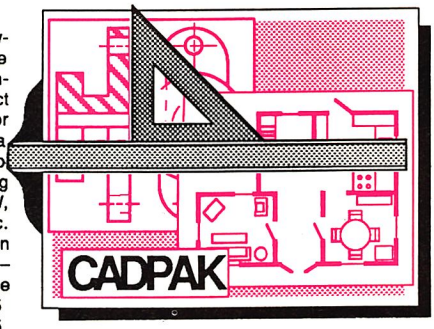
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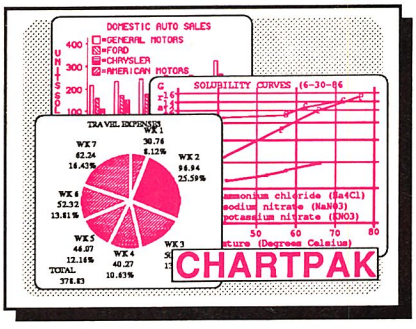
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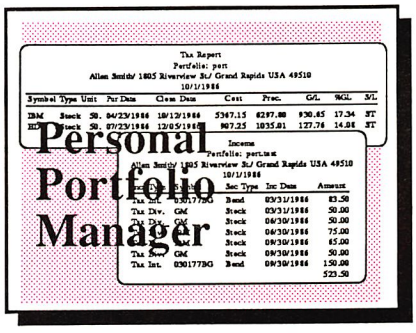
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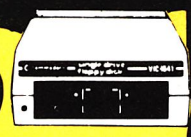
C-128



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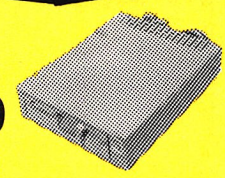
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$139

1541 COMMODORE

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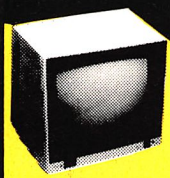
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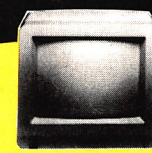
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Caught In-Between

The price and capabilities of 24-pin dot-matrix printers put them in a very interesting market position right now—somewhere between 9-pin printers and laser printers, and parallel in some ways to daisywheels. Though their strongest appeal may still be to the business market, consumer interest is beginning to pick up.

"The 24-pin market is really growing in both areas [business and consumer]," says Dennis Cox, peripherals product manager for Epson America, a large printer manufacturer. "You're getting higher performance 24-pins that are going into the business market, and they are taking away significant chunks of the daisywheel market. On the other side, moving down, they are going into more price-sensitive environments, which tend to be the home and small business."

The overlap with the lower end of the printer market comes between high-end 9-pin printers and low-end 24-pin printers. In the $600–$1,000 price range, both are represented. In the long run, one or the other will likely be bypassed. Representatives of leading printer manufacturers predict that high-end 9-pin printers will be replaced in that market position by low-end 24-pin printers and that most 9-pin printers will eventually sell for under $300 or $400.

Several other factors will also be affecting the printer market during the next couple of years. New *printer drivers*—the short software programs that allow your word processor, spreadsheet, or other application to send the right signals to different printers—will be written to take advantage of the 24-pin printers. Much of existing consumer software is compatible with 9-pin printers; 24-pin printer drivers will have to be widely available for those printers to become accepted by consumers.

Several years from now, color printers are likely to be a larger part of the market than at present. While not a necessity for the computer owner now, they have a long-term potential that will quickly be realized when color-capable photocopiers become widely available. The fast-growing popularity of specialized print packages like *The Newsroom* and *Print Shop* are making it more desirable. Any dot-matrix printer, no matter what the pin configuration, is technically capable of printing color with the right hardware and software setup. Twenty-four-pin printers have finer pins that offer sharper resolution. As color becomes more of an issue for the printer market, so will the quality of that color.

More immediately important is the recent introduction of inexpensive IBM PC clones into the U.S. market. Printer manufac-

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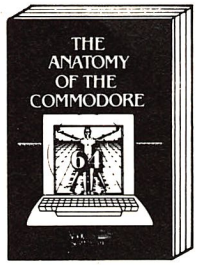
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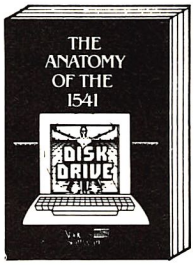
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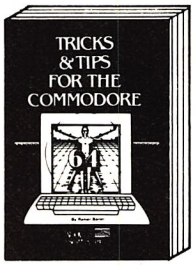
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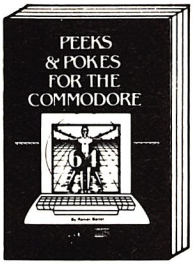
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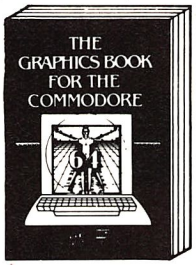
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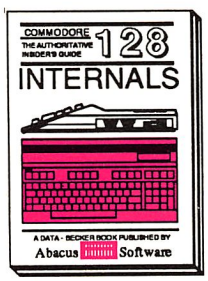
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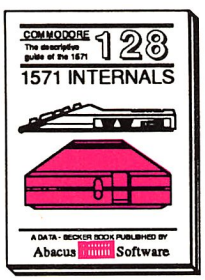
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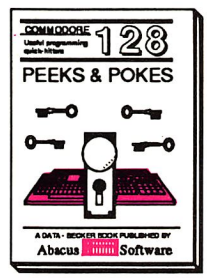
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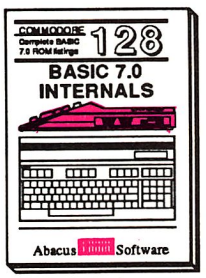
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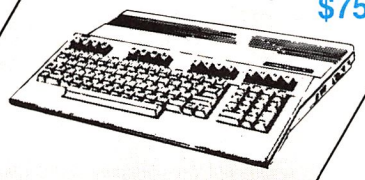
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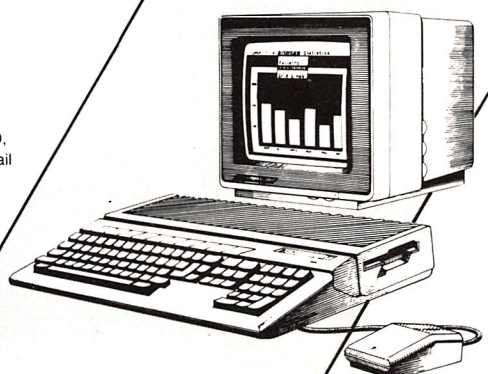
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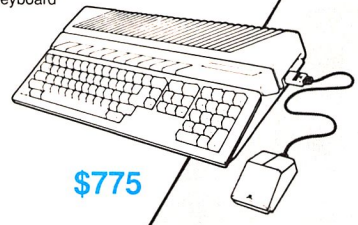
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turers have already started to see the effects from the proliferation of these machines into the consumer and business arenas, raising the demand for low-end printers even further. Some budget-conscious new owners may choose to buy the most inexpensive printer available, but those willing to spend $500–$1,000 will likely opt for one more fully featured.

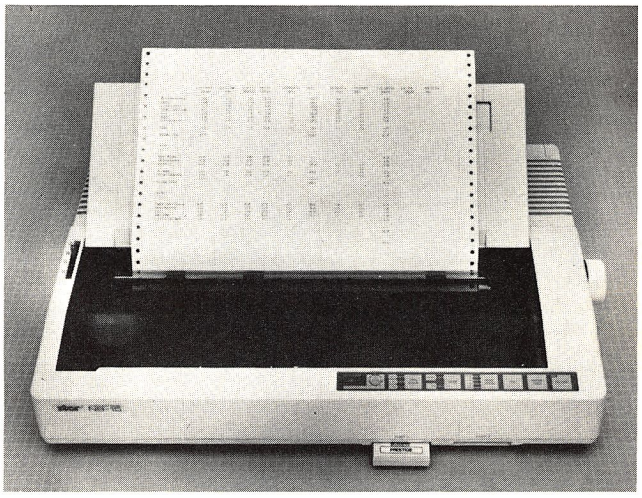
Other Technologies

Dot-matrix and daisywheel are not the only print technologies being used. *Ink-jet* printers, which form characters on paper by spraying ink through tiny tubes, are sold by several manufacturers. And light-emitting diode (LED) printers, which print through the use of tiny semiconductors that emit light when energized by a pulse of current, are also manufactured.

It's the laser printer, though, that most industry leaders look to as the printer of the future. Impeccable print quality and high-resolution graphics (generally 300 dots per inch) are the laser printer's forte. But the prohibitively high cost of such printers—$3,000–$6,000—has kept them almost exclusively in the business domain. Opinion is sharply divided as to whether they will ever play a major role in the consumer printer market, although some laser printers are already available for less than $2,000.

"I think it [the laser printer] will definitely be in the home of the future," says Star Micronics' Brian Kennedy. "Within about four years, you'll probably see them in the $500 price range, which would make them a consumer item. But I think there are other barriers to overcome before they're accepted in the consumer market, such as servicing. There's obviously some hesitancy on the part of people in general to approach lasers because they're not too sure from a servicing or maintenance standpoint what they're going to get from a laser."

Sal Sestito, national sales manager for Juki Office Machines, has a different viewpoint. "There's no consumer I can think of who needs a laser printer, either now or in the next ten years," he says. "I just don't see the technology of laser printers developing that fast and the price coming down that quickly to make it worthwhile. There's so much software for 9-pin and daisywheel printers—it would involve so much change that it's just not going to happen for a lot of years."



The Star Micronics NB-15 offers letter-quality printing at 100 cps and high-speed draft at 300 cps. In addition, the printer has a 15-inch-wide carriage and a 16K buffer. The NB-15 also features two slots for plug-in font cartridges, providing access to a wide range of character sets.

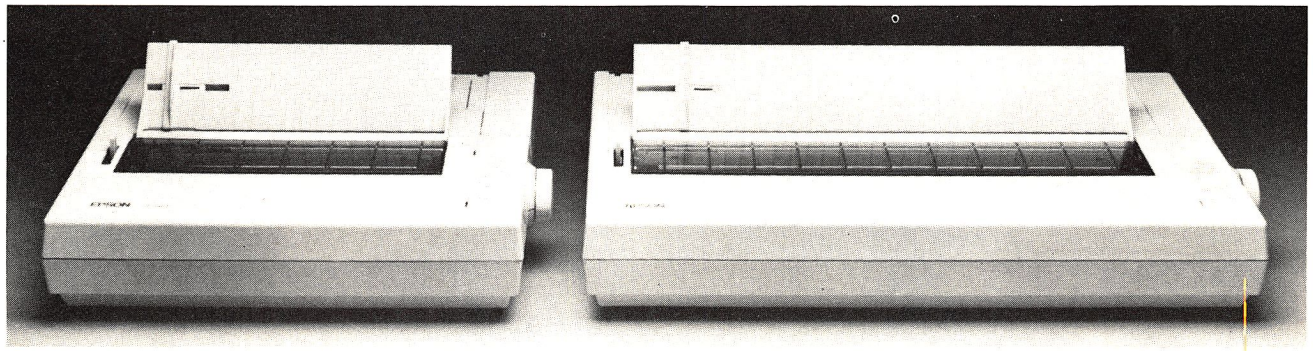
A Significant Impact

So for now, 24-pin printhead printers are carving an interesting niche in both the business and consumer markets, one that's only beginning to make a significant impact. "The 24-pin printers are starting to gain percentage in the overall share of the printer market [units sold]," says Epson's Dennis Cox.

"There's still a significant price difference between high-end 24-pin dot-matrix printers and entry-level low-cost laser printers," he says. "The lowest-priced laser is around $2,000, with the highest-end dot-matrix a little higher, and you're talking about different levels of functionality here."

"I think in the next year or so, 24-pins are going to steal the high-end 9-pin market away," says Kennedy. "Within the next five years, you're going to see the whole [impact] printer industry dominated by 24-pins."

Opinions are likely to remain divided over the future of the laser printer in the consumer marketplace. But what is no longer being debated is the remarkable performance of the latest wave of dot-matrix printers.



The LQ-800 and wide carriage LQ-1000 dot-matrix printers from Epson print drafts at 180 cps and business documents in letter-quality mode at 60 cps. These high-resolution 24-pin printers feature option cartridges that support extended Epson control codes or emulate IBM or Diablo 630 printers.



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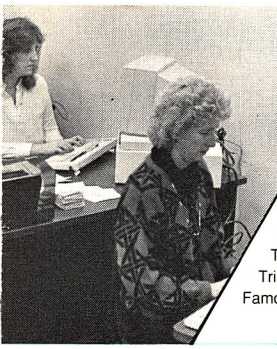
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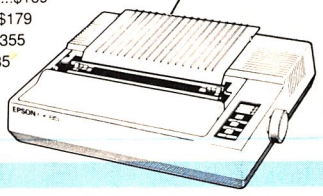
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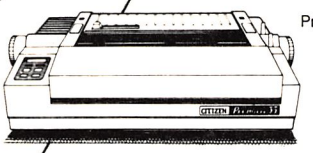


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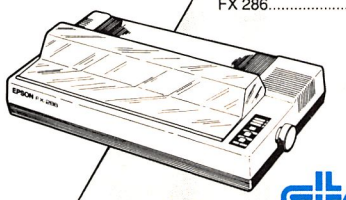
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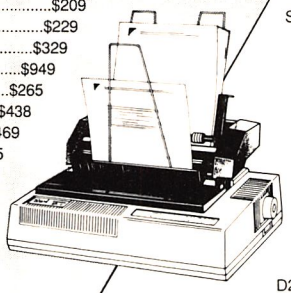


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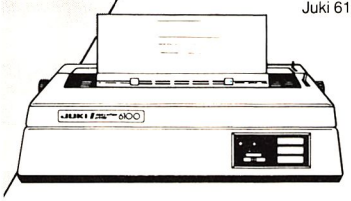
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Consumer Printer Outlook For 1987

The following list reveals some of the diversity and the overlapping price ranges for the major computer printer categories in the consumer market, based on interviews with printer manufacturers. Price ranges are approximate.

Laser Printers ($1,800–$6,000): Too early to predict consumer acceptance because of high price, lack of color capability, and perceived service problems. Opinion is divided as to whether there will ever be consumer need. The best projected application for 1987 is as a page printer for desktop publishing and other business needs. Prices will have to fall well below $1,000 before laser printers have a major impact in the consumer market.

High-End 24-Pin Printers ($1,000–$2,000): Good life expectancy for business use, but little consumer potential because of the price. These printers are faster and offer higher quality than low-end 24-pin printers. But prices will start to collide with low-end laser printers within the next year. These high-end 24-pin printers may prove more popular for business use than low-end laser units because of better resolution, color capability, easy operation, and more flexibility.

Low-End 24-Pin Printers ($600–$1,200): Good life expectancy for both business and consumer applications. These printers can be expected to have an impact in the consumer market because of decreasing prices, letter-quality print, speed, excellent graphics reproduction, and some color capabilities.

High-End 9-Pin Printers ($500–$1,000): A possibility that these will be phased out over the next year, or their prices will drop significantly. The prices are beginning to overlap with those of low-end 24-pin printers which offer more features and better quality.

Low-End 9-Pin Printers ($200–$600): These printers are expected to maintain a strong presence in the consumer market for the foreseeable future because of the low price, near-letter-quality capabilities, and capacity to print graphics. The popularity of low-cost IBM PC clones may also help to increase their sales in 1987.

Daisywheel Printers ($250–$1,400): Opinions on the future of daisywheel printers are mixed. Some manufacturers believe daisywheel printers, if inexpensive enough, may maintain a share of the business and consumer markets where color and graphics aren't necessary. Others predict that low-end 24-pin dot-matrix printers will push them out of the market in the next year or so. ©

The BIG Picture

Advances In Screen Display

Selby Bateman, Features Editor

Perhaps you're used to staring at the 64,000 picture elements, or *pixels*, that make up a Commodore 64 screen, or the 53,376 pixels on an Apple II screen. Or, maybe you're more familiar with the 174,104 pixels on a Macintosh or the 256,000 pixels in the high-resolution monochrome mode of the Atari ST or the normal-mode high resolution of the Amiga.

Whatever your computer, you're accustomed by now to its screen resolution, its sharpness, which is based in large part on the number of pixels that can be crowded onto the screen. The Commodore 64, for example, has a maximum screen resolution of 320 pixels high by 200 pixels wide—hence the total of 64,000. The Macintosh's monochrome display is 512 × 342, the Apple II series is 278 × 192, and the ST and Amiga computers have 640 × 400 capabilities. Although video displays depend on other factors besides pixels to determine the final output, it's the tiny pixel itself which has the most to do with what you see.

Now, however, new video display monitors are being produced that can put almost *two million pixels* on the screen at a time. Monochrome displays with

resolutions of 1664 × 1200 are now being offered, opening up a wide range of new possibilities for computer users.

"From the old days of computers, the 24 lines × 80 columns–displays represent a mature and extremely inexpensive technology," says Steve Gibson, president of Gibson Research, and a pioneer in computer display technology. "We've seen a direct...translation of that technology into our homes and personal computers. But the ultimate destiny is to very high resolution, large screens—and I mean for *everyone*.

"In the future, all computer screens will look like big-screen Macintoshes," he says. "When you see that much information on your screen, you get a better feel for it."

The first examples of large screen, high-resolution graphics are occurring in the burgeoning field of desktop publishing. Monitor manufacturers are building screen display devices that can present the user with screens of what-you-see-is-what-you-get pages, whether they're from a book, a newsletter, a pamphlet, or even a newspaper.

Complete Vision

When you can display 1200 lines of information with more than 1660 dots per line on one screen, amazing things begin to happen. Rather than looking at stair-stepped, blocky, diagonal lines, suddenly you can see shaded, perfectly straight diagonals. Digitized pictures can seem almost as real as those on your television set. And most importantly, you can manipulate entire pages of information while seeing the big picture—the overall impact on what is going to be printed out.

These new display monitors are expensive—anywhere from $600 to $2,000, depending on the size and quality of the units. But, Gibson points out, prices will begin to fall just as they have for computers and other electronics equipment.

"The price is the determiner. If they were inexpensive now, everyone would have them," he says. "That will happen first in desktop publishing within large corporations, where they really have a need for that kind of a screen. Then it will slowly migrate downward as economies of scale bring the price down lower."

Sigma Designs of Fremont, California, recently introduced its LaserView Display System for use with PC, XT, and AT computers. Aimed at the desktop publishing and computer-aided-design markets, LaserView consists of a high-resolution adapter board and a choice of a 15-inch ($1,895) or a 19-inch ($2,395) monochrome monitor. They display 150 and 110 dots per inch, respectively, which, when combined with four shades of gray, provides an effective perceived resolution close to the 300 dots per inch available from most current laser printers.

"This is the first time that close to two million pixels can be brought to the desktop publishing world, a resolution equivalent to 8 times that of an EGA (IBM's Extended Graphics Adapter) display and 11 times that of a Macintosh screen," says Thinh Tran, president of Sigma Designs.

Princeton Graphic Systems of Princeton, New Jersey, has just introduced its LM-300 high-resolution display. The $750 unit, which is compatible with the PC, XT, AT, and compatibles, offers 1200 lines by 1664 dots-per-line resolution on a 15-inch display. The LM-300 also emulates 300 dots per inch.



The LM-300 high-resolution monitor from Princeton Graphic Systems is one of a new breed of display devices capable of putting almost two million pixels on a computer screen.

One of the problems that designers of these new display devices are battling is simple human physiology—what Gibson calls the *flicker threshold*. If the screen, which is constantly redrawn—or *refreshed*—with a beam of electrons, is refreshed less than 60 times a second, the human eye picks up the flickering of the constant redrawing.

"It turns out that 60 cycles per second is around that threshold," says Gibson. "For example, we don't see flicker in a fluorescent light, even though it's really off half the time and on half the time. But [on the new hi-res display devices], in order to get the kind of resolution for realtime displays, you have to put out phenomenally fast data to paint incredibly more scan lines that are also crammed with more individual pixels."

Gibson believes that as more and more pixels are placed in displays, the old CRT (cathode ray tube) technology still being used may give way to new high-contrast liquid crystal displays (LCD) or similar technologies now under development. While most of us may not be buying the new high-resolution displays for a few years—at least until the prices come down significantly—it seems inevitable that their advantages will soon force them in the direction of all computer users. ©

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A Buyer's Guide To Printers

There are many good computer printers available this year for a variety of applications. Whatever your computer, chances are good that you'll find a printer listed below that will more than meet your needs.

To help you gather the information you'll need to make the best buying decision, we've gathered information on printers in the under-$800 price range and listed some of the most important features in the following chart. New printers are being introduced continually from major manufacturers, so it's possible that a few of the newest printers will not appear in our buyer's guide.

Here's a brief explanation of the major categories on the chart:

Compatibility. Chances are your computer has either a serial or parallel port (or both) that hooks up to a printer. Some printers come in either serial or parallel versions; some offer both interfaces; and some are available in parallel or serial only. If the printer you want comes only in a version that doesn't support your computer, you should be able to buy a separate interface that allows that configuration. Also, many printer manufacturers sell interfaces designed specifically for certain computers, avoiding any compatibility problems.

Be careful here. In some situations, a particular interface will let you print text, but will be incapable of producing graphics. If there's any doubt, it's best to try and test your setup at a computer dealer.

Print technology. This refers to how characters and graphics are actually transferred from printer to paper. There are three types in this price range: impact, thermal, and ink-jet.

Impact printers form characters by striking the paper through an inked ribbon, either with a *daisywheel* (a small wheel whose spokes have letters and numbers on their tips), or with a printhead containing a column of tiny wires or pins that form characters and graphics *(dot-matrix). Thermal* printers use either a column of hot pads that change the color of heat-sensitive paper, or a column of tiny spark plugs that evaporate a special aluminum coating onto the paper, exposing an underlying dark surface. Thermal printers require special paper, which often costs more than regular paper and has a shorter life. *Thermal transfer* printers work with any kind of paper because they use ribbons; heat from the printhead melts a waxlike ink onto the paper. *Ink-jet* printers spray ink onto the paper through tiny holes.

Speed. How fast does the printer operate? This can vary if the printer offers different modes. *Draft mode* is usually the fastest, but produces rougher, fainter type. *Near letter quality (NLQ),* or *correspondence mode,* takes longer to print, but looks more polished. Some printer speeds vary depending on the type of *font* (for example, pica or elite) used. In our chart, a wide speed range, like 30–120 characters per second (cps), indicates that the printer offers some kind of correspondence-quality type.

Pitch. This indicates how many characters fit on a line, measured in characters per inch (cpi) or characters per line (cpl). The pitch range for a printer often varies greatly, especially if it is capable of printing several types of fonts.

Buffer. A buffer is an area of memory in a printer that can store a fixed amount of text while the printer is working, freeing up the computer for other tasks. Most printers in the under-$800 price range still have rather small buffers, so if you'll be doing many long printing jobs, you may want to consider buying an add-on buffer.

Feed type. *Friction-feed* printers grip the paper and move it around the platen much as a typewriter does, while *tractor-feed* printers have teeth at both ends of the platen that grab holes at the edges of continuous-feed paper. Many printers have optional tractors.

Suggested retail price. This is the price set by the manufacturer; you may well find it at a lower price if you shop around.

A full explanation of the graphics capabilities of each printer takes more space than we have available. If you plan to use your printer extensively for printing graphics, make sure it's capable of doing what you need before you buy.

For more information on any of the printers listed in the following chart, please contact:

Alphacom
2108 Bering Dr., Unit C
San Jose, CA 95131

Alps America
3553 N. 1st St.
San Jose, CA 95134

Apple Computer
Customer Relations Department
20525 Mariani Ave.
Cupertino, CA 95014

Aprotek
1071-A Avenida Acaso
Camarillo, CA 93010

Axonix
417 Wakara Way
Salt Lake City, UT 84108

Blue Chip Electronics
2 W. Alameda Dr.
Tempe, AZ 85282

Brother International
8 Corporate Pl.
Piscataway, NJ 08854

C. Itoh Digital Products
19750 S. Vermont Ave.
Suite 220
Torrance, CA 90502

CAL-ABCO
6041 Variel Ave.
Woodland Hill, CA 91367

Canon USA
System Division
One Canon Plaza
Lake Success, NY 11042

Centronics Data Computer
1 Wall St.
Hudson, NH 03051

Citizen America
2425 Colorado Ave. #300
Santa Monica, CA 90404

Commodore Business Machines
1200 Wilson Dr.
West Chester, PA 19380

Dataproducts
6200 Canoga Ave.
Woodland Hills, CA 91365

Dynax
6070 Rickenbacker Rd.
Commerce, CA 90040

Edwards-CPE
Manufacturers of Axiom Printers
1014 Griswold Ave.
San Fernando, CA 91340

Continued on page 45.

Model Name	Manufacturer/ Distributor	Compatibility	Print Technology	Speed	Pitch	Buffer	Feed Type	Warranty	Suggested Retail Price	Comments
Alpha 42	Alphacom	Parallel or serial std	Thermal	2 lines/sec	10–15 cpi	1 line	Friction std	6 months	180	
Alpha 81	Alphacom	Parallel or serial std	Thermal	2 lines/sec	10–15 cpi	1 line	Friction std	6 months	169	80-column
Alphacom Aero	Alphacom	Parallel or serial std	Dot matrix	130 cps	5–16.5 cpi	2K	Friction and pin std	6 months	299	Dot-addressable and fully programmable graphics
Alphapro 101	Alphacom	Parallel or serial std	Daisywheel	20 cps	10–15 cpi	93 characters	Friction std	6 months	399.95	
ALQ 200	Alps America	Parallel std; serial opt	Dot matrix	80–240 cps	10–20 cpi	7K (64K opt)	Friction and cut-sheet feeder std; tractor opt	1 year	595	Interchangeable 18- and 24-pin printheads
Image Writer	Apple Computer	Serial std	Dot matrix	120 cps	4.5–17 cpi	32K available	Friction or tractor std	90 days	749	Wide carriage
Image Writer II	Apple Computer	Compatible with Apple II, III, Lisa	Dot matrix	180–250 cps	4.5–17 cpi	32K available	Friction and adjustable-width pin std; cut-sheet feeder opt	90 days	595	
Scribe	Apple Computer	Serial std	Dot matrix	50–80 cps	10–17 cpi	N/A	Tractor std	90 days	299	
Aprotek Daisy 1120	Aprotek	Parallel std; serial opt	Daisywheel	20 cps	10–15 cpi and proportional	2K	Friction std; tractor and cut-sheet feeder opt	1 year	279.95	Two-week trial available
SP-1000	Aprotek	Parallel or direct connect; IBM standard	Dot matrix	20–70 cps	10–15 cpi	1.5K	Friction and tractor std	2 years	169.95	Dot-addressable graphics; Commodore graphics built-in on Commodore version ($219.95)
Blue Chip 120/NLQ	Blue Chip Electronics	Parallel std	Dot matrix	120 cps	5–17 cpi	3 lines	Tractor std	6 months	279	
D12/10	Blue Chip Electronics	Commodore serial std	Daisywheel	12 cps	10 cpi	2K	Friction std; tractor opt	6 months	249	Comes with *Fleetwriter III* wordprocessor
D20/10	Blue Chip Electronics	Parallel and Commodore serial std	Daisywheel	20 cps	10 cpi	2K	Friction std; tractor opt	6 months	279	Comes with *Fleetwriter III* wordprocessor
M 120/10	Blue Chip Electronics	Parallel std; serial opt	Dot matrix	120 cps	5–17 cpi	3 lines (4K opt)	Friction and tractor std	6 months	229	Dot-addressable graphics
M 150/15	Blue Chip Electronics	Parallel std; serial opt	Dot matrix	130 cps	5–17 cpi	2K	Friction and tractor std	6 months	349	Dot-addressable graphics
HR-10	Brother International	Parallel and serial std	Daisywheel	12 cps	10–15 cpi and proportional	2K	Friction and tractor std	90 days	349	
HR-20	Brother International	Parallel and serial std	Daisywheel	22 cps	10–15 cpi and proportional	8K (16K opt)	Friction and tractor std; cut-sheet feeder opt	90 days	499	
M-1109	Brother International	Parallel and serial std	Dot matrix	25–100 cps	10 cpi	2K	Friction std; tractor opt	1 year	299	
M-1409	Brother International	Parallel std; serial opt	Dot matrix	45–180 cps	10–12 cpi and proportional	3K	Friction and tractor std; cut-sheet feeder opt	90 days	479	
M-1509	Brother International	Parallel and serial std	Dot matrix	45–180 cps	10 cpi	3K	Friction and tractor std; cut-sheet feeder opt	1 year	599	Seven bit-image graphics modes
M-1709	Brother International	Parallel and serial std	Dot matrix	50–240 cps	10 cpi	24K	Friction and tractor std; cut-sheet feeder opt	90 days	699	Seven bit-image graphics modes
Prowriter Jr.	C. Itoh	Parallel std; serial opt	Dot matrix	20–120 cps	10–17 cpi	1 line	Friction and tractor std	1 year	349	
Prowriter C-210XP	C. Itoh	Parallel std; serial opt	Dot matrix	45–180 cps	10–20 cpi	10K	Friction and tractor std	1 year	529	Epson SX80+ and IBM Proprinter compatible
Prowriter C-215XP	C. Itoh	Parallel std; serial opt	Dot matrix	45–180 cps	10–20 cpi	10K	Friction and tractor std	1 year	679	
Prowriter C-310XP	C. Itoh	Parallel std; serial opt	Dot matrix	33–300 cps	10–15 cpi	2K	Friction and tractor std	1 year	649	
Y10-20	C. Itoh	Serial or parallel std	Daisywheel	22 cps	10–15 cpi	2K	Friction std; tractor opt	1 year	549	
Legend 808	CAL-ABCO	Parallel std	Dot matrix	50–100 cps	5–17 cpi	1 line	Friction and tractor std	90 days	199	Bit-image graphics
Legend 1080A	CAL-ABCO	Parallel std; serial opt	Dot matrix	70–140 cps	5–17 cpi	1 line (4K opt)	Friction and tractor std	90 days	295	Five switch-selectable modes including NLQ
Legend 1380	CAL-ABCO	Parallel std; serial opt	Dot matrix	160 cps	5–17 cpi	2K (4K opt)	Friction and tractor std	90 days	345	10-inch version of 1385
Legend 1385	CAL-ABCO	Parallel std; serial opt	Dot matrix	160 cps	5–17 cpi	2K (4K opt)	Friction and tractor std	90 days	395	

Model Name	Manufacturer/ Distributor	Compatibility	Print Technology	Speed	Pitch	Buffer	Feed Type	Warranty	Suggested Retail Price	Comments
A-40	Canon USA	Parallel std	Dot matrix	27–140 cps	10 cpi	1.4K	Friction and tractor std	1 year	349	
A-50	Canon USA	Parallel std; serial opt	Dot matrix	34–180 cps	10 cpi	2K	Friction and tractor std; forms guide opt	1 year	499	Epson FX compatible
A-55	Canon USA	Parallel std	Dot matrix	27–140 cps	10 cpi	1.4K	Friction and tractor std; forms guide opt	1 year	699	17-inch carriage
A-60	Canon USA	Parallel or serial std	Dot matrix	100–200 cps	10–17 cpi	8.5K	Friction and tractor std	1 year	649	10-inch carriage
A-65	Canon USA	Parallel std	Dot matrix	134–200 cps	10–17 cpi	8.5K	Friction and tractor std	1 year	769	14-inch carriage
BJ-80	Canon USA	Parallel std	Bubble jet	110–220 cps	10 cpi	2–4.3K	Pin std	1 year	679	Cross between ink jet and thermal transfer
BJ-80 serial	Canon USA	Serial std	Bubble jet	110–220 cps	10 cpi	2–4.3K	Pin std	1 year	729	Cross between ink jet and thermal transfer
PJ-1080A	Canon USA	Parallel std	Ink jet (color)	37 cps	12 cpi	1 line	Friction std	1 year	699	
GLP II	Centronics	Parallel and serial std	Dot matrix	25–100 cps	5–17 cpi	N/A	Cut-sheet and fan-fold std	1 year	279	IBM PC block and pin-addressable graphics
H-80	Centronics	Parallel std; serial opt	Dot matrix	27–160 cps	5–20 cpi	2K opt	Cut-sheet and fan-fold std	1 year	699	
HPC-80B	Centronics	Parallel std; serial opt	Dot matrix	34–180 cps	5–20 cpi	2K opt	Cut-sheet and fan-fold std	N/A	699	Pin-addressable and block graphics
Printstation 220	Centronics	Parallel and serial std	Dot matrix	45–180 cps	5–20 cpi	3K	Friction, tractor std; cut-sheet feeder opt	N/A	599	
Citizen 120D	Citizen America	Parallel std; serial opt	Dot matrix	50–100 cps	10–12 cpi	8K	Friction and tractor std; cut-sheet feeder opt	18 months	499	Can create own graphics
MSP-10	Citizen America	Parallel std; serial opt	Dot matrix	40–160 cps	10–12 cpi	1K	Friction and tractor std; cut-sheet feeder opt	18 months	399	Emulates IBM graphics
MSP-15	Citizen America	Parallel std; serial opt	Dot matrix	40–160 cps	10 cpi	1K	Tractor and friction std; cut-sheet feeder opt	18 months	599	
MSP-20	Citizen America	Parallel std; serial opt	Dot matrix	50–100 cps	10–12 cpi	8K	Friction and tractor std; cut-sheet feeder opt	18 months	499	Can create own graphics
MSP-25	Citizen America	Parallel std; serial opt	Dot matrix	50–100 cps	10–12 cpi	8K	Friction and tractor std; cut-sheet feeder opt	18 months	749	Can create own graphics; 136-character column; wider carriage than MSP-20
Premiere 35	Citizen America	Parallel std; serial opt	Daisywheel	35 cps	10–15 cpi	8K	Tractor std	1 year	699	Diablo print wheel
MPS 1200	Commodore Business Machines	Two Commodore serial ports	Dot matrix	24–120 cps	5–20 cpi	2K	Friction and tractor std	90 days	299.95	Eight different graphics densities
FORTIS DX-15XL	Dynax	Parallel std; serial opt	Daisywheel	20 cps	10–15 cpi	5K	Friction std; cut-sheet feeder and tractor opt	90 days	599	
FORTIS DX-21	Dynax	Parallel and serial std	Daisywheel	25 cps	10–15 cpi	16K	Friction std; cut-sheet feeder and tractor opt	90 days	499	
FORTIS DM-2010	Dynax	Parallel std; serial opt	Dot matrix	50–200 cps	10–17 cpi	7K (8K opt)	Friction and tractor std; cut-sheet feeder opt	90 days	459	Graphics capabilities; wide-carriage model available for $559
DX 1500	Edwards-CPE	Parallel std	Daisywheel	14 cps	10–12 cpi and proportional	2K	Friction std; tractor and auto cut-sheet feeder opt	1 year	349	
DX 2000	Edwards-CPE	Parallel std	Daisywheel	20 cps	10–15 cpi and proportional	2K	Friction std; tractor opt	1 year	449	
DX 2500	Edwards-CPE	Parallel std; serial opt	Daisywheel	20 cps	10–15 cpi and proportional	2K	Friction std; tractor opt	1 year	499	
DX 3500	Edwards-CPE	Parallel and serial std	Daisywheel	35 cps	10–15 cpi and proportional	2K	Friction std; tractor opt	1 year	699	
Thin Print 80P/80S	Edwards-CPE	Parallel or serial std	Thermal transfer dot matrix	40 cps	10–17 cpi	2K	Friction std	90 days	339	High-resolution graphics; portable (battery powered), AC adapter included
Thin Print 100	Edwards-CPE	Parallel or serial std	Thermal transfer dot matrix	25–100 cps	10–17 cpi	2K	Friction std	90 days	299	
Thin Write 100	Edwards-CPE	Parallel and serial std	Dot matrix	25–100 cps	5–17 cpi	4K	Friction and pin std; tractor opt	90 days	479	

Model Name	Manufacturer/ Distributor	Compatibility	Print Technology	Speed	Pitch	Buffer	Feed Type	Warranty	Suggested Retail Price	Comments
AP-80	Epson America	Apple exclusive	Dot matrix	15–75 cps	9–17 cpi	1K	Friction and tractor std; auto cut-sheet feeder opt	1 year	379	
DX-10	Epson America	Parallel std	Daisywheel	10 cps	10–12 cpi	None	Friction std; tractor and cut-sheet feeder opt	1 year	299	
DX-20	Epson America	Diablo all-purpose interface std	Daisywheel	20 cps	10–15 cpi	1K (7K opt)	Friction std; tractor and cut-sheet feeder opt	1 year	459	110 column
EX-800	Epson America	Parallel and serial std	Dot matrix	50–250 cps	10–12 cpi	8K (32K opt)	Friction, tractor, and single-sheet feeder std	1 year	749	IBM Proprinter emulation
FX-85	Epson America	Parallel std	Dot matrix	32–160 cps	N/A	8K	Friction and tractor std; cut-sheet feeder opt	1 year	549	
FX-286	Epson America	Parallel std	Dot matrix	40–200 cps	5–20 cpi	8K	Friction and tractor std; cut-sheet feeder opt	1 year	799	
HS-80	Epson America	Parallel std	Ink jet	32–160 cps	5–20 cpi	1K	Friction std; auto cut-sheet feeder opt	1 year	499	
LQ-800	Epson America	Parallel and serial std	Dot matrix	60–180 cps	10–15 cpi and proportional	7K	Friction std	1 year	799	24-pin printhead
LX-86	Epson America	Parallel std	Dot matrix	16–120 cps	10–12 cpi	1K	Friction std; tractor and cut-sheet feeder opt	1 year	349	
Facit 4509	Facit	Parallel std	Dot matrix	70–120 cps	10–17 cpi and proportional	None	Tractor std	90 days	425	IBM compatible graphics
Facit 4510	Facit	Parallel and serial std	Dot matrix	70–120 cps	10–17 cpi and proportional	2K	Friction and tractor std	90 days	495	Block and pin-addressable graphics
Facit 4511	Facit	Parallel and serial std	Dot matrix	40–160 cps	10–17 cpi and proportional	2K	Friction and tractor std	90 days	595	Wide-carriage version $795
Facit 4513	Facit	Parallel and serial std	Dot matrix	40–160 cps	10–17 cpi and proportional	2K	Friction and tractor std	90 days	695	
Facit B 3100	Facit	Parallel and serial std	Dot matrix	25 cps	10–17 cpi	up to 16K	Friction and tractor std	1 year	745	Color and graphics capabilities
Facit D 2000	Facit	Parallel or serial std	Daisywheel	24–30 cps	10–15 cpi and proportional	2K	Friction std; tractor opt	90 days	695	
DX2100	Fujitsu America	Parallel std; serial opt	Dot matrix	220 cps	10–17 cpi	2K (18K opt)	Friction and tractor std; cut-sheet feeder opt	1 year	545 (Color 695)	Dot-addressable graphics
DX2200	Fujitsu America	Parallel std; serial opt	Dot matrix	220 cps	10–17 cpi	7K (16K opt)	Friction and tractor std; cut-sheet feeder opt	1 year	695	
GE 8100	General Electric	Parallel std; Atari, Commodore and IBM PCjr interfaces available	Thermal transfer (nonimpact dot matrix)	25–50 cps	24 cpi	2K	Friction std	2 years	259.95	Block graphics; special graphics characters
MP-1300AI	Hattori Seiko	Parallel and serial std	Dot matrix, 9 pin	50–300 cps	10–20 cpi	10K	Friction and tractor std	2 years	699	Optional color printer kit for $155; graphics resolution up to 240 dpi
SL-80AI	Hattori Seiko	Parallel std	Dot matrix, 24 pin	45–135 cps	10–20 cpi	16K	Friction and tractor std	2 years	549	Graphics resolution up to 240 dpi
SP-1000	Hattori Seiko	Parallel or serial std	Dot matrix	20–100 cps	10–17 cpi and proportional	Varies with model	Friction and tractor std	2 years	299	Commodore/VIC version: $270
SP-1200AI	Hattori Seiko	Parallel std	Dot matrix, 9-pin	25–120 cps	10–17 cpi and proportional	2.3K (8K opt)	Friction and tractor std	2 years	319	Graphics resolution up to 240 dpi
Thinkjet (HP2225)	Hewlett-Packard	Parallel, HP-1B, HP-1L and serial available	Thermal ink jet	150 cps	5–18 cpi	1K	Friction and pin std	1 year	599	Best results using special paper; portable
QuietJet (HP2228A)	Hewlett-Packard	Parallel or serial	Thermal ink jet	40–160 cps	5–20 cpi	2K	Friction and pin std	1 year	599	Best results using special paper; portable; graphics capabilities; wide carriage model, QuietJet Plus, available for $799
MT85	Mannesmann Tally	Parallel, serial or Apple std	Dot matrix	45–180 cps	10–17 cpi	3K	Friction and tractor std	1 year	549	Dot-addressable graphics
MT86	Mannesmann Tally	Parallel, serial, or Apple std	Dot matrix	45–180 cps	10–17 cpi	N/A	Friction and tractor std	1 year	679	

Model Name	Manufacturer/ Distributor	Compatibility	Print Technology	Speed	Pitch	Buffer	Feed Type	Warranty	Suggested Retail Price	Comments
E.L.F. 350	NEC Information Systems	Parallel and serial std	Daisywheel	19 cps	10–15 cpi	2K	Cut-sheet guide std; cut-sheet feeder and tractor opt	1 year	545	
E.L.F. 360	NEC Information Systems	Parallel and serial std	Daisywheel	19 cps	10–15 cpi	2K	Cut-sheet guide std; cut-sheet feeder and tractor opt	1 year	545	
P60	NEC Information Systems	Parallel std	Dot matrix; 24 wire	65–180 cps	10–15 cpi	8K	Tractor std; cut-sheet feeder, bidirectional, unidirectional, cut-sheet guide opt	1 year	699	80-column
P65	NEC Information Systems	Serial std	Dot matrix	65–180 cps	10–15 cpi	8K	Tractor std; cut-sheet feeder, bidirectional, unidirectional, cut-sheet guide opt	1 year	775	20 resident fonts; graphics capabilities
Microline 182	Okidata	Parallel and IBM std; serial opt	Dot matrix	30–120 cps	5–17 cpi	1 line	Friction and pin std	1 year	339	Serial version, $399
Microline 182 TTY	Okidata	Parallel and IBM std; serial opt	Dot matrix	30–120 cps	5–17 cpi	1 line	Friction and pin std	1 year	389	Designed for communications applications; serial version, $449
Microline 183	Okidata	Parallel std; serial opt	Dot matrix	30–120 cps	5–17 cpi	1 line	Friction and tractor std	1 year	549	Wide-carriage version of 182; block and bit-image graphics
Microline 192+	Okidata	Parallel and IBM std	Dot matrix	40–200 cps	5–17 cpi	8K	Friction and pin std	1 year	499	Block and bit-image graphics
Microline 193	Okidata	Parallel and serial std	Dot matrix	33–160 cps	5–17 cpi	8K	Friction and tractor std	1 year	699	Wide-carriage version of 192; block and bit-image graphics
Microline 292	Okidata	Parallel or serial std	Dot matrix	100–200 cps	10–17 cpi	8K	Pin std; tractor and cut-sheet feeder opt	1 year	699	
Okidata 120	Okidata	Commodore serial	Dot matrix	30–120 cps	5–17 cpi	1 line	Friction and pin std	1 year	269	All-points-addressable graphics; Commodore Special Graphics
Okimate 20	Okidata	IBM, Apple and Amiga	Dot matrix	40–80 cps	5–17 cpi	8K	Friction and tractor std	90 days	268	High-resolution, all-points-addressable, bit-image graphics
KX-P1080I	Panasonic	Parallel std; serial opt	Dot matrix	24–120 cps	10–17 cpi	1K	Friction and tractor std	2 years	329	Enhanced IBM graphics; 9-pin printhead
KX-P1091I	Panasonic	Parallel std; serial opt	Dot matrix	32–160 cps	10–17 cpi	1K (4K opt)	Friction and tractor std	2 years	429	IBM Proprinter compatible; word processing capabilities
KX-P1092I	Panasonic	Parallel std; serial opt	Dot matrix	48–240 cps	10–12 cpi and proportional	7K	Friction and push tractor std	2 years	549	IBM Proprinter compatible; wide carriage
KX-P1592	Panasonic	Parallel std; serial opt	Dot matrix	38–180 cps	10–17 cpi and proportional	7K (32K opt)	Push tractor or friction std	2 years	699	Color ribbons available
KX-P3131	Panasonic	Parallel std; serial opt	Daisywheel	17 cps	N/A	6K (32K opt)	Friction std; tractor and auto cut-sheet feeder opt	2 years	419	Diablo 630 code compatible; color ribbons available
KX-P3151	Panasonic	Parallel std; serial opt	Daisywheel	22 cps	10–12 cpi	7K (54.5K opt)	Friction std; tractor and cut-sheet feeder opt	2 years	659	
RP2200Q	Ricoh	Parallel and serial std	Daisywheel	20–22 cps	10–15 cpi	One line	Friction std; auto cut-sheet feeder and tractor opt	90 days	699	
EXP 420	Silver-Reed	Parallel or serial std	Daisywheel	10 cps	10–12 cpi	None	Friction std	90 days	299.95	
EXP 600	Silver-Reed	Parallel or serial std	Daisywheel	25 cps	10–15 cpi and proportional	3K (19K and 40K opt)	Friction std; tractor and cut-sheet feeder opt	90 days labor; 1 year parts	699	Dual bin feeder; emulates Diablo 630
Gemini II	Star Micronics	Commodore-specific	Dot matrix	30–120 cps	5–17 cpi	1 line	Tractor std	1 year	329	
NL-10	Star Micronics	Parallel std	Dot matrix	30–120 cps	5–17 cpi	1 line	Tractor std; cut-sheet feeders opt	1 year	319	Additional cost for interface
NP-10	Star Micronics	Parallel std	Dot matrix	25–100 cps	5–20 cpi	2K	Friction and tractor std	1 year	279	
NX-10	Star Micronics	Parallel std	Dot matrix	30–120 cps	5–10 cpi	5K	Friction and tractor std	1 year	349	Emulates IBM graphics printer
NX-10C	Star Micronics	Commodore serial std	Dot matrix	30–120 cps	5–17 cpi	1 line	Friction and tractor std	1 year	349	
Powertype	Star Micronics	Parallel std; serial opt	Daisywheel	18 cps	10–15 cpi and proportional	1 line	Friction std; tractor opt	180 days	499	
SB-10	Star Micronics	Parallel std	Dot matrix	60–144 cps	5–16.7 cpi	1 line	Cut-sheet feeder std	1 year	749	

Model Name	Manufacturer/ Distributor	Compatibility	Print Technology	Speed	Pitch	Buffer	Feed Type	Warranty	Suggested Retail Price	Comments
SD-10	Star Micronics	Parallel std; serial opt	Dot matrix	160 cps	5–17 cpi	2K	Friction and tractor std	1 year	449	Ultra-high-resolution bit-image graphics
SD-15	Star Micronics	Parallel std; serial opt	Dot matrix	160 cps	5–17 cpi	16K	Friction and tractor std	1 year	599	
SR-10	Star Micronics	Parallel std; serial opt	Dot matrix	200 cps	N/A	2K	Friction, tractor, automatic cut-sheet feed std	1 year	649	
SR-15	Star Micronics	Parallel std; serial opt	Dot matrix	200 cps	N/A	2K	Friction, tractor, cut-sheet feeder std	1 year	799	15-inch carriage
STX-80	Star Micronics	Parallel std	Thermal transfer dot matrix	60 cps	5–11 cpi	1 line	Friction std	1 year	199	Dot-addressable, bit-image graphics
Compumate 2100	Swintec	Parallel and serial std	Daisywheel	16 cps	10–15 cpi	1 line	Friction std	90 days	599	
M-20P	TAB Products	Parallel std	Dot matrix	120 cps	10–15 cpi	1K	Friction std; pin tractor opt	90 days	299	Dot-addressable graphics
M-21S	TAB Products	Serial std	Dot matrix	120 cps	10–15 cpi	1K	Friction std; pin tractor opt	90 days	378	Dot-addressable graphics
M-22P	TAB Products	Parallel std	Dot matrix	160 cps	10–15 cpi	1K	Friction and pin std; tractor and cut-sheet feeder opt	90 days	499	Dot-addressable graphics
M-23S	TAB Products	Serial std	Dot matrix	160 cps	10–15 cpi	1K	Pin and friction std; cut-sheet feeder and tractor opt	90 days	578	
M-24P	TAB Products	Parallel std	Dot matrix	160 cps	10–15 cpi	1K	Tractor and friction std; cut-sheet feeder opt	90 days	699	
M-25S	TAB Products	Serial std	Dot matrix	160 cps	10–15 cpi	1K	Tractor and friction std; cut-sheet feeder opt	90 days	778	
DMP 105	Tandy	Parallel and serial std	Dot matrix	80 cps	10–17 cpi and proportional	N/A	Friction and tractor std	90 days	199.95	Bit-image graphics
DMP 130	Tandy	Parallel and serial std	Dot matrix	100 cps	10–16 cpi	N/A	Friction and tractor std	90 days	349.95	Bit-image graphics
DMP 430	Tandy	Parallel and serial std	Dot matrix	20–100 cps	10–16 cpi	N/A	Friction and tractor std	90 days	699	Bit-image graphics
DWP 230	Tandy	Parallel and serial std	Daisywheel	20 cps	10–12 and proportional	N/A	Friction std; tractor opt	90 days	399.95	
P321	Toshiba	Parallel and serial std	Dot matrix	72–216 cps	10–12	2K	Friction and cut-sheet feeder std; tractor opt	1 year	699	Dot-addressable graphics; 24-pin printhead
IMP-24	Weigh-Tronix	Parallel or serial std	Dot matrix	16.8 cps	N/A	1 line	Friction std	90 days	135 (24 cpl) 150 (32 or 40 cpl)	Dot-addressable graphics
Advantage D-25	Xerox/Diablo	Parallel or serial std	Daisywheel	25 cps	N/A	2K	Friction and tractor std	90 days	745	

Epson America
3415 Kashiwa St.
Torrance, CA 90505

Facit
9 Executive Park Dr.
P.O. Box 334
Merrimack, NH 03054

Fujitsu America
3055 Orchard Dr.
San Jose, CA 95134

General Electric
Electronics Park
Syracuse, NY 13221

Hattori Seiko Computer Peripherals
1111 Macarthur Blvd.
Mahwah, NJ 07430

Hewlett-Packard
Personal Computer Group
10520 Ridgeview Ct.
Cupertino, CA 95014

Mannesmann Tally
8301 S. 180th St.
Kent, WA 98032

NEC Information Systems
1414 Massachusetts Ave.
Boxborough, MA 01719

Okidata
532 Fellowship Rd.
Mt. Laurel, NJ 08054

Panasonic
Computer Products Division
One Panasonic Way
Secaucus, NJ 07094

Ricoh America
5 Dedrick Pl.
West Caldwell, NJ 07006

Silver-Reed America
19600 S. Vermont Ave.
Torrance, CA 90502

Star Micronics Peripheral Division
200 Park Ave.
Suite 2309
Pan Am Bldg.
New York, NY 10166

Swintec
320 W. Commercial Ave.
P.O. Box 356
Moonachie, NJ 07074

TAB Products
1400 Page Mill Rd.
Palo Alto, CA 94304

Tandy/Radio Shack
1800 One Tandy Center
Fort Worth, TX 76102

Toshiba American
Information Systems Division
2441 Michelle Dr.
Tustin, CA 92680

Weigh-Tronix
1000 N. Armstrong
Fairmont, MN 56031

Xerox/Diablo
901 Page Ave.
P.O. Box 5030
Fremont, CA 94537

©

Euchre

David Shimoda

Here's a finely detailed implementation of the popular card game of Euchre. The author originally wrote the program in Pascal on an IBM PC. He then translated the Pascal program to BASIC for the Commodore 64. We've supplied new BASIC translations for the Amiga, Apple II series, IBM PC/PCjr, and Atari 400, 800, XL, and XE. The IBM PC/PCjr version requires BASICA and a color/graphics adapter for the PC or cartridge BASIC for the PCjr. The Atari program requires a joystick. A joystick is optional for the Commodore 64 version.

"Euchre" is a four-handed translation of the popular card game of the same name. In this version, you play with a computer partner against two computer opponents. The computer will deal the cards, keep score, and play your partner's as well as your opponents' hands. Even better, it never gets bored or commits blunders such as trumping your ace. Nearly all the subtleties of the original card game are reproduced faithfully, including lone hands, short suits, and more. You can even choose different personalities for your partner and opponents. Type in the program for your computer and read the special-application notes before you run it.

Computer Personalities

The game begins by asking you to choose personalities for your partner and your opponents. Move the reverse-video cursor to your choices, and make selections by pressing the joystick button or the Return key.

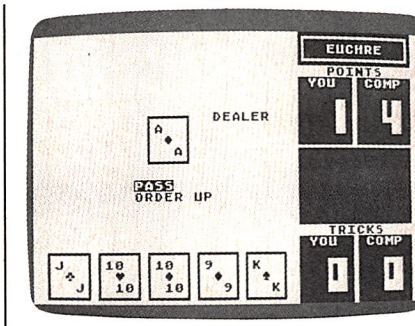
The normal personality plays a more cautious game, while the aggressive personality tends to take more risks. Both opponents must have the same personality, but the partner's personality is chosen separately. This makes the game much more varied than if the computer players always stick to the same, predictable strategy. One of the more difficult combinations is to choose a normal partner and aggressive opponents. Of course, your own style of play will have an impact on which combination you prefer.

Dealing And Trump

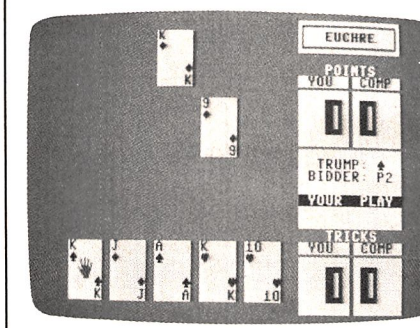
This Euchre variation uses only 24 cards from the standard 52-card deck. Each suit includes only the 9, 10, jack, queen, king, and ace. (The ace is high.) Before actual play begins, the first dealer must be selected. This is done by dealing out cards until a black jack is thrown. The first person who receives a black jack becomes the first dealer. After each hand, the position of dealer passes to the next player in clockwise order.

The dealer deals out 5 cards to each player and then places 1 card, face up, on the center of the table. The program automatically deals the cards, as it handles many other details in this game. As a consequence of this scheme, only 21 of the 24 cards are in play for any given hand. (Three cards are always left unplayed.)

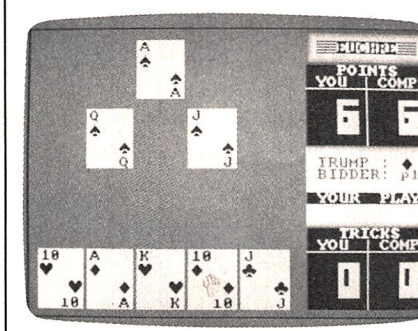
The next step is to choose *trump;* the trump suit is the most powerful of the four suits for the current hand. Trump is determined by moving around the table in clockwise order, giving each player an opportunity to choose whether the dealer should pick up the center card. Each player can either pass or *order up*—order the dealer to pick up the center card. When the dealer is forced to take the center card, that card's suit becomes trump, and the dealer discards one card. The computer players, of course, decide for themselves whether to pass or order up in this phase of the game.



"Euchre" for Atari 400, 800, XL, and XE computers.



"Euchre" for the Commodore 64 (and 128 in 64 mode) reproduces the subtleties of the familiar card game.



"Euchre" for the Amiga uses fine color scaling on a 32-color screen to dress up the playing field.

If no player chooses to order up in the first circuit of the table, each player then has a chance to pick any other suit as trump. If no player chooses trump on the second circuit, the hand is thrown out completely, and another is dealt.

Lone Hands

On certain occasions, a player may choose to exclude his partner from play, a tactic which is known as playing *lonehand*. The player who chooses trump must choose at the same time whether or not to play lonehand. If a player orders up a card into his partner's hand, the player who ordered up must play lonehand. (If your partner is the dealer and you order up, you must play lonehand).

For instance, you might want to play lonehand in a case where you hold most of the high cards in a suit, and your partner is the dealer, and the center card is a high card of your strong suit. By excluding your partner and playing lonehand, you are in a very strong position to take most or all of the tricks.

Tricks And Hands

A hand consists of five *tricks*. A trick consists of all players laying down one card. The player to the left of the dealer throws down the first card in the first trick. Subsequent tricks are begun by the winner of the previous trick. Suit must be followed within a trick. That is, you must throw a card of the suit which was led, as long as you have any card of that suit.

If no trump cards are thrown in a trick, the trick is won by the player who laid the highest card of the leading suit. If trump is thrown, then the highest trump card takes the trick.

For all suits except the trump suit, the rank of the cards follows the usual order. (The 9 is low, and the ace is high.) For the trump suit, however, the jack is the highest-ranking card. The jack of the same color, but different suit, is considered part of the trump suit—and it is the second highest ranking card. For example, if the trump suit is chosen as clubs, it follows this ranking:

jack of clubs
jack of spades
ace of clubs
king of clubs
queen of clubs
10 of clubs
9 of clubs

A hand is won by the side which wins a majority of tricks (three or more). If you or your partner orders up a card, your side must take the majority of tricks in that hand or else be *euchred*, meaning that the opposite side gets two extra points.

Scoring

A game of Euchre ends when one side accumulates ten or more points. You score one point for winning a hand, two points for winning all the tricks in a hand, and four points for winning all the tricks lonehand.

Commodore 64 Version

This version of Euchre (Program 1) can be played with either a joystick or the keyboard. To play with the keyboard, use the cursor keys to move the colored cursor, and press RETURN to make a selection.

Atari Version

The Atari version of Euchre (Program 2) runs on any Atari 400, 800, XL, or XE computer. It requires a joystick. Plug the joystick into port 1 before you run the program. The suits are all the same color, so you must remember that hearts and diamonds are red, while clubs and spades are black.

Apple II Version

Euchre for the Apple II runs on any computer in the Apple II series, under either ProDOS or DOS 3.3. The program consists of two files. The main program (Program 3) is written in Applesoft BASIC. It automatically loads a second file named EUCHRE.BIN which is used to create graphics. To create the EUCHRE.BIN file, enter the data from Program 4 using "Apple MLX," the machine language entry program printed elsewhere in this issue. When you run MLX, you'll be asked for a starting address and an ending address for the data. Here are the addresses you need for the EUCHRE.BIN file:

Starting address: 8CA8
Ending address: 91CE

For Program 3 to function properly, you must save the data from Program 4 with the filename EUCHRE.BIN.

The game is played with keyboard controls. Use the arrow keys and Return key to move the cursor and make selections.

IBM PC/PCjr Version

This version of Euchre (Program 5) requires color/graphics adapter hardware for the IBM PC and compatibles, and BASICA for the PC, or Cartridge BASIC for the PCjr. Move the cursor with the cursor keys, and press Enter to make selections.

Amiga Version

Euchre for the Amiga (Program 6) requires 512K of memory, and is played with keyboard controls, exactly like the IBM PC game.

For instructions on entering these programs, please refer to "COMPUTE!'s Guide to Typing In Programs" elsewhere in this issue.

Program 1: Commodore 64 Euchre

```
SK 10 GOSUB1100:GOSUB1000:GOSU
      B2700:GOSUB1300:GOSUB100
      00
SG 25 GOSUB2000
MS 30 IFTP<>4THEN70
QJ 35 POKEX,12:POKEY,30:SYSPLT
      :PRINT"{BLK}NO{2 SPACES}
      BIDS";
XQ 40 POKEX,13:POKEY,28:SYSPLT
      :PRINT"HAND{2 SPACES}DUM
      PED";
XG 50 GOSUB1400:FORI=0TO4:POKE
      X,19:POKEY,I*5+2:SYSPLT:
      PRINTEC$;:NEXT
XP 51 DL=FNNP(DL):POKEX,7:POKE
      Y,12:SYSPLT:PRINTEC$;
DH 55 GOSUB1900:GOTO25
FR 70 POKEX,12:POKEY,30:SYSPLT
      :PRINT"{BLK}TRUMP: "CO$(
      TP)S$(TP);
JJ 75 POKEX,13:POKEY,29:SYSPLT
      :PRINT"{BLK}BIDDER:";:IF
      BD=0THENPRINT"YOU";:GOTO
      90
EF 80 PRINT" P"RIGHT$(STR$(BD)
      ,1);
ES 90 PRINT"{BLU}";:IFKU=0THEN
      135
AX 100 IFDL>0THEN125
KM 115 POKEX,15:POKEY,28:SYSPL
       T:PRINT"{BLK}PICK DISCA
       RD";
FD 121 GOSUB2200:POKEX,15:POKE
       Y,28:SYSPLT:PRINT"{BLU}
       {12 SPACES}";:GOTO130
XM 125 GOSUB2300
JK 130 C(DL,F)=KC:S(DL,F)=KS:G
       OSUB1220
QJ 135 POKEX,7:POKEY,12:SYSPLT
       :PRINTEC$;
MK 140 GOSUB2500:GOSUB3000:IF(
       PW(0)>9)OR(PW(1)>9)THEN
       300
GS 150 POKEX,21:POKEY,31:SYSPL
       T:N=0:GOSUB1465
MP 151 POKEX,21:POKEY,35:SYSPL
       T:N=0:GOSUB1465
AG 200 POKEX,7:POKEY,31:SYSPLT
       :N=PW(0):GOSUB1465
BS 205 POKEX,7:POKEY,35:SYSPLT
       :N=PW(1):GOSUB1465
CD 210 DL=FNNP(DL):GOSUB1355:G
       OTO25
MP 300 WT=0:IFPW(1)>=10THENWT=
       1
```

```
PE 305 POKEX,7:POKEY,29+WT*6:S
       YSPLT:N=1:GOSUB1465
EQ 310 POKEX,7:POKEY,31+WT*6:S
       YSPLT:N=PW(WT)-10:GOSUB
       1465
KM 315 FORDE=1TO2000:NEXT
EM 320 GOSUB1450:POKEX,13:POKE
       Y,30:SYSPLT:PRINT"{RED}
       YOU";
DE 321 IFWT=0THENPRINT" WIN!";
PQ 322 IFWT=1THENPRINT" LOSE";
PJ 325 POKEX,15:POKEY,11:SYSPL
       T:PRINT"{RVS}{BLU}PLAY
       {SPACE}AGAIN?{OFF}";
BA 330 LO=11:HI=12:XP=15:YP=23
       :GOSUB1910
RG 340 IFAN=11THENRUN
AB 350 PRINT"{CLR}";
GG 999 END
JH 1000 POKE53281,15:POKE53280
       ,6:REM SETSCR
AR 1005 PRINT"{CLR}{BLU}";
CE 1010 FORI=1TO24:PRINT"{RVS}
       {28 SPACES}{OFF}
       {12 SPACES}";:NEXT
FB 1015 PRINT"{RVS}{28 SPACES}
       {OFF}{HOME}";
AC 1020 PRINTSPC(28)"{BLU}{A}C
       CCCCCCCCC{S}";
SG 1025 PRINTSPC(28)"B{RED}
       {2 SPACES}EUCHRE
       {2 SPACES}{BLU}B";
       {32 SPACES}
DD 1030 PRINTSPC(28)"{Z}CCCCCC
       CCCC{X}";
XF 1031 PRINTSPC(28)"{RVS}
       {12 SPACES}";
XB 1032 PRINTSPC(28)"
       {3 SPACES}POINTS
       {3 SPACES}{OFF}";
CD 1035 PRINTSPC(28)"{RED} YOU
        {BLU}{M}{G}{RED}COMP
       {SPACE}";
SB 1040 PRINTSPC(28)"{BLU}
       {5 Y}PO{5 Y}";
GR 1045 FORI=1TO4:PRINTSPC(28)
       "{5 SPACES}{M}{G}
       {5 SPACES}";:NEXT
KQ 1050 PRINTSPC(28)"{12 Y}
       {5 DOWN}";
AJ 1051 PRINTSPC(28)"{12 @}";
CP 1055 PRINTSPC(28)"{RVS}
       {3 SPACES}TRICKS
       {3 SPACES}{OFF}";
AC 1060 PRINTSPC(28)"{RED} YOU
        {BLU}{M}{G}{RED}COMP
       {SPACE}";
KE 1065 PRINTSPC(28)"{BLU}
       {5 Y}PO{5 Y}";
HR 1070 FORI=1TO3:PRINTSPC(28)
       "{5 SPACES}{M}{G}
       {5 SPACES}";:NEXT
DM 1075 PRINTSPC(28)"
       {5 SPACES}{M}{G}
       {4 SPACES}";
ER 1080 POKE2023,32:POKE56295,
       6
XS 1081 POKEX,7:POKEY,31:SYSPL
       T:GOSUB1465:POKEX,7:PO
       KEY,35:SYSPLT:GOSUB146
       5
SB 1082 POKEX,21:POKEY,31:SYSP
       LT:GOSUB1465:POKEX,21:
       POKEY,35:SYSPLT:GOSUB1
       465
QE 1090 RETURN
SS 1100 DIM C1$(7),C2$(7),S$(3
       ),DC(23),DS(23),C(3,4)
       ,S(3,4),CO$(3),CX(3),C
       Y(3)
MS 1101 DIM OB(6),OU(6),PU(6),
       MS(6,3),GA(6),ME$(15),
       PX(3),PY(3),NM$(9,2),N
       F(6)
SS 1102 DIM CL(7,3)
QS 1108 X=RND(-TI)
GQ 1109 FORI=0TO3:READS$(I),CO
       $(I):NEXT
EF 1110 DATA"Z","{RED}","X","
       {BLK}","S","{RED}","A"
       ,"{BLK}"
PE 1111 FORI=0TO6:READNF(I):NE
       XT:DATA4,0,1,2,3,4,0
JH 1115 FORI=0TO7:READC1$(I),C
       2$(I):NEXT
GG 1120 DATA"9 "," 9","10","10
       ","J "," J","Q "," Q",
       "K "," K","A "," A"
XJ 1125 DATA"J "," J","J "," J
       "
JS 1130 FORI=251TO254:READQ:PO
       KEI,Q:NEXT
RK 1135 DATA24,76,240,255
EM 1140 PLT=251:X=781:Y=782:SX
       =53248:BL$="
       {12 SPACES}"
GQ 1145 EC$="{4 SPACES}{DOWN}
       {4 LEFT}":EC$="{RVS}"+
       EC$+EC$+EC$+EC$+EC$+"
       {OFF}"
KS 1150 FORJ=0TO3:FORI=0TO5
AP 1155 DC(J*6+I)=I:DS(J*6+I)=
       J
RF 1160 NEXTI:NEXTJ
EK 1161 FORI=0TO3:READPX(I),PY
       (I):NEXT:DATA13,12,7,7
       ,1,12,7,17
PD 1165 FORI=0TO3:READCX(I),CY
       (I):NEXT
CF 1170 DATA17,11,10,4,3,11,10
       ,21
SQ 1171 FORI=0TO2:FORJ=0TO9:RE
       ADNM$(J,I):NEXT:NEXT
BR 1172 DATA"{RVS} {F}","{RVS}
       {K}{OFF}{K}","{RVS}{I}
        ","{RVS}{I} ","{2 K}"
       ,"{RVS} {I}","{RVS}
       {I}","{RVS}{I} ","
       {RVS} {F}","{RVS}{D} "
BX 1173 DATA" {K}","{RVS}{K}
       {OFF}{K}"," {I}","{I}
       {SPACE}","{RVS}{2 C}",
       "{I} "," {F}","{OFF}
       {RVS} "," {F}","{C} "
DH 1174 DATA" {RVS}{V}","{RVS}
       {K}{OFF}{K}"," {OFF}
       {I}","{OFF}{I}{RVS} ",
       "{OFF} {K}","{OFF}{I}
       {RVS} "," {V}","{OFF}
       {SPACE}{RVS} "," {V}",
       "{OFF}{I}{RVS} "
EA 1175 DEF FNNP(X)=((X+1)/4-I
       NT((X+1)/4))*4
HH 1176 FORI=0TO5:READCP(I):NE
       XT:DATA1,1,8,1,2,-1
QA 1177 FORI=0TO13:README$(I):
       NEXT
XX 1178 DATA"PASS{4 SPACES}","
       ORDER UP","PASS
       {3 SPACES}","PICK UP",
       "{2 SPACES}PASS
       {4 SPACES}"
EM 1179 DATA"Z DIAMONDS","X CL
       UBS{3 SPACES}","S HEAR
       TS{2 SPACES}","A SPADE
       S{2 SPACES}","NORMAL
       {4 SPACES}"
HH 1180 DATA"AGGRESSIVE","YES"
       ,"NO ","YES"
JD 1185 FORI=1TO3:READMX(I),MY
       (I):NEXT:DATA7,2,1,10,
       7,19
BQ 1186 FORI=0TO6:READOB(I),OU
       (I),PU(I),MS(I,0),MS(I
       ,1),MS(I,2),MS(I,3),GA
       (I):NEXT
FF 1187 DATA99,99,99,99,99,99,
       99,99
AF 1188 DATA99,99,99,99,99,99,
       99,99
JX 1189 DATA99,99,14,14,14,13,
       13,99
FQ 1190 DATA20,12,08,08,08,08,
       07,19
CK 1191 DATA14,00,00,00,00,00,
       00,16
ES 1192 DATA00,00,00,00,00,00,
       00,14
AK 1193 DATA00,00,00,00,00,00,
       00,00
XX 1199 RETURN
ER 1200 IF(S=TP)AND(C=6)THENS=
       S+2:S=(S/4-INT(S/4))*4
CH 1205 PRINTCO$(S)C1$(C)"
       {2 SPACES}{DOWN}
       {4 LEFT}"S$(S)"
       {3 SPACES}{DOWN}
       {4 LEFT}{4 SPACES}
       {DOWN}{4 LEFT}
       {3 SPACES}"S$(S)"
       {DOWN}{4 LEFT}
       {2 SPACES}"C2$(C);
XQ 1207 PRINT"{BLU}";
JM 1210 RETURN
AK 1220 FORU=0TO4:POKEX,19:POK
       EY,U*5+2:SYSPLT
AB 1225 C=C(0,U):S=S(0,U):GOSU
       B1200:NEXTU
CQ 1230 RETURN
XH 1250 FORI=0TO23:J=INT(RND(1
       )*24)
HA 1255 T=DC(I):DC(I)=DC(J):DC
       (J)=T
XQ 1260 T=DS(I):DS(I)=DS(J):DS
       (J)=T
HC 1265 NEXT
DE 1270 FORJ=0TO3:FORI=0TO4
AG 1275 C(J,I)=DC(J*5+I):S(J,I
       )=DS(J*5+I):NEXT:NEXT:
       KC=DC(20):KS=DS(20)
CA 1280 RETURN
SD 1300 GOSUB1450:POKEX,12:POK
       EY,28:SYSPLT
DF 1305 PRINT"{BLK}FIRST
       {2 SPACES}BLACK";
EX 1310 POKEX,13:POKEY,29:SYSP
       LT
GB 1315 PRINT"JACK DEALS";
XD 1320 GOSUB1250:DL=0:CC=0
SD 1325 POKEX,CX(DL):POKEY,CY(
       DL):SYSPLT
EP 1330 C=DC(CC):S=DS(CC):GOSU
       B1200
PQ 1331 FORDE=1TO500:NEXT
MH 1335 IF(DC(CC)=2)AND((DS(CC
       )AND253)=1)THENGOTO135
       5
JC 1336 POKEX,CX(DL):POKEY,CY(
       DL):SYSPLT
RC 1337 FORDE=1TO100:NEXT
MS 1340 PRINTEC$;:CC=CC+1:DL=F
       NNP(DL):GOTO1325
JK 1355 GOSUB1450:PRINT"{BLK}"
       ;:POKEX,12:POKEY,29:SY
       SPLT
RM 1356 IFDL=0THEN1370
HH 1360 PRINT" PLAYER"DL;
RE 1362 POKEX,13:POKEY,31:SYSP
       LT
AG 1365 PRINT"DEALS";:GOTO1375
KX 1370 PRINT"YOUR{2 SPACES}DE
       AL";
PR 1375 GOSUB1400
EB 1376 POKEX,CX(DL):POKEY,CY(
       DL):SYSPLT:PRINTEC$;
JG 1380 RETURN
JM 1400 POKEX,15:POKEY,28:SYSP
       LT
EE 1405 GOSUB6000:PRINT"{BLK}
       {RVS} HIT BUTTON {OFF}
       ";:POKE198,0
RR 1410 GETWT$:IF(WT$<>CHR$(13
```

```
        ))AND(PEEK(56320)<>111
        )THEN1410
DA 1415 PRINT"{BLU}";:GOSUB145
        0
HP 1430 RETURN
EM 1450 FORR=12TO16:POKEX,R:PO
        KEY,28:SYSPLT
JB 1455 PRINT"{12 SPACES}";:NE
        XT
QR 1460 RETURN
AS 1465 PRINT"{RED}";:FORI=0TO
        2:PRINTNM$(N,I)"{DOWN}
        {2 LEFT}";:NEXT:PRINT"
        {OFF}{BLU}";
DQ 1470 RETURN
KE 1500 FORI=0TO3:SP(P,I)=FC(P
        AND253):NS(P,I)=0:NEXT
RM 1505 FORI=0TO4:S=S(P,I):C=C
        (P,I):SP(P,S)=SP(P,S)+
        CP(C):NS(P,S)=NS(P,S)+
        1
JH 1510 IFC=2THENS=S+2:S=(S/4-
        INT(S/4))*4:SP(P,S)=SP
        (P,S)+6:NS(P,S)=NS(P,S
        )+1
XA 1515 IFC=5THENFORJ=0TO3:SP(
        P,J)=SP(P,J)+4:NEXTJ
QJ 1520 NEXTI
SE 1525 SS=0:FORI=0TO4:IFNS(P,
        I)=0THENSP(P,I)=0:SS=S
        S+1
BJ 1530 NEXT:FORI=0TO3:SP(P,I)
        =SP(P,I)+SS:NEXT
EC 1535 IFP<>DLTHEN1550
PX 1540 IFKC=5THENSP(P,KS)=SP(
        P,KS)+4
PP 1545 SP(P,KS)=SP(P,KS)+CP(K
        C):NS(P,KS)=NS(P,KS)+1
ED 1550 RETURN
BM 1600 LO=0:HI=1:XP=13:YP=10:
        GOSUB1910
RX 1605 IF AN=1THENTP=KS
CE 1610 RETURN
AB 1615 POKEX,13:POKEY,10:SYSP
        LT:PRINT"{RVS}LONEHAND
        ?{OFF}";
PJ 1616 LO=12:HI=13:XP=13:YP=2
        0:GOSUB1910:LH=0
SA 1618 IFAN=13THENLH=1:POKEX,
        MX(BD)+2:POKEY,MY(BD):
        SYSPLT:PRINT"{RVS}LONE
        HAND{OFF}";
CB 1619 POKEX,13:POKEY,10:SYSP
        LT:PRINT"{RVS}
        {9 SPACES}{OFF}";
HH 1620 RETURN
SP 1625 LH=0:IFSP(P,TP)>GA(NS(
        P,TP))THENLH=1
JH 1630 RETURN
EX 1650 IFFNNP(FNNP(P))=DLTHEN
        GOSUB1625:F=LH:GOTO168
        5
GE 1654 F=0:IFKC=2THENGOTO1660
HF 1655 IFSP(P,KS)>OU(NS(P,KS)
        )THENF=1
HS 1660 IFSP(P,KS)>OB(NS(P,KS)
        )THENF=1
AP 1665 IF(F=0)OR(P<>FNNP(DL))
        THEN1685
XJ 1670 SB=CP(KC):IFKC=5THENSB
        =3
CX 1675 FORI=0TO3:IFI<>KSTHENI
        FSP(P,I)>=(SP(P,KS)-SB
        )THENF=0
BR 1680 NEXT
DX 1685 IFF=1THENTP=KS
XX 1699 RETURN
SA 1700 LO=2:HI=3:XP=13:YP=11:
        GOSUB1910
QH 1705 IF AN=3THENTP=KS
QM 1710 RETURN
GG 1750 IFSP(P,KS)>PU(NS(P,KS)
        )THENTP=KS
AB 1755 RETURN
KE 1800 LO=4:HI=8:XP=13:YP=9:G
        OSUB1910
AS 1801 IFAN-5=KSTHEN1800
AQ 1805 IFAN>4THENTP=AN-5
HD 1810 RETURN
KA 1850 DF=0:FORI=0TO3:IFI=KST
        HEN1865
GQ 1855 IFSP(P,I)-MS(NS(P,I),P
        S)<DFTHEN1865
CS 1860 DF=SP(P,I)-MS(NS(P,I),
        PS):TP=I
RK 1865 NEXT
KH 1870 RETURN
QH 1900 FORI=1TO3:FORJ=0TO2:PO
        KEX,MX(I)+J:POKEY,MY(I
        ):SYSPLT:PRINT"{RVS}
        {8 SPACES}";
PC 1905 NEXT:NEXT:PRINT"{OFF}"
        ;
PJ 1907 RETURN
ED 1910 POKE198,0:AN=LO
BD 1915 X1=XP:Y1=YP:FORI=LOTOH
        I:PRINT"{RVS}{BLU}";
BJ 1920 IFI<>ANTHEN1925
JC 1921 IF(AN=LO)OR(HI-LO=1)TH
        ENPRINT"{RED}";:GOTO19
        25
JM 1922 PRINTCO$(I-LO-1);
HJ 1925 POKEX,X1:POKEY,Y1:SYSP
        LT:PRINTME$(I);:X1=X1+
        1:NEXT
BH 1930 GETR$:DR=PEEK(56320):I
        FNOT((R$="{UP}")OR(DR=
        126))THENGOTO1940
RH 1935 AN=AN-1:IFAN<LOTHENAN=
        HI
PJ 1940 IFNOT((R$="{DOWN}")OR(
        DR=125))THENGOTO1950
GX 1945 AN=AN+1:IFAN>HITHENAN=
        LO
SB 1950 IFNOT((R$=CHR$(13))OR(
        DR=111))THENGOTO1915
SG 1955 X1=XP:Y1=YP:PRINT"
        {RVS}{BLU}";:FORI=LOTO
        HI
HG 1960 POKEX,X1:POKEY,Y1:SYSP
        LT:PRINTLEFT$(BL$,LEN(
        ME$(LO)));:X1=X1+1:NEX
        T
JK 1965 PRINT"{OFF}";:RETURN
FQ 2000 GOSUB1250:GOSUB1220:P=
        FNNP(DL):TP=4:BD=0:KU=
        0
MK 2005 POKEX,7:POKEY,12:SYSPL
        T:C=KC:S=KS:GOSUB1200
HX 2007 IFDL<>0THENPOKEX,MX(DL
        ):POKEY,MY(DL)+1:SYSPL
        T:PRINT"{RVS}DEALER"
BA 2010 GOSUB1500
XS 2015 IFP=0THENGOSUB1600:GOT
        O2040
BH 2016 IFABS(P-DL)<>2THEN2020
RS 2017 GOSUB1625:IFLH=1THENTP
        =KS:GOTO2025
RG 2020 GOSUB1650
XA 2025 POKEX,MX(P):POKEY,MY(P
        ):SYSPLT:PRINT"{RVS}";
RH 2030 IFTP=4THENPRINT"
        {2 SPACES}PASS":GOTO20
        40
FD 2035 BD=P:PRINT"ORDER UP";
AF 2040 P=FNNP(P):IF(P<>DL)AND
        (TP=4)THEN2010
KM 2045 P=DL:GOSUB1500:IFTP<>4
        THEN2105
RM 2050 IFDL=0THENGOSUB1700:GO
        TO2070
PS 2055 GOSUB1750:POKEX,MX(DL)
        :POKEY,MY(DL):SYSPLT:P
        RINT"{RVS}{BLU}";
CQ 2060 IFTP=4THENPRINT" TURNE
        D{DOWN}{5 LEFT}DOWN";:
        GOTO2070
AJ 2065 BD=P:PRINT" PICKED
        {DOWN}{4 LEFT}UP";
HM 2070 FORDE=1TO2000:NEXT
HR 2071 IF(BD=0)AND(TP<>4)THEN
        2105
QE 2072 POKEX,7:POKEY,12:SYSPL
        T:PRINTEC$;:IFTP<>4THE
        N2105
QC 2073 GOSUB1900:PS=0
HX 2075 P=FNNP(P)
JS 2080 IFP=0THENGOSUB1800:GOT
        O2090
PK 2085 GOSUB1850:POKEX,MX(P):
        POKEY,MY(P):SYSPLT:PRI
        NT"{RVS}";
RS 2086 FORDE=1TO600:NEXT
FC 2088 IFTP=4THENPRINT"
        {2 SPACES}PASS";:GOTO2
        090
RS 2089 BD=P:PRINTRIGHT$(ME$(T
        P+5),8);
HD 2090 IF(P<>DL)AND(TP=4)THEN
        PS=PS+1:GOTO2075
PK 2100 GOTO2109
KK 2105 KU=1:IF(BD=0)AND(DL=2)
        THENLH=1:GOTO2120
DR 2109 IFTP=4THEN2140
RA 2110 IF(LH=1)AND(BD<>0)THEN
        2120
DP 2111 IFBD=0THENGOSUB1615:GO
        TO2140
RS 2112 GOSUB1625
MA 2115 IFLH=0THEN2140
EX 2120 POKEX,MX(BD)+2:POKEY,M
        Y(BD):SYSPLT:PRINT"
        {RVS}LONEHAND";
CF 2140 PRINT"{OFF}";:FORDE=1T
        O2000:NEXT
DX 2145 GOSUB1900
PG 2150 RETURN
DF 2200 POKE198,0:F=-1
GE 2205 F=F+1:IFC(0,F)=-1THEN2
        205
PQ 2210 G=F:POKESX+1,214:POKES
        X,(F*5+3)*8+22:POKE532
        69,1
AG 2215 POKESX+1,214:POKESX,(F
        *5+3)*8+22
QS 2220 GETR$:DR=PEEK(56320):I
        F(R$="")AND(DR=127)THE
        N2220
ES 2225 G=F:IFNOT((R$="{LEFT}"
        )OR(DR=123))THEN2250
XF 2230 F=NF(F):IFC(0,F)<0THEN
        2230
CA 2245 GOTO2215
BP 2250 IFNOT((R$="{RIGHT}")OR
        (DR=119))THEN2275
DA 2255 F=NF(F+2):IFC(0,F)<0TH
        EN2255
QD 2270 GOTO2215
FH 2275 IFNOT((R$=CHR$(13))OR(
        DR=111))THEN2215
KB 2280 RETURN
DG 2300 FORI=0TO4:IF(S(P,I)=TP
        )AND(C(P,I)=2)THENC(P,
        I)=7:GOTO2310
HK 2305 IF((S(P,I)AND253)=(TPA
        ND253))AND(C(P,I)=2)TH
        ENC(P,I)=6:S(P,I)=TP
SA 2310 NEXT
AH 2315 FORI=0TO4:FORJ=0TO3:IF
        S(P,J)>S(P,J+1)THENGOT
        O2331
QE 2320 IFS(P,J)=S(P,J+1)THENI
        FC(P,J)>C(P,J+1)THENGO
        TO2331
GC 2325 T=C(P,J):C(P,J)=C(P,J+
        1):C(P,J+1)=T
KP 2330 T=S(P,J):S(P,J)=S(P,J+
        1):S(P,J+1)=T
XC 2331 NEXT
SX 2335 FORI=0TO4:PT(I)=0:IFS(
        P,I)=TPTHENPT(I)=C(P,I
        )+10:GOTO2350
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SF 2340 IFC(P,I)=5THENPT(I)=9:
        GOTO2350
QC 2345 IF(S(P,I)<>S(P,NF(I)))
        AND(S(P,I)<>S(P,NF(I+2
        )))THENPT(I)=-1
CE 2350 NEXT
XM 2355 L=99:FORI=0TO4:IFPT(I)
        <LTHENF=I:L=PT(I)
SQ 2360 NEXT:RETURN
MJ 2500 FORI=0TO3:FORJ=0TO3:NS
        (I,J)=0:NEXT:FORJ=0TO4
        :IFC(I,J)<>2THEN2515
QH 2505 IFS(I,J)=TPTHENC(I,J)=
        7:GOTO2515
RD 2510 IFABS(S(I,J)-TP)=2THEN
        C(I,J)=6:S(I,J)=TP
GQ 2515 NS(I,S(I,J))=NS(I,S(I,
        J))+1:NEXT:NEXT
RX 2520 RETURN
KJ 2700 PRINT"{HOME}{2 DOWN}
        {2 RIGHT}{RVS}PARTNER?
        {OFF}";:LO=9:HI=10:XP=
        2:YP=12:GOSUB1910
FK 2705 FC(0)=0:IFAN=10THENFC(
        0)=2
XM 2710 PRINT"{HOME}{2 DOWN}
        {2 RIGHT}{RVS}OPPONENT
        S?{OFF}";:LO=9:HI=10:X
        P=2:YP=14:GOSUB1910
EG 2715 FC(1)=0:IFAN=10THENFC(
        1)=2
GG 2720 PRINT"{HOME}{2 DOWN}
        {2 RIGHT}{RVS}
        {10 SPACES}{OFF}";:RET
        URN
FS 3000 FORI=0TO7:FORJ=0TO3:CL
        (I,J)=0:NEXT:NEXT:CL(2
        ,TPAND253)=1
FF 3001 FORI=0TO3:SL(I)=0:NEXT
XX 3002 LD=FNNP(DL):DM=4:TR(0)
        =0:TR(1)=0:IFLH=0THEN3
        015
QR 3005 IFBD=2THENFORI=0TO4:PO
        KEX,19:POKEY,I*5+2:SYS
        PLT:PRINTEC$;:NEXT
JE 3010 DM=FNNP(FNNP(BD))
BB 3011 IFLH=1THENIFLD=DMTHENL
        D=FNNP(LD)
EJ 3015 FORTK=0TO4:P=LD:PS=0:T
        L=0:IFDM=PTHENP=FNNP(P
        )
SP 3020 GOSUB3500:WP=P:IFLH=1T
        HENPS=PS+1
DX 3021 SL(S(P,PC(P)))=1
PP 3025 IFS(P,PC(P))=TPTHENTL=
        1
FH 3030 FORI=1TO3:P=FNNP(P):IF
        P=DMTHEN3060
RS 3035 PS=PS+1:GOSUB3500:IFTL
        =0THEN3050
XF 3040 IFS(P,PC(P))=TPTHENIFC
        (P,PC(P))>C(WP,PC(WP))
        THENWP=P
JD 3045 GOTO3060
GS 3050 IFS(P,PC(P))=TPTHENWP=
        P:TL=1:GOTO3060
CK 3055 IFS(P,PC(P))=S(WP,PC(W
        P))THENIFC(P,PC(P))>C(
        WP,PC(WP))THENWP=P
DF 3060 NEXT:FORDE=1TO400:NEXT
KQ 3065 POKESX+3,(PX(WP)+1)*8+
        52:POKESX+2,(PY(WP)+1)
        *8+19:POKE53269,2
GX 3071 FORDE=1TO3000:NEXT:LD=
        WP:WT=WPAND253:TR(WT)=
        TR(WT)+1
HG 3072 POKEX,21:POKEY,31+4*WT
        :SYSPLT:N=TR(WT):GOSUB
        1465:POKE53269,0
QF 3075 FORI=0TO3:POKEX,PX(I):
        POKEY,PY(I):SYSPLT:PRI
        NTEC$;:C(I,PC(I))=-1:N
        EXT:NEXT
KJ 3078 POKEX,MX(BD)+2:POKEY,M
        Y(BD):SYSPLT:PRINT"
        {RVS}{9 SPACES}{OFF}";
DR 3080 BT=BDAND253:POKEX,15:P
        OKEY,28:SYSPLT
XA 3085 PRINT"{BLK}";:IFTR(BT)
        <3THEN3108
JP 3086 IFTR(BT)<5THEN3097
AB 3087 PW(BT)=PW(BT)+2+LH*2
CF 3090 IFBT=0THENPRINT"
        {2 SPACES}YOU
        {2 SPACES}WON{DOWN}
        {9 LEFT}ALL TRICKS";:G
        OTO3200
RB 3095 IFBT=1THENPRINT"COMPUT
        ER WON{DOWN}{11 LEFT}A
        LL TRICKS";:GOTO3200
FQ 3097 PW(BT)=PW(BT)+1
EA 3100 IFTR(0)>2THENPRINT"YOU
         WON HAND";:GOTO3200
FP 3105 IFTR(1)>2THENPRINT"
        {2 SPACES}COMPUTER
        {DOWN}{8 LEFT}WON HAND
        ";:GOTO3200
SR 3108 PW(1-BT)=PW(1-BT)+2
GE 3110 IFTR(0)<3THENPRINT"YOU
        'VE{2 SPACES}BEEN
        {DOWN}{10 LEFT}EUCHRED
        !":GOTO3200
QM 3115 IFTR(1)<3THENPRINT"
        {2 SPACES}COMPUTER
        {DOWN}{8 LEFT}EUCHRED!
        ";:
GH 3119 FORDE=1TO4000:NEXT
EG 3200 FORDE=1TO4000:NEXT:PRI
        NT"{BLU}";
GJ 3205 RETURN
JJ 3500 IFP>0THEN3509
EG 3501 POKEX,15:POKEY,28:SYSP
        LT
GK 3502 PRINT"{BLK}{RVS} YOUR
        {2 SPACES}PLAY {OFF}
        {BLU}";:GOSUB2200
MA 3503 LS=S(LD,PC(LD)):IF(PS=
        0)OR(S(P,F)=LS)OR(NS(P
        ,LS)=0)THEN3507
QM 3504 GOSUB2215:GOTO3503
AF 3505 POKE53269,0:POKEX,19:P
        OKEY,F*5+2:SYSPLT:PRIN
        TEC$;:GOTO3530
PE 3507 POKEX,15:POKEY,28:SYSP
        LT:PRINT"{12 SPACES}"
BG 3508 POKE53269,0:POKEX,19:P
        OKEY,F*5+2:SYSPLT:PRIN
        TEC$;:GOTO3530
FJ 3509 IFTK<5THEN3515
ER 3510 FORK=0TO4:IFC(P,J)>-1T
        HENF=I
RH 3512 NEXT:GOTO3530
MH 3515 ON(PS+1)GOSUB4000,4100
        ,4200,4200
QF 3530 PC(P)=F:POKEX,PX(P):PO
        KEY,PY(P):SYSPLT:C=C(P
        ,F):S=S(P,F):GOSUB1200
RG 3535 NS(P,S(P,F))=NS(P,S(P,
        F))-1:CL(C(P,F),S(P,F)
        )=1
MX 3540 RETURN
SH 4000 IFNOT(NS(P,TP)=5-TK)TH
        EN4015
GR 4005 SP=TP:GOSUB5200:IFF=1T
        HENGOTO5150
MQ 4010 GOTO5160
BA 4015 IFNOT((LH=1)AND(BD=P))
        THENGOTO4030
SF 4020 IFNS(P,TP)>0THENSP=TP:
        GOTO5150
RR 4025 GOTO5050
QF 4030 GOSUB5000:IF(F=1)AND(A
        BS(BD-P)=2)THENSP=TP:G
        OTO5150
CH 4035 GOSUB5250:IFNOT((F=1)A
        ND(P=BD))THENGOTO5050
CF 4040 GOSUB5200:IFF=1THENSP=
        TP:GOTO5150
FQ 4045 IFNS(P,TP)>2THENSP=TP:
        GOTO5160
JC 4050 GOTO5050
HF 4100 IFNS(P,S(LD,PC(LD)))=0
        THEN4115
RJ 4105 GOSUB5300:SP=S(LD,PC(L
        D)):IFF=1THEN5150
DH 4110 GOTO5160
XR 4115 IFNS(P,TP)=5-TKTHENSP=
        TP:GOTO5160
SB 4120 IFNS(P,TP)=0THEN5100
PD 4125 IFC(LD,PC(LD))=5THENSP
        =TP:GOTO5160
QC 4130 IFBD<>PTHENSP=TP:GOTO5
        160
XM 4135 GOSUB5250:IFF=1THENSP=
        TP:GOTO5160
EB 4140 GOTO5100
SA 4200 IFNS(P,S(LD,PC(LD)))=0
        THEN4235
MJ 4201 SP=S(LD,PC(LD))
KH 4205 IF(SP<>TP)AND(TL=1)THE
        N5160
RS 4210 IFABS(WP-P)<>2THEN4225
PR 4215 GOSUB5300:IFF=1THENGOS
        UB5350:IFF=0THEN5150
GS 4220 GOTO5160
JK 4225 GOSUB5300:IFF=1THEN515
        0
DX 4230 GOTO5160
BH 4235 IFNS(P,TP)<5-TKTHEN427
        0
XG 4245 SP=TP:IFABS(WP-P)=2THE
        N5160
XA 4250 IFTL=0THEN5160
RQ 4255 GOSUB5300:IFF=1THENGOT
        O5400
MR 4260 GOTO5160
BS 4270 IFNS(P,TP)=0THENGOTO51
        00
KA 4275 IFABS(WP-P)<>2THEN4310
HD 4280 IF(TL=1)OR(PS=3)THEN51
        00
XP 4285 IFC(WP,PC(WP))=5THEN51
        00
HG 4290 IFC(WP,PC(WP))<4THENSP
        =TP:GOTO5160
PD 4300 GOSUB5250:IFF=1THENSP=
        TP:GOTO5160
FQ 4305 GOTO5100
GE 4310 IFTL=0THENSP=TP:GOTO51
        60
BP 4315 GOSUB5300:IFF=1THENSP=
        TP:GOTO5400
MQ 4320 GOTO5100
BQ 5000 F=0:FORA=0TO4:IFC(P,A)
        >5THENF=1
BA 5005 NEXT:RETURN
QR 5050 F=-1:FORA=0TO4:IF(SL(S
        (P,A))=0)AND(S(P,A)<>T
        P)THENIFC(P,A)=5THENF=
        A
BD 5055 NEXT:IFF>-1THEN5070
CS 5060 LC=-1:FORA=0TO4:IFS(P,
        A)<>TPTHENIFC(P,A)>LCT
        HENLC=C(P,A):F=A
SB 5065 NEXT
BQ 5070 RETURN
GK 5100 IFNS(P,TP)>0THEN5125
SD 5105 SP=-1:FORA=0TO4
HM 5110 IFS(P,A)<>TPTHENIF(C(P
        ,A)=5)AND(NS(P,S(P,A))
        >1)THENSP=S(P,A)
EJ 5115 NEXT:IFSP>-1THEN5160
PH 5120 GOTO5180
FX 5125 V=4:F=-1:FORA=0TO4
DG 5126 IFS(P,A)=TPTHEN5135
XP 5130 IF(NS(P,S(P,A))<>1)OR(
        SL(S(P,A))=1)THEN5135
FH 5131 IF(C(P,A)>=0)AND(C(P,A
        )<V)THENV=C(P,A):F=A
HJ 5135 NEXT:IFF=-1THEN5180
FA 5140 RETURN
BJ 5150 IFPS=3THEN5400
```

```
MQ 5151 V=-1:FORA=ØTO4:IFS(P,A
        )=SPTHENIFC(P,A)>VTHEN
        V=C(P,A):F=A
MS 5155 NEXT:RETURN
SJ 5160 V=1Ø:FORA=ØTO4
EH 5161 IFS(P,A)=SPTHENIF(C(P,
        A)>=Ø)AND(C(P,A)<V)THE
        NV=C(P,A):F=A
RR 5165 NEXT:RETURN
SM 5180 V=1Ø:FORA=ØTO4:IFS(P,A
        )<>TPTHENIFC(P,A)>-1TH
        ENIFC(P,A)<VTHENV=C(P,
        A):F=A
QD 5185 NEXT:RETURN
XJ 5200 HT=8:F=Ø
QM 5205 HT=HT-1:IFHT>ØTHENIFCL
        (HT,TP)=1THEN5205
GJ 5210 IFHT<ØTHEN524Ø
QS 5215 FORA=ØTO4:IFS(P,A)=TPT
        HENIFC(P,A)=HTTHENF=1
BG 5220 NEXT
DM 5240 RETURN
XG 5250 F=1:FORA=ØTO4:IFC(P,A)
        >-1THENIF(S(P,A)<>TP)A
        ND(C(P,A)<5)THENF=Ø
PH 5255 NEXT:RETURN
DD 5300 F=Ø:FORA=ØTO4:IFS(P,A)
        =S(WP,PC(WP))THENIFC(P
        ,A)>C(WP,PC(WP))THENF=
        1
AF 5305 NEXT:RETURN
ES 5350 F=Ø:FORA=ØTO4:IFS(P,A)
        =S(WP,PC(WP))THENIFC(P
        ,A)-C(WP,PC(WP))=1THEN
        F=1
BK 5355 NEXT:RETURN
PH 5400 D=1Ø:FORA=ØTO4
BC 5405 IFS(P,A)=S(WP,PC(WP))T
        HENE=C(P,A)-C(WP,PC(WP
        )):IF(E<D)AND(E>Ø)THEN
        D=E:F=A
MX 5410 NEXT:RETURN
QE 6000 FORR=54272TO54296:POKE
        R,Ø:NEXT:POKE54275,1
QC 6010 POKE54277,21:POKE54278
        ,135:POKE54273,150:POK
        E54276,17
HX 6020 FORR=15TOØSTEP-.2:POKE
        54296,R:NEXT
FR 6030 POKE54276,16:POKE54296
        ,Ø:RETURN
QG 10000 POKE53285,13:POKE5328
         7,11:POKE53288,5:POKE
         53276,2:POKE2040,13:P
         OKE2041,14
SX 10010 SA=832:FORJ=ØTO1:SA=S
         A+J*64:FORI=ØTO63:REA
         DA:POKESA+I,A:NEXT:NE
         XT:RETURN
PJ 10050 DATA Ø,96,Ø,6,108,Ø,6
         ,108
SX 10051 DATA Ø,6,109,128,3,10
         9,128,3
DF 10052 DATA 253,128,27,255,Ø
         ,13,255,Ø
PF 10053 DATA 15,255,Ø,7,254,Ø
         ,3,254
AX 10054 DATA Ø,1,252,Ø,Ø,252,
         Ø,Ø
GF 10055 DATA 252,Ø,Ø,Ø,Ø,Ø,Ø,
         Ø
HS 10056 DATA Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø
RH 10057 DATA Ø,Ø,Ø,Ø,Ø,Ø,Ø,19
         Ø
PP 10060 DATA 1Ø,17Ø,168,1Ø,14
         9,168,1Ø,85
SR 10061 DATA 104,9,89,88,9,1Ø
         6,152,9
SG 10062 DATA 153,88,9,153,88,
         9,153,88
BB 10063 DATA 9,153,88,9,106,8
         8,9,89
KH 10064 DATA 152,9,89,152,9,8
         9,152,9
RX 10065 DATA 89,152,9,170,88,
         9,89,88
DF 10066 DATA 1Ø,85,104,1Ø,149
         ,168,1Ø,17Ø
FX 10067 DATA 168,Ø,Ø,Ø,Ø,Ø,Ø,
         Ø
```

Program 2: Euchre For Atari 400, 800, XL, And XE

```
DH 1  GRAPHICS Ø:POKE 71Ø,6:P
      OKE 7Ø9,Ø:POKE 712,112:
      PRINT "PLEASE WAIT"
EI 2  FOR I=Ø TO 11:READ A:PO
      KE 1664+I,A:NEXT I
JB 5  DATA 104,165,2Ø3,37,2Ø4
      ,133,212,169,Ø,133,213,
      96
ID 1Ø POKE 752,1:GOSUB 11ØØ:
      GOSUB 1ØØØ:GOSUB 27ØØ:
      GOSUB 13ØØ
KJ 25 GOSUB 2ØØØ
NK 3Ø IF TP<>4 THEN 7Ø
JC 35 POSITION 29,11:? "NO
      BIDS"
KI 4Ø POSITION 27,12:? "HAND
      DUMPED"
KK 5Ø GOSUB 14ØØ:X=19:FOR I=
      Ø TO 4:Y=I*5+1:GOSUB 9
      ØØØ:NEXT I
AO 51 J=DL:GOSUB 81ØØ:DL=K:X
      =7:Y=12:GOSUB 9ØØØ
IO 55 GOSUB 19ØØ:GOTO 25
CE 7Ø POSITION 28,11:? "TRUM
      P :";RS$(TP+1,TP+1)
NI 75 POSITION 28,12:? "BIDD
      ER:";:IF BD=Ø THEN ?
      "YOU";:GOTO 9Ø
CK 8Ø ? "S";CHR$(ASC(STR$(BD
      ))+128)
MN 9Ø IF KU=Ø THEN 135
OF 1ØØ IF DL>Ø THEN 125
OE 115 POSITION 27,14:? "PIC
       K DISCARD"
AA 121 GOSUB 22ØØ:POSITION 2
       7,14:? "{12 SPACES}";:
       GOTO 13Ø
NN 125 GOSUB 23ØØ
CP 13Ø C(DL,F)=KC:S(DL,F)=KS
      :GOSUB 122Ø
BK 135 X=7:Y=11:GOSUB 9ØØØ
GG 14Ø GOSUB 25ØØ:GOSUB 3ØØØ
      :IF (PW(Ø)>9) OR (PW(
      1)>9) THEN 3ØØ
DP 15Ø X=3Ø:Y=2Ø:N=Ø:GOSUB 1
      465
EG 151 X=36:Y=2Ø:N=Ø:GOSUB 1
       465
AH 2ØØ X=3Ø:Y=6:N=PW(Ø):GOSU
       B 1465
BD 2Ø5 X=36:Y=6:N=PW(1):GOSU
       B 1465
OB 21Ø J=DL:GOSUB 81ØØ:DL=K:
       GOSUB 1355:GOTO 25
MB 3ØØ WT=Ø:IF PW(1)>=1Ø THE
       N WT=1
FC 3Ø5 X=27+WT*6:Y=6:N=1:GOS
       UB 1465
EI 31Ø X=3Ø+WT*6:Y=6:N=PW(WT
       )-1Ø:GOSUB 1465
KN 315 FOR DE=1 TO 1ØØ:NEXT
       DE
PO 32Ø GOSUB 1450:POSITION 2
       9,13:? "YOU";
JO 321 IF WT=Ø THEN ? "WIN!
       "
ME 322 IF WT=1 THEN ? "LOSE
       "
DB 325 POSITION 2,2:? "PLAY
       AGAIN?"
JG 33Ø LO=11:HI=12:XP=2:YP=1
       4:GOSUB 191Ø
HI 34Ø IF AN=11 THEN RUN
CK 35Ø GRAPHICS Ø:END
OK 1ØØØ ? CHR$(125)
IH 1ØØ5 POSITION 27,Ø:? "
       {Q}{1Ø R}{E}"
OO 1Ø1Ø POSITION 27,1:? "
       EUCHRE "
JB 1Ø15 POSITION 27,2:? "
       {Z}{1Ø R}{C}"
JJ 1Ø25 POSITION 3Ø,3:? "POI
       NTS"
GD 1Ø3Ø POSITION 27,4:? "YO
       U {B}{L}COMP "
PN 1Ø4Ø FOR I=Ø TO 4:POSITIO
       N 27,5+I:? "
       {5 SPACES}{B}{L}
       {5 SPACES}":NEXT I
IL 1Ø42 POSITION 27,1Ø:? "
       {12 M}"
HG 1Ø43 POSITION 27,16:? "
       {12 SPACES}"
MD 1Ø45 POSITION 3Ø,17:? "TR
       ICKS"
JK 1Ø5Ø POSITION 27,18:? "Y
       OU {B}{L}COMP "
HD 1Ø55 FOR I=Ø TO 4:POSITIO
       N 27,19+I:? "
       {5 SPACES}{B}{L}
       {5 SPACES}";:NEXT I
AJ 1Ø81 N=Ø:X=3Ø:Y=6:GOSUB 1
       465:X=36:GOSUB 1465
EB 1Ø82 X=3Ø:Y=2Ø:GOSUB 1465
       :X=36:GOSUB 1465
CO 1Ø9Ø GOSUB 145Ø:RETURN
MM 11ØØ DIM C1$(16),C2$(16),
       ME$(1Ø),TME$(14Ø),BL
       $(1Ø),FC(2),DC(23),D
       S(23),EC$(5),MX(3),M
       Y(3)
KD 1101 DIM CX(3),CY(3),C(3,
       4),S(3,4),A$(1Ø),S$(
       4),OB(6),OU(6),PU(6)
       ,MS(6,3),GA(6),PX(3)
       ,PY(3),NF(6),CL(7,3)
KN 1102 DIM SP(3,5),NS(3,5),
       CP(5),RS$(4),LTME(13
       ),PT(4),SL(3),TR(1),
       PC(3),NM1$(3Ø),NM2$(
       3Ø),NM3$(3Ø),PW(1)
OL 1103 S$="{.}{P}{,}{;}":RS
       $="{H}{P}{H}{H}":BL$
       ="{1Ø SPACES}":EC$="
       {5 SPACES}"
CB 1105 FOR I=Ø TO 3:FOR J=Ø
        TO 5:SP(I,J)=Ø:NS(I
       ,J)=Ø:NEXT J:NEXT I
DB 1110 C1$="9 1ØJ Q K A J J
       "
DH 1115 C2$=" 91Ø J Q K A J
       J"
FF 1120 RESTORE 1120:FOR I=Ø
        TO 6:READ A:NF(I)=A
       :NEXT I:DATA 4,Ø,1,2
       ,3,4,Ø
OK 1150 FOR J=Ø TO 3:FOR I=Ø
        TO 5
AP 1155 DC(J*6+I)=I:DS(J*6+I
       )=J
LC 1160 NEXT I:NEXT J:PW(Ø)=
       Ø:PW(1)=Ø
AM 1161 RESTORE 1161:FOR I=Ø
        TO 3:READ A,B:PX(I)
       =A:PY(I)=B:NEXT I:DA
       TA 13,11,7,6,1,11,7,
       16
DC 1163 RESTORE 1163:FOR I=Ø
        TO 5:READ A:CP(I)=A
       :NEXT I:DATA 1,1,8,1
       ,2,-1
AK 1165 RESTORE 117Ø:FOR I=Ø
        TO 3:READ A,B:CX(I)
       =A:CY(I)=B:NEXT I
HL 117Ø DATA 12,11,7,6,2,11,
       7,16
```

```
AL 1172 NM1$="{I} ■ {U} {U}
        {Y} {I}{U}{I}{2 U}
        {I} {I} "
JB 1173 NM2$="{Y} ■ {I}{2 U}
        {K} {U} {I} ■ {I}
        {U} "
CA 1174 NM3$=" ■{5 SPACES}■
        {5 SPACES}■
        {5 SPACES}"
MH 1175 RESTORE 1178:FOR I=0
        TO 13:READ A$:J=LEN
        (A$):LTME(I)=J-1:IF
        J<10 THEN A$(J+1)=BL
        $
BK 1176 J=(I)*10+1:TME$(J)=A
        $:NEXT I
AI 1178 DATA PASS,ORDER UP,P
        ASS,PICK UP,  PASS,
        {.} DIAMONDS
OD 1179 DATA {P} CLUBS,{,} H
        EARTS,{;} SPADES,NOR
        MAL,AGGRESSIVE,YES,N
        O,YES
MI 1185 RESTORE 1185:FOR I=1
        TO 3:READ A,B:MX(I)
        =A:MY(I)=B:NEXT I:DA
        TA 7,1,1,9,7,17
PA 1186 RESTORE 1190:FOR I=0
        TO 6:READ A,B,C,D,E
        ,F,G,H:OB(I)=A:OU(I)
        =B:PU(I)=C
IK 1187 MS(I,0)=D:MS(I,1)=E:
        MS(I,2)=F:MS(I,3)=G:
        GA(I)=H:NEXT I
KJ 1190 DATA 99,99,99,99,99,
        99,99,99
KK 1191 DATA 99,99,99,99,99,
        99,99,99
GI 1192 DATA 99,99,14,14,14,
        13,13,99
GC 1193 DATA 20,12,8,8,8,8,7
        ,19
AJ 1194 DATA 14,0,0,0,0,0,0,
        16
ND 1195 DATA 0,0,0,0,0,0,0,0,1
        4
JP 1196 DATA 0,0,0,0,0,0,0,0,0
LE 1199 RETURN
GO 1200 IF (S=TP) AND (C=6)
        THEN S=S+2:S=(S/4-IN
        T(S/4))*4
CC 1201 NC=C*2+1:POSITION Y,
        X:? "{O}{3 R}{E}"
HF 1202 POSITION Y,X+1:? "¦"
        ;C1$(NC,NC+1);" ¦"
DG 1203 POSITION Y,X+2:? "¦
        ";S$(S+1,S+1);" ¦"
HK 1204 POSITION Y,X+3:? "¦
        ";C2$(NC,NC+1);"¦"
ME 1205 POSITION Y,X+4:? "
        {Z}{3 R}{C}";
KE 1210 RETURN
FO 1220 FOR U=0 TO 4:Y=U*5+1
        :X=19
PJ 1225 C=C(0,U):S=S(0,U):GO
        SUB 1200:NEXT U
KG 1230 RETURN
GA 1250 FOR I=0 TO 23:J=INT(
        RND(1)*24)
CB 1255 T=DC(I):DC(I)=DC(J):
        DC(J)=T
GC 1260 T=DS(I):DS(I)=DS(J):
        DS(J)=T
FB 1265 NEXT I
ON 1270 FOR J=0 TO 3:FOR I=0
        TO 4
FB 1275 C(J,I)=DC(J*5+I):S(J
        ,I)=DS(J*5+I):NEXT I
        :NEXT J:KC=DC(20):KS
        =DS(20)
KL 1280 RETURN
BC 1300 POSITION 27,11:? "FI
        RST   BLACK"
JC 1310 POSITION 28,12:? "JA
        CK DEALS"
HC 1320 GOSUB 1250:DL=0:CC=0
PC 1330 Y=CY(DL):X=CX(DL):C=
        DC(CC):S=DS(CC):GOSU
        B 1200
LA 1331 FOR DE=1 TO 50:NEXT
        DE
IN 1335 POKE 203,DS(CC):POKE
        204,253:J=USR(1664)
        :IF (DC(CC)=2) AND (
        J=1) THEN 1355
KO 1336 Y=CY(DL):X=CX(DL):GO
        SUB 9000
LC 1337 FOR DE=1 TO 10:NEXT
        DE
MN 1340 CC=CC+1:J=DL:GOSUB 8
        100:DL=K:GOTO 1330
LP 1355 GOSUB 1450:POSITION
        28,11
FF 1356 IF DL=0 THEN 1370
ND 1360 ? "  PLAYER ";CHR$(AS
        C(STR$(DL))+128)
AC 1365 POSITION 29,12:? "DE
        ALS";:GOTO 1375
NG 1370 POSITION 28,12:? "YO
        UR  DEAL";
BF 1375 GOSUB 1400
LC 1376 Y=CY(DL):X=CX(DL):GO
        SUB 9000
KM 1380 RETURN
ON 1400 POSITION 27,14:? " H
        IT BUTTON ";
MC 1410 IF STRIG(0)=1 THEN 1
        410
BF 1415 GOSUB 1450
KI 1430 RETURN
EI 1450 FOR I=11 TO 15:POSIT
        ION 27,I:? "
        {12 SPACES}":NEXT I:R
        ETURN
PH 1465 I=N*2+1:POSITION X,Y
        :? NM1$(I,I+1);
IP 1466 POSITION X,Y+1:? NM2
        $(I,I+1);
JC 1467 POSITION X,Y+2:? NM3
        $(I,I+1);
KM 1470 RETURN
FF 1500 FOR I=0 TO 3:POKE 20
        3,P:POKE 204,253:J=U
        SR(1664)
AC 1502 SP(P,I)=FC(J):NS(P,I
        )=0:NEXT I
CJ 1505 FOR I=0 TO 4:S=S(P,I
        ):C=C(P,I):SP(P,S)=S
        P(P,S)+CP(C):NS(P,S)
        =NS(P,S)+1
HI 1510 IF C=2 THEN S=S+2:S=
        (S/4-INT(S/4))*4:SP(
        P,S)=SP(P,S)+6:NS(P,
        S)=NS(P,S)+1
MA 1515 IF C=5 THEN FOR J=0
        TO 3:SP(P,J)=SP(P,J)
        +4:NEXT J
FA 1520 NEXT I
OP 1525 SS=0:FOR I=0 TO 4:IF
        NS(P,I)=0 THEN SP(P
        ,I)=0:SS=SS+1
HK 1530 NEXT I:FOR I=0 TO 3:
        SP(P,I)=SP(P,I)+SS:N
        EXT I
LB 1535 IF P<>DL THEN 1550
EA 1540 IF KC=5 THEN SP(P,KS
        )=SP(P,KS)+4
LA 1545 SP(P,KS)=SP(P,KS)+CP
        (KC):NS(P,KS)=NS(P,K
        S)+1
KL 1550 RETURN
JB 1600 LO=0:HI=1:XP=13:YP=1
        0:GOSUB 1910
AG 1605 IF AN=1 THEN TP=KS
KI 1610 RETURN
EL 1615 POSITION 8,13:? "LON
        EHAND";
EA 1616 LO=12:HI=13:XP=13:YP
        =17:GOSUB 1910:LH=0
NF 1618 IF AN=13 THEN LH=1:P
        OSITION MY(BD),MX(BD
        ):? "LONEHAND";
AG 1619 POSITION 8,13:? "
        {8 SPACES}";
KJ 1620 RETURN
AG 1625 LH=0:IF SP(P,TP)>GA(
        NS(P,TP)) THEN LH=1
KK 1630 RETURN
KL 1650 J=P:GOSUB 8100:J=K:G
        OSUB 8100:IF K=DL TH
        EN GOSUB 1625:F=LH:G
        OTO 1685
HO 1654 F=0:IF KC=2 THEN GOT
        O 1660
JA 1655 IF SP(P,KS)>OU(NS(P,
        KS)) THEN F=1
HJ 1660 IF SP(P,KS)>OB(NS(P,
        KS)) THEN F=1
ED 1665 J=DL:GOSUB 8100:IF (
        F=0) OR (P<>K) THEN
        1685
AP 1670 SB=CP(KC):IF KC=5 TH
        EN SB=3
GF 1675 FOR I=0 TO 3:IF I<>K
        S THEN IF SP(P,I)>=(
        SP(P,KS)-SB) THEN F=
        0
FH 1680 NEXT I
MF 1685 IF F=1 THEN TP=KS
LJ 1699 RETURN
JH 1700 LO=2:HI=3:XP=13:YP=1
        1:GOSUB 1910
AJ 1705 IF AN=3 THEN TP=KS
KJ 1710 RETURN
FI 1750 IF SP(P,KS)>PU(NS(P,
        KS)) THEN TP=KS
LC 1755 RETURN
HB 1800 LO=4:HI=8:XP=13:YP=9
        :GOSUB 1910
BN 1801 IF AN-5=KS THEN 1800
FP 1805 IF AN>4 THEN TP=AN-5
KK 1810 RETURN
BC 1850 DF=0:FOR I=0 TO 3:IF
        I=KS THEN 1865
II 1855 IF SP(P,I)-MS(NS(P,I
        ),PS)<DF THEN 1865
FH 1860 DF=SP(P,I)-MS(NS(P,I
        ),PS):TP=I
FM 1865 NEXT I
LA 1870 RETURN
LC 1900 FOR I=1 TO 3:FOR J=0
        TO 2:POSITION MY(I)
        ,MX(I)+J:? "
        {10 SPACES}";
BK 1905 NEXT J:NEXT I
LB 1907 RETURN
DC 1910 AN=LO
CO 1915 POKE 77,0:X1=XP:Y1=Y
        P:FOR I=LO TO HI:GOS
        UB 8000:IF I<>AN THE
        N 1925
PM 1920 FOR J=1 TO LEN(ME$):
        ME$(J,J)=CHR$(ASC(ME
        $(J,J))+128):NEXT J
JG 1925 POSITION Y1,X1:? ME$
        ;:X1=X1+1:NEXT I
NK 1930 DR=STICK(0):IF DR<>1
        4 THEN 1940
EG 1935 AN=AN-1:IF AN<LO THE
        N AN=HI
MP 1940 IF DR<>13 THEN 1950
EH 1945 AN=AN+1:IF AN>HI THE
        N AN=LO
NF 1950 IF STRIG(0)=1 THEN 1
        915
OE 1955 X1=XP:Y1=YP:FOR I=LO
        TO HI:GOSUB 8000
JB 1960 POSITION Y1,X1:? BL$
        ;:X1=X1+1:NEXT I
```

```
LF 1965 RETURN
DC 2000 GOSUB 1250:GOSUB 122
        0:J=DL:GOSUB 8100:P=
        K:TP=4:BD=0:KU=0
PC 2005 X=7:Y=11:C=KC:S=KS:G
        OSUB 1200
DF 2007 IF DL<>0 THEN POSITI
        ON MY(DL)+1,MX(DL):?
         "DEALER"
AJ 2010 GOSUB 1500
MD 2015 IF P=0 THEN GOSUB 16
        00:GOTO 2040
CL 2016 IF ABS(P-DL)<>2 THEN
         2020
MN 2017 GOSUB 1625:IF LH=1 T
        HEN TP=KS:GOTO 2025
BA 2020 GOSUB 1650
PH 2025 POSITION MY(P),MX(P)
IL 2030 IF TP=4 THEN ? "  PA
        SS":GOTO 2040
LL 2035 BD=P:? "ORDER UP"
NB 2040 J=P:GOSUB 8100:P=K:I
        F (P<>DL) AND (TP=4)
         THEN 2010
HK 2045 P=DL:GOSUB 1500:IF T
        P<>4 THEN 2105
AG 2050 IF DL=0 THEN GOSUB 1
        700:GOTO 2070
AB 2055 GOSUB 1750:POSITION
        MY(DL),MX(DL)
GF 2060 IF TP=4 THEN ? " TUR
        NED":POSITION MY(DL)
        ,MX(DL)+1:? "  DOWN"
        :GOTO 2070
PD 2065 BD=P:? " PICKED":POS
        ITION MY(DL),MX(DL)+
        1:? "{3 SPACES}UP"
NN 2070 FOR DE=1 TO 100:NEXT
         DE
AK 2071 IF (BD=0) AND (TP<>4
        ) THEN 2105
FO 2072 X=7:Y=11:GOSUB 9000:
        IF TP<>4 THEN 2105
GA 2073 GOSUB 1900:PS=0
DK 2075 J=P:GOSUB 8100:P=K
MM 2080 IF P=0 THEN GOSUB 18
        00:GOTO 2090
IF 2085 GOSUB 1850:POSITION
        MY(P),MX(P)
LG 2086 FOR DE=1 TO 30:NEXT
        DE
NI 2088 IF TP=4 THEN ? "  PA
        SS";:GOTO 2090
JG 2089 BD=P:I=TP+5:GOSUB 80
        00:? ME$;
IN 2090 IF (P<>DL) AND (TP=4
        ) THEN PS=PS+1:GOTO
        2075
MI 2100 GOTO 2109
GP 2105 KU=1:IF (BD=0) AND (
        DL=2) THEN LH=1:GOTO
         2120
GG 2109 IF TP=4 THEN 2140
OO 2110 IF (LH=1) AND (BD<>0
        ) THEN 2120
PN 2111 IF BD=0 THEN GOSUB 1
        615:GOTO 2140
BE 2112 GOSUB 1625
EP 2115 IF LH=0 THEN 2140
FC 2120 POSITION MY(BD),MX(B
        D):? "LONEHAND":POSI
        TION MY(BD),MX(BD)+1
        :? "{8 SPACES}"
NL 2140 FOR DE=1 TO 100:NEXT
         DE
BG 2145 GOSUB 1900
KI 2150 RETURN
KF 2200 F=-1
IA 2205 F=F+1:IF C(0,F)=-1 T
        HEN 2205
IP 2210 G=F
GN 2215 POSITION G*5+1,19:?
        "{Q}{3 R}{E}":POSITI
        ON G*5+1,23:? "{Z}
        {3 R}{C}";
FP 2218 POSITION F*5+1,19:?
        "{H}{3 R}{J}":POSITI
        ON F*5+1,23:? "{■}
        {3 R}{■}";
ML 2220 DR=STICK(0):POKE 77,
        0
MI 2225 G=F:IF DR<>11 THEN 2
        250
NG 2230 F=NF(F):IF C(0,F)<0
        THEN 2230
NA 2245 GOTO 2215
JO 2250 IF DR<>7 THEN 2275
EB 2255 F=NF(F+2):IF C(0,F)<
        0 THEN 2255
MO 2270 GOTO 2215
NA 2275 IF STRIG(0)=1 THEN 2
        215
KM 2280 RETURN
LO 2300 FOR I=0 TO 4:IF (S(P
        ,I)=TP) AND (C(P,I)=
        2) THEN C(P,I)=7:GOT
        O 2310
DG 2305 POKE 203,S(P,I):POKE
         204,253:J=USR(1664)
        :POKE 203,TP:POKE 20
        4,253:K=USR(1664)
OK 2308 IF (J=K) AND (C(P,I)
        =2) THEN C(P,I)=6:S(
        P,I)=TP
EO 2310 NEXT I
BM 2315 FOR I=0 TO 4:FOR J=0
         TO 3:IF S(P,J)>S(P,
        J+1) THEN 2331
MH 2320 IF S(P,J)=S(P,J+1) T
        HEN IF C(P,J)>C(P,J+
        1) THEN 2331
LP 2325 T=C(P,J):C(P,J)=C(P,
        J+1):C(P,J+1)=T
PL 2330 T=S(P,J):S(P,J)=S(P,
        J+1):S(P,J+1)=T
BE 2331 NEXT J:NEXT I
AF 2335 FOR I=0 TO 4:PT(I)=0
        :IF S(P,I)=TP THEN P
        T(I)=C(P,I)+10:GOTO
        2350
ED 2340 IF C(P,I)=5 THEN PT(
        I)=9:GOTO 2350
JJ 2345 IF (S(P,I)<>S(P,NF(I
        ))) AND (S(P,I)<>S(P
        ,NF(I+2))) THEN PT(I
        )=-1
FC 2350 NEXT I
AD 2355 L=99:FOR I=0 TO 4:IF
         PT(I)<L THEN F=I:L=
        PT(I)
GN 2360 NEXT I:RETURN
HG 2500 FOR I=0 TO 3:FOR J=0
         TO 3:NS(I,J)=0:NEXT
         J:FOR J=0 TO 4:IF C
        (I,J)<>2 THEN 2515
NF 2505 IF S(I,J)=TP THEN C(
        I,J)=7:GOTO 2515
JE 2510 IF ABS(S(I,J)-TP)=2
        THEN C(I,J)=6:S(I,J)
        =TP
HP 2515 NS(I,S(I,J))=NS(I,S(
        I,J))+1:NEXT J:NEXT
        I
KJ 2520 RETURN
CO 2700 POSITION 2,2:? "PART
        NER?";:LO=9:HI=10:XP
        =2:YP=12:GOSUB 1910
OD 2705 FC(0)=0:IF AN=10 THE
        N FC(0)=2
NL 2710 POSITION 2,2:? "OPPO
        NENTS?";:LO=9:HI=10:
        XP=2:YP=14:GOSUB 191
        0
OG 2715 FC(1)=0:IF AN=10 THE
        N FC(1)=2
OC 2720 POSITION 2,2:? "
        {10 SPACES}";:RETURN
LD 3000 FOR I=0 TO 7:FOR J=0
         TO 3:CL(I,J)=0:NEXT
         J:NEXT I
HH 3001 POKE 203,TP:POKE 204
        ,253:I=USR(1664):CL(
        2,I)=1:FOR I=0 TO 3:
        SL(I)=0:NEXT I
EM 3002 J=DL:GOSUB 8100:LD=K
        :DM=4:TR(0)=0:TR(1)=
        0:IF LH=0 THEN 3015
EB 3005 IF BD=2 THEN X=19:FO
        R I=0 TO 4:Y=I*5+1:G
        OSUB 9000:NEXT I
OG 3010 J=BD:GOSUB 8100:J=K:
        GOSUB 8100:DM=K
IN 3011 IF LH=1 THEN IF LD=D
        M THEN J=LD:GOSUB 81
        00:LD=K
PN 3015 FOR TK=0 TO 4:P=LD:P
        S=0:TL=0:IF DM=P THE
        N J=P:GOSUB 8100:P=K
FE 3020 GOSUB 3500:WP=P:IF L
        H=1 THEN PS=PS+1
HI 3021 SL(S(P,PC(P)))=1
ML 3025 IF S(P,PC(P))=TP THE
        N TL=1
LP 3030 FOR I=1 TO 3:J=P:GOS
        UB 8100:P=K:IF P=DM
        THEN 3060
PJ 3035 PS=PS+1:GOSUB 3500:I
        F TL=0 THEN 3050
CA 3040 IF S(P,PC(P))=TP THE
        N IF C(P,PC(P))>C(WP
        ,PC(WP)) THEN WP=P
MO 3045 GOTO 3060
HD 3050 IF S(P,PC(P))=TP THE
        N WP=P:TL=1:GOTO 306
        0
IE 3055 IF S(P,PC(P))=S(WP,P
        C(WP)) THEN IF C(P,P
        C(P))>C(WP,PC(WP)) T
        HEN WP=P
HA 3060 NEXT I:FOR DE=1 TO 2
        0:NEXT DE
PL 3065 POSITION PY(WP),PX(W
        P):? "{C}{3 R}{Z}";
FE 3066 POSITION PY(WP),PX(W
        P)+4:? "{E}{3 R}{Q}"
        ;
II 3071 FOR DE=1 TO 150:NEXT
         DE:LD=WP:POKE 203,W
        P:POKE 204,253:J=USR
        (1664):WT=J:TR(WT)=T
        R(WT)+1
BN 3072 X=30+6*WT:Y=20:N=TR(
        WT):GOSUB 1465
MO 3075 FOR I=0 TO 3:X=PX(I)
        :Y=PY(I):GOSUB 9000:
        C(I,PC(I))=-1:NEXT I
        :NEXT TK
LC 3078 POSITION MY(BD),MX(B
        D):PRINT "
        {8 SPACES}";
NI 3080 POKE 203,BD:POKE 204
        ,253:BT=USR(1664):PO
        SITION 27,14
FG 3085 IF TR(BT)<3 THEN 310
        8
GA 3086 IF TR(BT)<5 THEN 309
        7
KD 3087 PW(BT)=PW(BT)+2+LH*2
GJ 3090 IF BT=0 THEN ? "■YO
        U WON ":POSITION 2
        7,15:? "■ALL TRICKS
        ":GOTO 3200
EB 3095 IF BT=1 THEN ? "■COMP
        UTER WON":POSITION 2
        7,15:? "■ALL TRICKS
        ":GOTO 3200
II 3097 PW(BT)=PW(BT)+1
FL 3100 IF TR(0)>2 THEN ? "■Y
        OU WON HAND";:GOTO 3
        200
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NP 3105 IF TR(1)>2 THEN ? "■
        COMPUTER ■":POSITIO
        N 27,15:? "■ WON HAN
        D ■":GOTO 3200
DO 3108 PW(1-BT)=PW(1-BT)+2
PF 3110 IF TR(0)<3 THEN ? "■
        OU'VE ■ BEEN":POSITIO
        N 27,15:? "■ EUCHRED
        ! ■":GOTO 3200
JJ 3115 IF TR(1)<3 THEN ? "■
        COMPUTER ■":POSITIO
        N 27,15:? "■ EUCHRED
        ! ■"
NK 3200 FOR DE=1 TO 200:NEXT
         DE
KK 3205 RETURN
BF 3500 IF P>0 THEN 3509
DJ 3501 POSITION 27,15
DE 3502 POSITION 27,14:? " Y
        OUR  PLAY ";:GOSUB 2
        200
ED 3503 LS=S(LD,PC(LD)):IF (
        PS=0) OR (S(P,F)=LS)
         OR (NS(P,LS)=0) THE
        N 3507
FE 3504 GOSUB 2215:GOTO 3503
FO 3505 Y=F*5+1:X=19:GOSUB 9
        000:GOTO 3530
LG 3507 POSITION 27,14:? "
        {12 SPACES}";
GB 3508 Y=F*5+1:X=19:GOSUB 9
        000:GOTO 3530
GN 3509 IF TK<5 THEN 3515
PJ 3510 FOR K=0 TO 4:IF C(P,
        J)>-1 THEN F=I
JD 3512 NEXT K:GOTO 3530
NE 3515 ON (PS+1) GOSUB 4000
        ,4100,4200,4200
HB 3530 PC(P)=F:Y=PY(P):X=PX
        (P):C=C(P,F):S=S(P,F
        ):GOSUB 1200
ID 3535 NS(P,S(P,F))=NS(P,S(
        P,F))-1:CL(C(P,F),S(
        P,F))=1
KM 3540 RETURN
NJ 4000 IF NS(P,TP)<>5-TK TH
        EN 4015
HO 4005 SP=TP:GOSUB 5200:IF
        F=1 THEN GOTO 5150

MK 4010 GOTO 5160
CB 4015 IF (LH<>1) OR (BD<>P
        ) THEN 4030
MG 4020 IF NS(P,TP)>0 THEN S
        P=TP:GOTO 5150
MO 4025 GOTO 5050
II 4030 GOSUB 5000:IF (F=1)
        AND (ABS(BD-P)=2) TH
        EN SP=TP:GOTO 5150
FO 4035 GOSUB 5250:IF (F<>1)
         OR (P<>BD) THEN 505
        0
IA 4040 GOSUB 5200:IF I=1 TH
        EN SP=TP:GOTO 5150
NA 4045 IF NS(P,TP)>2 THEN S
        P=TP:GOTO 5160
MM 4050 GOTO 5050
PN 4100 IF NS(P,S(LD,PC(LD))
        )=0 THEN 4115
HH 4105 GOSUB 5300:SP=S(LD,P
        C(LD)):IF F=1 THEN 5
        150
ML 4110 GOTO 5160
JM 4115 IF NS(P,TP)=5-TK THE
        N SP=TP:GOTO 5160
MK 4120 IF NS(P,TP)=0 THEN 5
        100
ID 4125 IF C(LD,PC(LD))=5 TH
        EN SP=TP:GOTO 5160
JJ 4130 IF BD<>P THEN SP=TP:
        GOTO 5160
II 4135 GOSUB 5250:IF F=1 TH
        EN SP=TP:GOTO 5160
MI 4140 GOTO 5100

AB 4200 IF NS(P,S(LD,PC(LD))
        )=0 THEN 4235
HL 4201 SP=S(LD,PC(LD))
JJ 4205 IF (SP<>TP) AND (TL=
        1) THEN 5160
EJ 4210 IF ABS(WP-P)<>2 THEN
         4225
ID 4215 GOSUB 5300:IF F=1 TH
        EN GOSUB 5350:IF F=0
         THEN 5150
MN 4220 GOTO 5160
IM 4225 GOSUB 5300:IF F=1 TH
        EN 5150
MO 4230 GOTO 5160
KI 4235 IF NS(P,TP)<5-TK THE
        N 4270
NB 4245 SP=TP:IF ABS(WP-P)=2
         THEN 5160
GC 4250 IF TL=0 THEN 5160
IN 4255 GOSUB 5300:IF F=1 TH
        EN 5400
NB 4260 GOTO 5160
NA 4270 IF NS(P,TP)=0 THEN 5
        100
EP 4275 IF ABS(WP-P)<>2 THEN
         4310
LG 4280 IF (TL=1) OR (PS=3)
        THEN 5100
LL 4285 IF C(WP,PC(WP))=5 TH
        EN 5100
LC 4290 IF C(WP,PC(WP))<4 TH
        EN SP=TP:GOTO 5160
IC 4300 GOSUB 5250:IF F=1 TH
        EN SP=TP:GOTO 5160
ML 4305 GOTO 5100
FG 4310 IF TL=0 THEN SP=TP:G
        OTO 5160
IB 4315 GOSUB 5300:IF F=1 TH
        EN SP=TP:GOTO 5400
MI 4320 GOTO 5100
IO 5000 F=0:FOR A=0 TO 4:IF
        C(P,A)>5 THEN F=1
GE 5005 NEXT A:RETURN
EA 5050 F=-1:FOR A=0 TO 4:IF
         (SL(S(P,A))=0) AND
        (S(P,A)<>TP) THEN IF
         C(P,A)=5 THEN F=A
PF 5055 NEXT A:IF F>-1 THEN
        5070
AJ 5060 LC=-1:FOR A=0 TO 4:I
        F S(P,A)<>TP THEN IF
         C(P,A)>LC THEN LC=C
        (P,A):F=A
FA 5065 NEXT A
KM 5070 RETURN
NB 5100 IF NS(P,TP)>0 THEN 5
        125
KP 5105 SP=-1:FOR A=0 TO 4
HJ 5110 IF S(P,A)<>TP THEN I
        F (C(P,A)=5) AND (NS
        (P,S(P,A)))>1) THEN S
        P=S(P,A)
EP 5115 NEXT A:IF SP>-1 THEN
         5160
MP 5120 GOTO 5180
FF 5125 V=4:F=-1:FOR A=0 TO
        4
JM 5126 IF S(P,A)=TP THEN 51
        35
NB 5130 IF (NS(P,S(P,A))<>1)
         OR (SL(S(P,A))=1) T
        HEN 5135
LO 5131 IF (C(P,A)>=0) AND (
        C(P,A)<V) THEN V=C(P
        ,A):F=A
PF 5135 NEXT A:IF F=-1 THEN
        5180
KK 5140 RETURN
GF 5150 IF PS=3 THEN 5400
CB 5151 V=-1:FOR A=0 TO 4:IF
         S(P,A)=SP THEN IF C
        (P,A)>V THEN V=C(P,A
        ):F=A
GK 5155 NEXT A:RETURN
GG 5160 V=10:FOR A=0 TO 4
MA 5161 IF S(P,A)=SP THEN IF
         (C(P,A)>=0) AND (C(
        P,A)<V) THEN V=C(P,A
        ):F=A
GL 5165 NEXT A:RETURN
AN 5180 V=10:FOR A=0 TO 4:IF
         S(P,A)<>TP THEN IF
        C(P,A)>-1 THEN IF C(
        P,A)<V THEN V=C(P,A)
        :F=A
GN 5185 NEXT A:RETURN
MF 5200 HT=8:F=0
OF 5205 HT=HT-1:IF HT>0 THEN
         IF CL(HT,TP)=1 THEN
         5205
FJ 5210 IF HT<0 THEN 5240
AP 5215 FOR A=0 TO 4:IF S(P,
        A)=TP THEN IF C(P,A)
        =HT THEN F=1
EJ 5220 NEXT A
KL 5240 RETURN
DC 5250 F=1:FOR A=0 TO 4:IF
        C(P,A)>-1 THEN IF (S
        (P,A)<>TP) AND (C(P,
        A)<5) THEN F=0
GL 5255 NEXT A:RETURN
KM 5300 F=0:FOR A=0 TO 4:IF
        S(P,A)=S(WP,PC(WP))
        THEN IF C(P,A)>C(WP,
        PC(WP)) THEN F=1
GH 5305 NEXT A:RETURN
AO 5350 F=0:FOR A=0 TO 4:IF
        S(P,A)=S(WP,PC(WP))
        THEN IF C(P,A)-C(WP,
        PC(WP))=1 THEN F=1
GM 5355 NEXT A:RETURN
FB 5400 D=10:FOR A=0 TO 4
MH 5405 IF S(P,A)=S(WP,PC(WP
        )) THEN E=C(P,A)-C(W
        P,PC(WP)):IF (E<D) A
        ND (E>0) THEN D=E:F=
        A
GE 5410 NEXT A:RETURN
NI 8000 J=I*10+1:ME$=TME$(J,
        J+LTME(I)):RETURN
DH 8100 K=((J+1)/4-INT((J+1)
        /4))*4:RETURN
PC 9000 FOR J=X TO X+4:POSIT
        ION Y,J:PRINT EC$;:N
        EXT J:RETURN
```

Program 3: Apple II Euchre

```
9C 5 POKE 49232,0: POKE 49237,0:
     POKE 49239,0: POKE 230,64:
     POKE 28,42: CALL 62454
33 8 GOSUB 1100
91 10 GOSUB 1000: GOSUB 2700: GO
     SUB 1300
92 25 GOSUB 2000
C5 30 INVERSE : IF TP < > 4 THEN
     70
13 35 VTAB 12: HTAB 30: PRINT "N
     O BIDDERS"
1F 40 VTAB 13: HTAB 29: PRINT "H
     AND  DUMPED"
75 50 NORMAL : GOSUB 1400:X = 20
     : FOR I = 0 TO 4:Y = I * 4
      + 5: GOSUB 9000: NEXT
C7 51 DL = FN NP(DL):X = 8:Y = 1
     3: GOSUB 9000
A5 55 GOSUB 1900: GOTO 25
D9 70 VTAB 12: HTAB 30: PRINT "T
     RUMP : ";S$(TP)
4F 75 VTAB 13: HTAB 30: PRINT "B
     IDDER: ";: IF BD = 0 THEN
     PRINT "YOU";: GOTO 90
58 80 PRINT "P";BD
15 90 NORMAL : IF KU = 0 THEN 13
     5
12 100 IF DL > 0 THEN 125
```

```
A9 115 VTAB 15: HTAB 29: PRINT "
       PICK DISCARD"
9C 121 GOSUB 2200: VTAB 15: HTAB
       29: PRINT EW$: GOTO 130
DC 125 GOSUB 2300
21 130 C(DL,F) = KC:S(DL,F) = KS
       : GOSUB 1220
EA 135 X = 8:Y = 13: GOSUB 9000
A4 140 GOSUB 2500: GOSUB 3000: I
       F (PW(0) > 9) OR (PW(1) >
       9) THEN 300
70 150 X = 21:Y = 32:N = 0: GOSU
       B 1465
A4 151 X = 21:Y = 38:N = 0: GOSU
       B 1465
7D 200 X = 7:Y = 32:N = PW(0): G
       OSUB 1465
AB 205 X = 7:Y = 38:N = PW(1): G
       OSUB 1465
1A 210 DL = FN NP(DL): GOSUB 135
       5: GOTO 25
8F 300 WT = 0: IF PW(1) > = 10 T
       HEN WT = 1
EF 305 X = 7:Y = 29 + WT * 6:N =
        1: GOSUB 1465
01 310 X = 7:Y = 32 + WT * 6:N =
        PW(WT) - 10: GOSUB 1465
F8 312 FOR I = 7 TO 9: VTAB I: H
       TAB 29: PRINT "<": NEXT
CB 315 FOR DE = 1 TO 2000: NEXT
81 320 GOSUB 1450: VTAB 14: HTAB
        29: INVERSE : PRINT "  Y
       OU";
E7 321 IF WT = 0 THEN PRINT " WI
       N!  "
9E 322 IF WT = 1 THEN PRINT " LO
       SE  "
60 325 VTAB 2: HTAB 2: PRINT "PL
       AY AGAIN?"
42 330 LO = 11:HI = 12:XP = 2:YP
        = 14: GOSUB 1910
E9 340 IF AN = 11 THEN CALL 6245
       4: GOTO 10
DA 350 TEXT : HOME : END
20 1000 HOME : HCOLOR= 3
2D 1005 VTAB 1: HTAB 29: PRINT "
       @@@@@@@@@@@@@"
DD 1010 VTAB 2: HTAB 29: PRINT "
       @  EUCHRE  @"
33 1015 VTAB 3: HTAB 29: PRINT "
       @@@@@@@@@@@@@"
F1 1025 VTAB 4: HTAB 29: PRINT "
       <  POINTS  ;"
92 1028 VTAB 18: HTAB 29: PRINT
       "<  TRICKS  ;"
7A 1030 VTAB 5: HTAB 29: PRINT "
       <YOU ; COMP;"
F4 1040 FOR I = 0 TO 4: VTAB 6 +
        I: HTAB 29: PRINT "<
        ;     ;": NEXT
E3 1042 VTAB 11: HTAB 29: PRINT
       EW$
F7 1043 VTAB 17: HTAB 29: PRINT
       EW$
75 1050 VTAB 19: HTAB 29: PRINT
       "<YOU ; COMP;"
89 1055 FOR I = 0 TO 4: VTAB 20
       + I: HTAB 29: PRINT "<
         ;     ;";: NEXT
79 1060 HPLOT 198,40 TO 278,40
99 1065 HPLOT 198,152 TO 278,152
       : HPLOT 198,191 TO 278,1
       91
BA 1081 N = 0:X = 7:Y = 32: GOSU
       B 1465:Y = 38: GOSUB 146
       5
11 1082 X = 21:Y = 32: GOSUB 146
       5:Y = 38: GOSUB 1465
87 1090 GOSUB 1450
1E 1095 RETURN
59 1100 DIM C(3,4),S(3,4),MS(6,3
       ),CL(7,3),DC(23),DS(23),
       SP(3,5),NS(3,5),ME$(15),
       NM$(9,2)
B8 1102 DEF FN B1(X) = NOT ( INT
        (X / 2) = X / 2)
F5 1105 DEF FN NP(X) = ((X + 1)
       / 4 - INT ((X + 1) / 4))
        * 4
31 1110 BL$ = "/././././.":EW$ =
       "@@@@@@@@@@@@@"
E4 1115 FOR I = 0 TO 3: READ S$(
       I): NEXT : DATA %&,(),*+
       ,",-"
B2 1120 FOR I = 0 TO 6: READ NF(
       I): NEXT : DATA 4,0,1,2,
       3,4,0
A9 1125 FOR I = 0 TO 2: FOR J =
       0 TO 9: READ NM$(J,I): N
       EXT J,I
9E 1127 DATA #@," @",>@,>@,=@,#>
       ,#>,#@,#@,#@
C1 1128 DATA =@," @",#>,>@,$@,>@
       ,#@," @",#@,>@
45 1129 DATA @@," @",@@,@@," @",
       @@,@@," @",@@," @"
D3 1150 FOR J = 0 TO 3: FOR I =
       0 TO 5:DC(J * 6 + I) = I
       :DS(J * 6 + I) = J: NEXT
        I,J
39 1161 FOR I = 0 TO 3: READ PY(
       I),PX(I): NEXT : DATA 13
       ,14,7,8,13,2,19,8
5D 1165 FOR I = 0 TO 3: READ CX(
       I),CY(I): NEXT : DATA 18
       ,13,11,5,4,13,11,21
3D 1170 FOR I = 0 TO 5: READ CP(
       I): NEXT : DATA 1,1,8,1,
       2,-1
B7 1175 FOR I = 0 TO 13: READ ME
       $(I): NEXT
DF 1178 DATA " PASS      "," ORDE
       R UP "," PASS      "," PIC
       K UP "," PASS      "," DI
       AMONDS "," CLUBS     "
14 1179 DATA " HEARTS    "," SPAD
       ES    "," NORMAL ","AGGRE
       SSIVE"," YES "," NO   "," 
        YES "
6F 1185 FOR I = 0 TO 3: READ MX(
       I),MY(I): NEXT : DATA 1,
       2,8,2,2,10,8,18
A4 1186 FOR I = 0 TO 6: READ OB(
       I),OU(I),PU(I),MS(I,0),M
       S(I,1),MS(I,2),MS(I,3),G
       A(I): NEXT
C5 1190 DATA 99,99,99,99,99,99,9
       9,99
CD 1191 DATA 99,99,99,99,99,99,9
       9,99
B1 1192 DATA 99,99,14,14,14,13,1
       3,99
B2 1193 DATA 20,12,8,8,8,8,7,19
D5 1194 DATA 14,0,0,0,0,0,0,16
33 1195 DATA 0,0,0,0,0,0,0,14
A0 1196 DATA 0,0,0,0,0,0,0,0
40 1199 RETURN
C5 1200 IF (S = TP) AND (C = 6)
       THEN S = S + 2:S = (S /
       4 - INT (S / 4)) * 4
AA 1201 C1 = C: IF C1 > 5 THEN C
       1 = 2
9D 1202 CALL 36568,S * 6 + C1 +
       1,Y * 7 - 2,X * 8
D9 1210 RETURN
21 1220 X = 20: FOR U = 0 TO 4:Y
        = U * 4 + 5
75 1225 C = C(0,U):S = S(0,U): G
       OSUB 1200: NEXT
E1 1230 RETURN
11 1250 FOR I = 0 TO 23:J = INT
       ( RND (1) * 24):T = DC(I
       ):DC(I) = DC(J):DC(J) =
       T
57 1260 T = DS(I):DS(I) = DS(J):
       DS(J) = T: NEXT
70 1270 FOR J = 0 TO 3: FOR I =
       0 TO 4
AD 1275 C(J,I) = DC(J * 5 + I):S
       (J,I) = DS(J * 5 + I): N
       EXT I,J:KC = DC(20):KS =
        DS(20)
F5 1280 RETURN
2F 1300 INVERSE : VTAB 13: HTAB
       29: PRINT "FIRST  BLACK"
       : VTAB 14: HTAB 30: PRIN
       T "JACK DEALS"
CD 1320 NORMAL : GOSUB 1250:DL =
       0:CC = 0
4B 1330 C = DC(CC):S = DS(CC):X
       = CX(DL):Y = CY(DL): GOS
       UB 1200
5D 1331 FOR DE = 1 TO 500: NEXT
35 1335 IF (DC(CC) = 2) AND ( FN
       B1(DS(CC))) THEN 1355
41 1336 X = CX(DL):Y = CY(DL): G
       OSUB 9000
0D 1337 FOR DE = 1 TO 100: NEXT
9A 1340 CC = CC + 1:DL = FN NP(D
       L): GOTO 1330
88 1355 GOSUB 1450: VTAB 12: HTA
       B 30
77 1356 INVERSE : IF DL = 0 THEN
        1370
2F 1360 PRINT " PLAYER "; STR$ (
       DL)
03 1365 VTAB 13: HTAB 31: PRINT
       " DEALS";: GOTO 1375
4E 1370 PRINT "YOUR  DEAL";
5E 1375 NORMAL : GOSUB 1400
51 1376 X = CX(DL):Y = CY(DL): G
       OSUB 9000
F7 1380 RETURN
BC 1400 VTAB 15: HTAB 29: PRINT
       " HIT RETURN "; CHR$ (7)
       ;
45 1410 K = PEEK (49152): IF K >
        127 THEN POKE 49168,0
67 1412 IF K < > 141 THEN 1410
97 1415 GOSUB 1450
E5 1430 RETURN
E4 1450 FOR I = 12 TO 16: VTAB I
       : HTAB 29: PRINT EW$: NE
       XT : RETURN
EB 1465 FOR I = 0 TO 2: VTAB X +
        I: HTAB Y: PRINT NM$(N,
       I): NEXT : RETURN
E9 1500 FOR I = 0 TO 3:SP(P,I) =
        FC( FN B1(P)):NS(P,I) =
        0: NEXT
0A 1505 FOR I = 0 TO 4:S = S(P,I
       ):C = C(P,I):SP(P,S) = S
       P(P,S) + CP(C):NS(P,S) =
        NS(P,S) + 1
5D 1510 IF C = 2 THEN S = S + 2:
       S = (S / 4 - INT (S / 4)
       ) * 4:SP(P,S) = SP(P,S)
       + 6:NS(P,S) = NS(P,S) +
       1
E1 1515 IF C = 5 THEN FOR J = 0
       TO 3:SP(P,J) = SP(P,J) +
        4: NEXT
B3 1520 NEXT
F8 1525 SS = 0: FOR I = 0 TO 4:
       IF NS(P,I) = 0 THEN SP(P
       ,I) = 0:SS = SS + 1
A5 1530 NEXT : FOR I = 0 TO 3:SP
       (P,I) = SP(P,I) + SS: NE
       XT
79 1535 IF P < > DL THEN 1550
34 1540 IF KC = 5 THEN SP(P,KS)
       = SP(P,KS) + 4
8D 1545 SP(P,KS) = SP(P,KS) + CP
       (KC):NS(P,KS) = NS(P,KS)
        + 1
EF 1550 RETURN
57 1600 LO = 0:HI = 1:XP = 14:YP
        = 10: GOSUB 1910
10 1605 IF AN = 1 THEN TP = KS
E1 1610 RETURN
D7 1615 VTAB 14: HTAB 8: PRINT "
       LONEHAND";
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05 1616 LO = 12:HI = 13:XP = 14:
        YP = 18: GOSUB 1910:LH =
        0
CE 1618 IF AN = 13 THEN LH = 1:
        VTAB MX(BD): HTAB MY(BD)
        : PRINT "LONEHAND";
A5 1619 VTAB 14: HTAB 8: PRINT B
        L$
E5 1620 RETURN
E9 1625 LH = 0: IF SP(P,TP) > GA
        (NS(P,TP)) THEN LH = 1
E9 1630 RETURN
05 1650 IF FN NP( FN NP(P)) = DL
        THEN GOSUB 1625:F = LH:
        GOTO 1685
E1 1654 F = 0: IF KC = 2 THEN GO
        TO 1660
84 1655 IF SP(P,KS) > OU(NS(P,KS
        )) THEN F = 1
4D 1660 IF SP(P,KS) > OB(NS(P,KS
        )) THEN F = 1
34 1665 IF (F = 0) OR (P < > FN
        NP(DL)) THEN 1685
C6 1670 SB = CP(KC): IF KC = 5 T
        HEN SB = 3
BB 1675 FOR I = 0 TO 3: IF I < >
        KS THEN IF SP(P,I) > =
        (SP(P,KS) - SB) THEN F =
        0
CD 1680 NEXT
70 1685 IF F = 1 THEN TP = KS
4A 1699 RETURN
7A 1700 LO = 2:HI = 3:XP = 14:YP
        = 10: GOSUB 1910
16 1705 IF AN = 3 THEN TP = KS
E3 1710 RETURN
DE 1750 IF SP(P,KS) > PU(NS(P,KS
        )) THEN TP = KS
1C 1755 RETURN
CD 1800 LO = 4:HI = 8:XP = 14:YP
        = 10: GOSUB 1910
C1 1801 IF AN - 5 = KS THEN 1800
BB 1805 IF AN > 4 THEN TP = AN -
        5
E5 1810 RETURN
12 1850 DF = 0: FOR I = 0 TO 3:
        IF I = KS THEN 1865
90 1855 IF SP(P,I) - MS(NS(P,I),
        PS) < DF THEN 1865
6A 1860 DF = SP(P,I) - MS(NS(P,I
        ),PS):TP = I
F1 1865 NEXT
FD 1870 RETURN
96 1900 FOR I = 1 TO 3: FOR J =
        0 TO 2: VTAB MX(I) + J:
        HTAB MY(I): PRINT BL$
27 1905 NEXT J,I
1C 1907 RETURN
0D 1910 AN = LO
54 1915 X1 = XP:Y1 = YP: FOR I =
        LO TO HI: NORMAL : IF I
        = AN THEN INVERSE
B8 1925 VTAB X1: HTAB Y1: PRINT
        ME$(I);:X1 = X1 + 1: NEX
        T
E1 1930 K = PEEK (49152):J = RND
        (1): IF K > 127 THEN PO
        KE 49168,0
B3 1932 IF K < > 136 THEN 1940
CD 1935 AN = AN - 1: IF AN < LO
        THEN AN = HI
C7 1940 IF K < > 149 THEN 1950
EF 1945 AN = AN + 1: IF AN > HI
        THEN AN = LO
DC 1950 IF K < > 141 THEN GOTO 1
        915
42 1955 X1 = XP:Y1 = YP: NORMAL
        : FOR I = LO TO HI: VTAB
        X1: HTAB Y1: PRINT BL$;
        :X1 = X1 + 1: NEXT
24 1965 RETURN
16 2000 GOSUB 1250: GOSUB 1220:P
        = FN NP(DL):TP = 4:BD =
        0:KU = 0
A3 2005 X = 8:Y = 13:C = KC:S =
        KS: GOSUB 1200
71 2007 IF DL < > 0 THEN VTAB MX
        (DL): HTAB MY(DL): PRINT
        "  DEALER  "
44 2010 GOSUB 1500
28 2015 IF P = 0 THEN GOSUB 1600
        : GOTO 2040
69 2016 IF ABS (P - DL) < > 2 TH
        EN 2020
11 2017 GOSUB 1625: IF LH = 1 TH
        EN TP = KS: GOTO 2025
74 2020 GOSUB 1650
F9 2025 VTAB MX(P): HTAB MY(P)
1C 2030 IF TP = 4 THEN PRINT "
        PASS   ": GOTO 2040
65 2035 BD = P: PRINT " ORDER UP
        "
72 2040 P = FN NP(P): IF (P < >
        DL) AND (TP = 4) THEN 20
        10
94 2045 P = DL: GOSUB 1500: IF T
        P < > 4 THEN 2105
3A 2050 IF DL = 0 THEN GOSUB 170
        0: GOTO 2070
F7 2055 GOSUB 1750: VTAB MX(DL):
        HTAB MY(DL)
EB 2060 IF TP = 4 THEN PRINT "
        TURNED  ": VTAB MX(DL) +
        1: HTAB MY(DL): PRINT "
          DOWN   ": GOTO 2070
E9 2065 BD = P: PRINT "  PICKED
        ": VTAB MX(DL) + 1: HTA
        B MY(DL): PRINT "    UP
          "
34 2070 FOR DE = 1 TO 2000: NEXT
44 2071 IF (BD = 0) AND (TP < >
        4) THEN 2105
45 2072 X = 8:Y = 13: GOSUB 9000
        : IF TP < > 4 THEN 2105
19 2073 GOSUB 1900:PS = 0
B2 2075 P = FN NP(P)
CC 2080 IF P = 0 THEN GOSUB 1800
        : GOTO 2090
C9 2085 GOSUB 1850: VTAB MX(P):
        HTAB MY(P)
B4 2086 FOR DE = 1 TO 600: NEXT
67 2088 IF TP = 4 THEN PRINT "
        PASS   ";: GOTO 2090
BE 2089 BD = P: PRINT ME$(TP + 5
        );
FC 2090 IF (P < > DL) AND (TP =
        4) THEN PS = PS + 1: GOT
        O 2075
98 2100 GOTO 2109
BB 2105 KU = 1: IF (BD = 0) AND
        (DL = 2) THEN LH = 1: GO
        TO 2120
4C 2109 IF TP = 4 THEN 2140
48 2110 IF (LH = 1) AND (BD < >
        0) THEN 2120
60 2111 IF BD = 0 THEN GOSUB 161
        5: GOTO 2140
BA 2112 GOSUB 1625
22 2115 IF LH = 0 THEN 2140
3A 2120 VTAB 1: HTAB 2: PRINT "L
        ONEHAND"
2A 2140 FOR DE = 1 TO 2000: NEXT
8A 2145 GOSUB 1900
E8 2150 RETURN
C8 2200 F = - 1
B5 2205 F = F + 1: IF C(0,F) = -
        1 THEN 2205
4A 2210 G = F
95 2215 X = (G * 4 + 5) * 7 - 5:
        Y = 158:X1 = X + 22:Y1 =
        Y + 27: HCOLOR= 1: HPLO
        T X,Y TO X1,Y TO X1,Y1 T
        O X,Y1 TO X,Y
2E 2218 X = (F * 4 + 5) * 7 - 5:
        Y = 158:X1 = X + 22:Y1 =
        Y + 27: HCOLOR= 3: HPLO
        T X,Y TO X1,Y TO X1,Y1 T
        O X,Y1 TO X,Y
46 2220 K = PEEK (49152): IF K >
        127 THEN POKE 49168,0
89 2223 IF K = 141 THEN 2280
E5 2225 G = F: IF K < > 136 THEN
        2250
18 2230 F = NF(F): IF C(0,F) < 0
        THEN 2230
B8 2245 GOTO 2215
E1 2250 IF K < > 149 THEN 2275
3E 2255 F = NF(F + 2): IF C(0,F)
        < 0 THEN 2255
9C 2270 GOTO 2215
A0 2275 GOTO 2220
89 2280 X = (G * 4 + 5) * 7 - 5:
        Y = 158:X1 = X + 22:Y1 =
        Y + 27: HCOLOR= 1: HPLO
        T X,Y TO X1,Y TO X1,Y1 T
        O X,Y1 TO X,Y
1F 2285 RETURN
AF 2300 FOR I = 0 TO 4: IF (S(P,
        I) = TP) AND (C(P,I) = 2
        ) THEN C(P,I) = 7: GOTO
        2310
FE 2305 IF ( FN B1(S(P,I)) = FN
        B1(TP)) AND (C(P,I) = 2)
        THEN C(P,I) = 6:S(P,I)
        = TP
AC 2310 NEXT
20 2315 FOR I = 0 TO 4: FOR J =
        0 TO 3: IF S(P,J) > S(P,
        J + 1) THEN 2331
67 2320 IF S(P,J) = S(P,J + 1) T
        HEN IF C(P,J) > C(P,J +
        1) THEN 2331
DB 2325 T = C(P,J):C(P,J) = C(P,
        J + 1):C(P,J + 1) = T
C0 2330 T = S(P,J):S(P,J) = S(P,
        J + 1):S(P,J + 1) = T
08 2331 NEXT J,I
A3 2335 FOR I = 0 TO 4:PT(I) = 0
        : IF S(P,I) = TP THEN PT
        (I) = C(P,I) / 10: GOTO
        2350
04 2340 IF C(P,I) = 5 THEN PT(I)
        = 9: GOTO 2350
10 2345 IF (S(P,I) < > S(P,NF(I)
        )) AND (S(P,I) < > S(P,N
        F(I + 2))) THEN PT(I) =
        - 1
BC 2350 NEXT
F4 2355 L = 99: FOR I = 0 TO 4:
        IF PT(I) < L THEN F = I:
        L = PT(I)
4A 2360 NEXT : RETURN
7C 2500 FOR I = 0 TO 3: FOR J =
        0 TO 3:NS(I,J) = 0: NEXT
        : FOR J = 0 TO 4: IF C(
        I,J) < > 2 THEN 2515
FF 2505 IF S(I,J) = TP THEN C(I,
        J) = 7: GOTO 2515
52 2510 IF ABS (S(I,J) - TP) = 2
        THEN C(I,J) = 6:S(I,J)
        = TP
AB 2515 NS(I,S(I,J)) = NS(I,S(I,
        J)) + 1: NEXT J,I
E4 2520 RETURN
66 2700 VTAB 2: HTAB 2: PRINT "P
        ARTNER?";:LO = 9:HI = 10
        :XP = 2:YP = 12: GOSUB 1
        910
43 2705 FC(0) = 0: IF AN = 10 TH
        EN FC(0) = 2
71 2710 VTAB 2: HTAB 2: PRINT "O
        PPONENTS?";:LO = 9:HI =
        10:XP = 2:YP = 14: GOSUB
        1910
CB 2715 FC(1) = 0: IF AN = 10 TH
        EN FC(1) = 2
85 2720 VTAB 2: HTAB 2: PRINT BL
        $: RETURN
F9 3000 FOR I = 0 TO 7: FOR J =
        0 TO 3:CL(I,J) = 0: NEXT
        J,I:CL(2, FN B1(TP)) =
        1
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B7 3001 FOR I = 0 TO 3:SL(I) = 0
       : NEXT I
4E 3002 LD = FN NP(DL):DM = 4:TR
       (0) = 0:TR(1) = 0: IF LH
        = 0 THEN 3015
2B 3005 IF BD = 2 THEN X = 20: F
       OR I = 0 TO 4:Y = I * 4
       + 5: GOSUB 9000: NEXT
BA 3010 DM = FN NP( FN NP(BD))
AB 3011 IF LH = 1 THEN IF LD = D
       M THEN LD = FN NP(LD)
F5 3015 FOR TK = 0 TO 4:P = LD:P
       S = 0:TL = 0: IF DM = P
       THEN P = FN NP(P)
EE 3020 GOSUB 3500:WP = P: IF LH
        = 1 THEN PS = PS + 1
B7 3021 SL(S(P,PC(P))) = 1
7F 3025 IF S(P,PC(P)) = TP THEN
       TL = 1
F5 3030 FOR I = 1 TO 3:P = FN NP
       (P): IF P = DM THEN 3060
69 3035 PS = PS + 1: GOSUB 3500:
       IF TL = 0 THEN 3050
B9 3040 IF S(P,PC(P)) = TP THEN
       IF C(P,PC(P)) > C(WP,PC(
       WP)) THEN WP = P
9E 3045 GOTO 3060
46 3050 IF S(P,PC(P)) = TP THEN
       WP = P:TL = 1: GOTO 3060
98 3055 IF S(P,PC(P)) = S(WP,PC(
       WP)) THEN IF C(P,PC(P))
       > C(WP,PC(WP)) THEN WP =
        P
6F 3060 NEXT : FOR DE = 1 TO 400
       : NEXT
1E 3065 FOR J = 1 TO 15: FOR I =
        3 TO 1 STEP - 1:Y = PX(
       WP) * 8 - 2:X = PY(WP) *
        7 - 5:X1 = X + 22:Y1 =
       Y + 27
27 3070 HCOLOR= I: HPLOT X,Y TO
       X1,Y TO X1,Y1 TO X,Y1 TO
        X,Y: FOR DE = 1 TO 5: N
       EXT DE,I,J
EA 3071 LD = WP:WT = FN B1(WP):T
       R(WT) = TR(WT) + 1
BB 3072 X = 21:Y = 32 + 6 * WT:N
       = TR(WT): GOSUB 1465
AF 3075 FOR I = 0 TO 3:X = PX(I)
       :Y = PY(I): GOSUB 9000:C
       (I,PC(I)) = - 1: NEXT I,
       TK
42 3078 VTAB 1: HTAB 2: PRINT BL
       $
1B 3080 BT = FN B1(BD): VTAB 15:
        HTAB 29
46 3085 IF TR(BT) < 3 THEN 3100
F6 3086 IF TR(BT) < 5 THEN 3097
AF 3087 PW(BT) = PW(BT) + 2 + LH
        * 2
E5 3090 IF BT = 0 THEN PRINT "
       YOU  WON  ": VTAB 16: HT
       AB 29: PRINT " ALL TRICK
       S ": GOTO 3200
25 3095 IF BT = 1 THEN PRINT "CO
       MPUTER WON": VTAB 16: HT
       AB 29: PRINT " ALL TRICK
       S ": GOTO 3200
68 3097 PW(BT) = PW(BT) + 1
17 3100 IF TR(0) > 2 THEN PRINT
       "YOU WON HAND";: GOTO 32
       00
B0 3105 IF TR(1) > 2 THEN PRINT
       "  COMPUTER  ": VTAB 16:
        HTAB 29: PRINT "  WON H
       AND  ": GOTO 3200
3A 3108 PW(1 - BT) = PW(1 - BT)
       + 2
DA 3110 IF TR(0) < 3 THEN PRINT
       "YOU'VE  BEEN": VTAB 16:
        HTAB 29: PRINT "  EUCHR
       ED!  ": GOTO 3200
85 3115 IF TR(1) < 3 THEN PRINT
       "  COMPUTER  ": VTAB 16:
        HTAB 29: PRINT "  EUCHR
       ED!  "
5D 3200 FOR DE = 1 TO 4000: NEXT
FF 3205 RETURN
FE 3500 IF P > 0 THEN 3509
92 3502 VTAB 15: HTAB 29: PRINT
       " YOUR  PLAY ";: GOSUB 2
       200
05 3503 LS = S(LD,PC(LD)): IF (P
       S = 0) OR (S(P,F) = LS)
       OR (NS(P,LS) = 0) THEN 3
       507
5D 3504 GOSUB 2215: GOTO 3503
A1 3505 X = 20:Y = F * 4 + 5: GO
       SUB 9000: GOTO 3530
10 3507 VTAB 15: HTAB 29: PRINT
       EW$
B9 3508 X = 20:Y = F * 4 + 5: GO
       SUB 9000: GOTO 3530
1D 3509 IF TK < 5 THEN 3515
C2 3510 FOR K = 0 TO 4: IF C(P,J
       ) > - 1 THEN F = I
5D 3512 NEXT : GOTO 3530
3E 3515 ON (PS + 1) GOSUB 4000,4
       100,4200,4200
5B 3530 PC(P) = F:Y = PY(P):X =
       PX(P):C = C(P,F):S = S(P
       ,F): GOSUB 1200
7C 3535 NS(P,S(P,F)) = NS(P,S(P,
       F)) - 1:CL(C(P,F),S(P,F)
       ) = 1
ED 3540 RETURN
72 4000 IF NS(P,TP) < > 5 - TK T
       HEN 4015
7D 4005 SP = TP: GOSUB 5200: IF
       F = 1 THEN GOTO 5150
6F 4010 GOTO 5160
17 4015 IF (LH < > 1) OR (BD < >
        P) THEN 4030
15 4020 IF NS(P,TP) > 0 THEN SP
       = TP: GOTO 5150
95 4025 GOTO 5050
D4 4030 GOSUB 5000: IF (F = 1) A
       ND ( ABS (BD - P) = 2) T
       HEN SP = TP: GOTO 5150
8C 4035 GOSUB 5250: IF (F < > 1)
       OR (P < > BD) THEN 5050
F4 4040 GOSUB 5200: IF I = 1 THE
       N SP = TP: GOTO 5150
47 4045 IF NS(P,TP) > 2 THEN SP
       = TP: GOTO 5160
79 4050 GOTO 5050
EE 4100 IF NS(P,S(LD,PC(LD))) =
       0 THEN 4115
55 4105 GOSUB 5300:SP = S(LD,PC(
       LD)): IF F = 1 THEN 5150
71 4110 GOTO 5160
CB 4115 IF NS(P,TP) = 5 - TK THE
       N SP = TP: GOTO 5160
33 4120 IF NS(P,TP) = 0 THEN 510
       0
4E 4125 IF C(LD,PC(LD)) = 5 THEN
        SP = TP: GOTO 5160
E7 4130 IF BD < > P THEN SP = TP
       : GOTO 5160
48 4135 GOSUB 5250: IF F = 1 THE
       N SP = TP: GOTO 5160
65 4140 GOTO 5100
73 4200 IF NS(P,S(LD,PC(LD))) =
       0 THEN 4235
AA 4201 SP = S(LD,PC(LD))
2C 4205 IF (SP < > TP) AND (TL =
       1) THEN 5160
0F 4210 IF ABS (WP - P) < > 2 TH
       EN 4225
0D 4215 GOSUB 5300: IF F = 1 THE
       N GOSUB 5350: IF F = 0 T
       HEN 5150
77 4220 GOTO 5160
07 4225 GOSUB 5300: IF F = 1 THE
       N 5150
7B 4230 GOTO 5160
FE 4235 IF NS(P,TP) < 5 - TK THE
       N 4270
A8 4245 SP = TP: IF ABS (WP - P)
       = 2 THEN 5160
D4 4250 IF TL = 0 THEN 5160
0C 4255 GOSUB 5300: IF F = 1 THE
       N 5400
87 4260 GOTO 5160
49 4270 IF NS(P,TP) = 0 THEN 510
       0
C4 4275 IF ABS (WP - P) < > 2 TH
       EN 4310
DE 4280 IF (TL = 1) OR (PS = 3)
       THEN 5100
0A 4285 IF C(WP,PC(WP)) = 5 THEN
        5100
24 4290 IF C(WP,PC(WP)) < 4 THEN
        SP = TP: GOTO 5160
18 4300 GOSUB 5250: IF F = 1 THE
       N SP = TP: GOTO 5160
81 4305 GOTO 5100
53 4310 IF TL = 0 THEN SP = TP:
       GOTO 5160
FB 4315 GOSUB 5300: IF F = 1 THE
       N SP = TP: GOTO 5400
61 4320 GOTO 5100
45 5000 F = 0: FOR A = 0 TO 4: I
       F C(P,A) > 5 THEN F = 1
57 5005 NEXT : RETURN
DF 5050 F = - 1: FOR A = 0 TO 4:
        IF (SL(S(P,A)) = 0) AND
       (S(P,A) < > TP) THEN IF
        C(P,A) = 5 THEN F = A
65 5055 NEXT : IF F > - 1 THEN 5
       070
1D 5060 LC = - 1: FOR A = 0 TO 4
       : IF S(P,A) < > TP THEN
       IF C(P,A) > LC THEN LC =
        C(P,A):F = A
E5 5065 NEXT
F1 5070 RETURN
6F 5100 IF NS(P,TP) > 0 THEN 512
       5
5C 5105 SP = - 1: FOR A = 0 TO 4
85 5110 IF S(P,A) < > TP THEN IF
        (C(P,A) = 5) AND (NS(P,
       S(P,A)) > 1) THEN SP = S
       (P,A)
0F 5115 NEXT A: IF SP > - 1 THEN
        5160
7E 5120 GOTO 5180
E3 5125 V = 4:F = - 1: FOR A = 0
       TO 4
28 5126 IF S(P,A) = TP THEN 5135
ED 5130 IF (NS(P,S(P,A)) < > 1)
       OR (SL(S(P,A)) = 1) THEN
        5135
2C 5131 IF (C(P,A) > = 0) AND (C
       (P,A) < V) THEN V = C(P,
       A):F = A
7F 5135 NEXT : IF F = - 1 THEN 5
       180
E7 5140 RETURN
D7 5150 IF PS = 3 THEN 5400
8F 5151 V = - 1: FOR A = 0 TO 4:
        IF S(P,A) = SP THEN IF
       C(P,A) > V THEN V = C(P,
       A):F = A
6D 5155 NEXT : RETURN
25 5160 V = 10: FOR A = 0 TO 4
9E 5161 IF S(P,A) = SP THEN IF (
       C(P,A) > = 0) AND (C(P,A
       ) < V) THEN V = C(P,A):F
        = A
71 5165 NEXT : RETURN
05 5180 V = 10: FOR A = 0 TO 4:
       IF S(P,A) < > TP THEN IF
        C(P,A) > - 1 THEN IF C(
       P,A) < V THEN V = C(P,A)
       :F = A
C4 5185 NEXT A: RETURN
1B 5200 HT = 8:F = 0
43 5205 HT = HT - 1: IF HT > 0 T
       HEN IF CL(HT,TP) = 1 THE
       N 5205
```

```
44 5210 IF HT < 0 THEN 5240
F1 5215 FOR A = 0 TO 4: IF S(P,A
      ) = TP THEN IF C(P,A) =
      HT THEN F = 1
B1 5220 NEXT
E9 5240 RETURN
85 5250 F = 1: FOR A = 0 TO 4: I
      F C(P,A) > - 1 THEN IF (
      S(P,A) < > TP) AND (C(P,
      A) < 5) THEN F = 0
6F 5255 NEXT : RETURN
A1 5300 F = 0: FOR A = 0 TO 4: I
      F S(P,A) = S(WP,PC(WP))
      THEN IF C(P,A) > C(WP,PC
      (WP)) THEN F = 1
5D 5305 NEXT : RETURN
DB 5350 F = 0: FOR A = 0 TO 4: I
      F S(P,A) = S(WP,PC(WP))
      THEN IF C(P,A) - C(WP,PC
      (WP)) = 1 THEN F = 1
71 5355 NEXT : RETURN
F1 5400 D = 10: FOR A = 0 TO 4
85 5405 IF S(P,A) = S(WP,PC(WP))
       THEN E = C(P,A) - C(WP,
      PC(WP)): IF (E < D) AND
      (E > 0) THEN D = E:F = A
3B 5410 NEXT : RETURN
46 9000 CALL 36568,0,Y * 7 - 1,X
       * 8: RETURN
```

Program 4: Graphics File For Apple Euchre

Refer to the instructions in the article before entering this lising.

```
8CA8: D8 78 85 45 86 46 84 47 EE
8CB0: A6 07 0A 0A B0 04 10 3E B4
8CB8: 30 04 10 01 E8 E8 0A 86 82
8CC0: 1B 18 65 06 85 1A 90 02 32
8CC8: E6 1B A5 28 85 08 A5 29 14
8CD0: 29 03 05 E6 85 09 A2 08 EB
8CD8: A0 00 B1 1A 24 32 30 02 66
8CE0: 49 7F A4 24 91 08 E6 1A E9
8CE8: D0 02 E6 1B A5 09 18 69 64
8CF0: 04 85 09 CA D0 E2 A5 45 DD
8CF8: A6 46 A4 47 58 4C F0 FD D3
8D00: 00 00 00 00 00 00 00 00 1B
8D08: 00 30 30 30 30 00 30 00 1A
8D10: 00 00 00 00 00 00 00 00 2B
8D18: FF FF FF FF 87 87 87 87 24
8D20: 87 87 87 87 FF FF FF FF 4A
8D28: 00 00 40 50 54 50 40 00 B4
8D30: 00 00 00 02 0A 02 00 00 C3
8D38: 00 18 0C 00 00 00 00 00 DA
8D40: 00 00 60 60 78 78 60 00 D3
8D48: 00 00 01 01 07 07 01 00 E9
8D50: 00 00 10 54 54 50 40 00 17
8D58: 00 00 02 0A 0A 02 00 00 AC
8D60: 00 00 40 70 7C 7C 60 00 21
8D68: 00 00 00 03 0F 0F 01 00 6A
8D70: 2A 2A 2A 2A 2A 2A 2A 2A 8B
8D78: 55 55 55 55 55 55 55 55 93
8D80: 80 BC E6 F6 EE E6 BC 80 64
8D88: 80 98 9C 98 98 98 BC 80 48
8D90: 80 BC E6 B0 8C E6 FE 80 81
8D98: 80 BC E6 B0 E0 E6 BC 80 A7
8DA0: 80 B0 B8 B4 FE B0 B0 80 27
8DA8: 80 FE 86 BE E0 E6 BC 80 1D
8DB0: 80 BC 86 BE E6 E6 BC 80 C4
8DB8: 80 FE E0 B0 98 8C 8C 80 8B
8DC0: 80 BC E6 BC E6 E6 BC 80 C0
8DC8: 80 BC E6 E6 FC B0 98 80 FA
8DD0: 80 80 8C 80 80 8C 80 80 9D
8DD8: F0 F0 F0 F0 F0 F0 F0 F0 F3
8DE0: 83 83 83 83 83 83 83 83 FB
8DE8: 87 87 87 87 87 87 87 87 04
8DF0: 7F 7F 7F 7F 00 00 00 00 93
8DF8: 80 BC E6 B0 98 80 98 80 E3
8E00: FF FF FF FF FF FF FF FF 1D
8E08: 80 FC E6 E6 FE E6 E6 80 D1
8E10: 80 BE E6 E6 BE E6 FE 80 78
8E18: 80 BC E6 86 86 E6 BE 80 B7
8E20: 80 BE E6 E6 E6 E6 BE 80 49
8E28: 80 FE 86 86 BE 86 FE 80 0D
8E30: 80 FE 86 86 BE 86 86 80 24
8E38: 80 BC E6 86 F6 E6 BE 80 5B
8E40: 80 E6 E6 E6 FE E6 E6 80 84
8E48: 80 98 98 98 98 98 98 80 41
8E50: 80 E0 E0 E0 E0 E6 BC 80 AC
8E58: 80 E6 E6 B6 9E E6 E6 80 96
8E60: 80 86 86 86 86 86 FE 80 65
8E68: 80 E6 FE E6 E6 E6 E6 80 EE
8E70: 80 BE E6 E6 E6 E6 E6 80 E9
8E78: 80 BC E6 E6 E6 E6 BC 80 1D
8E80: 80 BE E6 E6 BE 86 86 80 76
8E88: 80 BC E6 E6 E6 B6 EC 80 CC
8E90: 80 BE E6 E6 BE E6 E6 80 C8
8E98: 80 BC E6 8C B0 E6 BE 80 E9
8EA0: 80 FE 98 98 98 98 98 80 33
8EA8: 80 E6 E6 E6 E6 E6 BE 80 DB
8EB0: 80 E6 E6 E6 E6 E6 98 80 97
8EB8: 80 E6 E6 E6 E6 FE E6 80 9C
8EC0: 80 E6 E6 E6 BC E6 E6 80 F2
8EC8: 80 E6 E6 E6 BC 98 98 80 25
8ED0: 80 FE B0 98 8C 86 FE 80 8A
8ED8: 20 D0 8F B0 7E 20 E4 90 06
8EE0: B0 79 20 49 91 B0 74 AD 33
8EE8: D9 91 F0 0F A9 7F 8D E0 AD
8EF0: 91 8D E1 91 A9 07 8D E2 F6
8EF8: 91 D0 0F A9 2A 8D E0 91 6A
8F00: A9 55 8D E1 91 A9 02 8D DD
8F08: E2 91 A9 03 8D D0 91 A9 DE
8F10: 02 8D D7 91 AD DC 91 8D 39
8F18: D6 91 AD DB 91 8D D5 91 7A
8F20: 20 ED 8F A9 18 8D D1 91 83
8F28: 20 7C 90 20 40 90 EE D4 81
8F30: 91 CE D1 91 D0 F2 AD D9 A6
8F38: 91 F0 20 A0 00 AD DA 91 68
8F40: 20 6C 8F A0 04 AD DA 91 A4
8F48: 20 6C 8F A0 08 AD D9 91 CA
8F50: 20 6C 8F A0 0C AD D9 91 F2
8F58: 20 6C 8F 60 60 91 03 08 F1
8F60: 80 91 0A 08 98 91 01 01 F3
8F68: 98 91 0A 0F 0A 0A 0A 8D 84
8F70: DE 91 B9 5C 8F 85 FC C8 B5
8F78: B9 5C 8F 85 FD C8 AD DB 20
8F80: 91 8D D5 91 B9 5C 8F C8 C6
8F88: 18 6D DC 91 C9 07 90 07 56
8F90: E9 07 EE D5 91 B0 F5 8D 6A
8F98: D6 91 B9 5C 8F 18 6D DD 1A
8FA0: 91 8D D4 91 A9 01 8D D0 DC
8FA8: 91 A9 07 8D D7 91 A9 08 15
8FB0: 8D D1 91 AC DE 91 B1 FC A5
8FB8: 8D E0 91 20 ED 8F 20 7C 75
8FC0: 90 20 40 90 EE D4 91 EE 1E
8FC8: DE 91 CE D1 91 D0 E4 60 AC
8FD0: 20 55 91 C9 19 90 01 60 91
8FD8: A2 00 8E DA 91 C9 07 90 1B
8FE0: 07 E9 06 EE DA 91 B0 F5 22
8FE8: 8D D9 91 18 60 AD D0 91 E5
8FF0: 8D D2 91 A8 A9 00 99 E0 A9
8FF8: 91 AD D6 91 18 6D D7 91 F7
9000: C9 07 90 05 E9 07 EE D2 46
9008: 91 8D D8 91 AD E0 91 09 A6
9010: 7F 8D D3 91 AC D6 91 F0 BC
9018: 15 A2 00 0E E0 91 BD E0 F6
9020: 91 0A 3E E1 91 E8 EC D2 4F
9028: 91 D0 F3 88 D0 EB AC D2 AF
9030: 91 B9 E0 91 09 80 2D D3 36
9038: 91 99 E0 91 88 10 F2 60 88
9040: AC D8 91 B9 6E 90 AC D2 9D
9048: 91 88 31 FE 19 E0 91 91 6B
9050: FE 88 30 0A F0 08 B9 E0 B5
9058: 91 91 FE 88 D0 F8 AC D6 A9
9060: 91 B9 75 90 A0 00 31 FE D6
9068: 0D E0 91 91 FE 60 7F 7E 8A
9070: 7C 78 70 60 40 00 01 03 09
9078: 07 0F 1F 3F AD D4 91 29 C5
9080: 3F A8 B9 A4 90 05 E6 85 D8
9088: FF AD D4 91 29 08 F0 02 16
9090: A9 80 18 2C D4 91 70 04 3E
9098: 10 04 69 28 69 28 6D D5 0F
90A0: 91 85 FE 60 00 04 08 0C FD
90A8: 10 14 18 1C 00 04 08 0C C7
90B0: 10 14 18 1C 01 05 09 0D DE
90B8: 11 15 19 1D 01 05 09 0D D7
90C0: 11 15 19 1D 02 06 0A 0E EE
90C8: 12 16 1A 1E 02 06 0A 0E E7
90D0: 12 16 1A 1E 03 07 0B 0F FE
90D8: 13 17 1B 1F 03 07 0B 0F F7
90E0: 13 17 1B 1F A9 00 8D DB EA
90E8: 91 8D DC 91 20 55 91 C0 25
90F0: 01 90 12 F0 01 60 C9 18 3D
90F8: 90 01 60 A9 24 8D DB 91 E9
9100: A9 04 8D DC 91 8D 11 91 EE
9108: A9 00 8D DF 91 A2 04 18 E6
9110: 69 00 6A 6E DF 91 4A 6E 64
9118: DF 91 4A 6E DF 91 CA D0 6B
9120: EE AA AD DF 91 2A 2A 2A CC
9128: 2A 29 07 C9 07 D0 03 A9 53
9130: 00 E8 18 6D DC 91 C9 07 2F
9138: 90 03 A9 00 E8 8D DC 91 62
9140: 8A 18 6D DB 91 8D DB 91 26
9148: 60 20 55 91 8D D4 91 8D D7
9150: DD 91 C9 C0 60 20 B1 00 F2
9158: 20 05 E1 A5 A1 A4 A0 60 A4
9160: 7F 7F 5F 57 55 57 5F 7F CA
9168: 7F 7F 47 47 01 01 47 7F A2
9170: 7F 7F 77 55 55 57 5F 7F BD
9178: 7F 7F 5F 07 01 01 0F 7F 41
9180: 7F 7F 7F 7E 7A 7E 7F 7F 67
9188: 7F 7F 7F 7F 7E 7E 7F 7F 9F
9190: 7F 7F 7E 7A 7A 7E 7F 7F 17
9198: 7F 7F 7F 7E 78 78 7F 7F 57
91A0: 63 1C 1C 1C 03 1F 1C 63 F1
91A8: 40 73 73 73 73 73 73 73 32
91B0: 1F 1F 1F 1F 1F 1F 1C 63 12
91B8: 63 1C 1C 1C 1C 10 44 13 96
91C0: 1C 1C 1C 60 1C 1C 1C 1C 28
91C8: 63 49 1C 1C 00 1C 1C 50 2E
```

Program 5: IBM PC/PCjr Euchre

```
NJ 5 KEY OFF:DEF SEG=0:DEFINT A-
     Z:POKE 1047,PEEK(1047) OR 6
     4:RANDOMIZE TIMER
KP 10 GOSUB 1100:GOSUB 1000:GOSU
     B 2700:GOSUB 1300
MD 25 GOSUB 2000:COLOR 1,7
PC 30 IF TP<>4 THEN 70
MA 35 LOCATE 12,29:PRINT "NO BID
     DERS"
MP 40 LOCATE 13,28:PRINT "HAND
     DUMPED"
JL 50 GOSUB 1400:X=20:FOR I=0 TO
      4:Y=I*5+3:GOSUB 9000:NEXT
      I
EP 51 DL=FNNP(DL):X=8:Y=13:GOSUB
      9000
DA 55 GOSUB 1900:GOTO 25
LO 70 COLOR 9,7:LOCATE 12,29:PRI
     NT "TRUMP : ";:COLOR CO(TP
     ):PRINT S$(TP):COLOR 9
JB 75 LOCATE 13,29:PRINT "BIDDER
     : ";:IF BD=0 THEN PRINT "y
     ou";:GOTO 90
JO 80 PRINT "p";RIGHT$(STR$(BD),
     1)
BL 90 IF KU=0 THEN 135
OF 100 IF DL>0 THEN 125
FH 115 COLOR 14,0:LOCATE 15,28:P
     RINT "PICK DISCARD"
CG 121 GOSUB 2200:LOCATE 15,28:P
     RINT "                ";:GOTO
      130
BK 125 GOSUB 2300
HJ 130 C(DL,F)=KC:S(DL,F)=KS:GOS
     UB 1220
GI 135 X=8:Y=13:GOSUB 9000
PP 140 GOSUB 2500:GOSUB 3000:COL
     OR 0,4:IF (PW(0)>9) OR (P
     W(1)>9) THEN 300
KI 150 X=21:Y=31:N=0:GOSUB 1465
PJ 151 X=21:Y=37:N=0:GOSUB 1465
GK 200 X=7:Y=31:N=PW(0):GOSUB 14
     65
ME 205 X=7:Y=37:N=PW(1):GOSUB 14
     65
BM 210 DL=FNNP(DL):GOSUB 1355:GO
     TO 25
```

```
LL 300 WT=0:IF PW(1)>=10 THEN WT
       =1
PD 305 X=7:Y=28+WT*6:N=1:GOSUB 1
       465
KL 310 X=7:Y=31+WT*6:N=PW(WT)-10
       :GOSUB 1465
BC 315 FOR DE=1 TO 1000:NEXT
JF 320 GOSUB 1450:COLOR 0,4:LOCA
       TE 13,28:PRINT "  YOU";
GO 321 IF WT=0 THEN PRINT " WIN!
         "
JA 322 IF WT=1 THEN PRINT " LOSE
         "
JO 325 COLOR 7,1:LOCATE 2,2:PRIN
       T "Play again?"
LL 330 LO=11:HI=12:XP=2:YP=14:GO
       SUB 1910
EJ 340 IF AN=11 THEN RUN
LP 350 PRINT CHR$(125):END
EF 1000 SCREEN 0,1:WIDTH 40:COLO
       R ,1,9:CLS
LB 1005 COLOR 0,6:LOCATE 1,28,0:
       PRINT "▛▀▀▀▀▀▀▀▀▀▀▜"
EH 1010 LOCATE 2,28:PRINT "▌ EU
       CHRE ▐"
CH 1015 LOCATE 3,28:PRINT " ▙▄▄▄
       ▄▄▄▄▟"
AF 1025 COLOR 10,0:LOCATE 4,28:P
       RINT "---POINTS---"
GJ 1028 LOCATE 18,28:PRINT "---T
       RICKS---"
FG 1030 COLOR 2,0:LOCATE 5,28:PR
       INT " YOU   COMP "
LM 1040 FOR I=0 TO 4:LOCATE 6+I,
       28:PRINT "              ":
       NEXT
PI 1042 COLOR 5,7:LOCATE 11,28:P
       RINT "              "
OM 1043 LOCATE 17,28:PRINT "
                "
OF 1050 COLOR 2,0:LOCATE 19,28:P
       RINT " YOU   COMP "
HJ 1055 FOR I=0 TO 4:LOCATE 20+I
       ,28:PRINT "              "
       ;:NEXT I
MC 1060 FOR I=0 TO 5:LOCATE 19+I
       ,33:PRINT"▐";:NEXT
IH 1070 FOR I=0 TO 5:LOCATE 5+I,
       33:PRINT"▐";:NEXT
CD 1081 COLOR 0,4:N=0:X=7:Y=31:G
       OSUB 1465:Y=37:GOSUB 146
       5
PL 1082 X=21:Y=31:GOSUB 1465:Y=3
       7:GOSUB 1465
KB 1090 GOSUB 1450:COLOR 7,1:RET
       URN
DB 1100 DIM C(3,4),S(3,4),MS(6,3
       ),CL(7,3),DC(23),DS(23),
       SP(3,5),NS(3,5),ME$(15)
JP 1105 DEF FNNP(X)=((X+1)/4-INT
       ((X+1)/4))*4
MA 1110 BL$=SPACE$(10):C$="9 10J
         Q K A J J  910 J Q K A
        J J"
KA 1111 T$=SPACE$(4):CD$=CHR$(31
       ):CL$=CHR$(29):NL$=CD$+S
       TRING$(4,29)
MD 1112 N$(0)="▗▟▙▖▝▀▘▗▄▖
         ":N$(1)="▟▙▖▝▀▘▗▄▖▟▙▖
         ":N$(2)="▝▀▘▗▄▖▟▙▖▝▀▘
         "
KO 1115 RESTORE 1115:FOR I=0 TO
       3:READ S,CO(I):S$(I)=CHR
       $(S):NEXT:DATA 4,4,5,0,3
       ,4,6,0
GO 1120 RESTORE 1120:FOR I=0 TO
       6:READ NF(I):NEXT:DATA 4
       ,0,1,2,3,4,0
PB 1150 FOR J=0 TO 3:FOR I=0 TO
       5:DC(J*6+I)=I:DS(J*6+I)=
       J:NEXT I,J
ME 1161 RESTORE 1161:FOR I=0 TO
       3:READ PY(I),PX(I):NEXT:
       DATA 13,14,8,8,13,2,18,8
MA 1165 RESTORE 1165:FOR I=0 TO
       3:READ CX(I),CY(I):NEXT:
       DATA 18,12,11,5,4,12,11,
       19
JK 1170 RESTORE 1170:FOR I=0 TO
       5:READ CP(I):NEXT:DATA 1
       ,1,8,1,2,-1
OP 1175 RESTORE 1178:FOR I=0 TO
       13:READ ME$(I):NEXT:ME$(
       5)=CHR$(4)+ME$(5):ME$(6)
       =CHR$(5)+ME$(6):ME$(7)=C
       HR$(3)+ME$(7):ME$(8)=CHR
       $(6)+ME$(8)
JM 1178 DATA "pass    ","order u
       p","pass    ","pick up","
         PASS    "," diamonds",
       " clubs   "," hearts  ",
       " spades  ","normal","ag
       gressive","yes","no ","y
       es"
IF 1185 RESTORE 1185:FOR I=0 TO
       3:READ MX(I),MY(I):NEXT:
       DATA 1,1,8,4,2,12,8,20
CG 1186 RESTORE 1190:FOR I=0 TO
       6:READ OB(I),OU(I),PU(I)
       ,MS(I,0),MS(I,1),MS(I,2)
       ,MS(I,3),GA(I):NEXT
QO 1190 DATA 99,99,99,99,99,99,9
       9,99
AC 1191 DATA 99,99,99,99,99,99,9
       9,99
ON 1192 DATA 99,99,14,14,14,13,1
       3,99
GO 1193 DATA 20,12,8,8,8,8,7,19
LJ 1194 DATA 14,0,0,0,0,0,0,16
ED 1195 DATA 0,0,0,0,0,0,0,14
OG 1196 DATA 0,0,0,0,0,0,0,0
EM 1199 RETURN
EA 1200 IF (S=TP) AND (C=6) THEN
         S=S+2:S=(S/4-INT(S/4))*
       4
LL 1201 NC=C*2+1:COLOR CO(S),7:L
       OCATE X,Y
II 1202 PRINT MID$(C$,NC,2);"  "
       ;NL$;S$(S);"   ";NL$;T$;
       NL$;"   ";S$(S);NL$;"  "
       ;MID$(C$,NC+16,2);
AC 1210 RETURN
GI 1220 FOR U=0 TO 4:X=20:Y=U*5+
       3
PM 1225 C=C(0,U):S=S(0,U):GOSUB
       1200:NEXT
BI 1230 RETURN
QK 1250 FOR I=0 TO 23:J=INT(RND(
       1)*24):T=DC(I):DC(I)=DC(
       J):DC(J)=T
NJ 1260 T=DS(I):DS(I)=DS(J):DS(J
       )=T:NEXT
HB 1270 FOR J=0 TO 3:FOR I=0 TO
       4
CJ 1275 C(J,I)=DC(J*5+I):S(J,I)=
       DS(J*5+I):NEXT I,J:KC=DC
       (20):KS=DS(20)
BH 1280 RETURN
HM 1300 COLOR 1,7:LOCATE 12,28:P
       RINT "FIRST  BLACK":LOCA
       TE 13,29:PRINT "JACK DEA
       LS"
DJ 1320 GOSUB 1250:DL=0:CC=0
AG 1330 C=DC(CC):S=DS(CC):X=CX(D
       L):Y=CY(DL):GOSUB 1200
PM 1331 FOR DE=1 TO 500:NEXT
ND 1335 IF (DC(CC)=2) AND ((DS(C
       C) AND 253)=1) THEN 1355
CG 1336 X=CX(DL):Y=CY(DL):GOSUB
       9000
MM 1337 FOR DE=1 TO 100:NEXT
EA 1340 CC=CC+1:DL=FNNP(DL):GOTO
         1330
GC 1355 GOSUB 1450:COLOR 1,7:LOC
       ATE 12,29
QJ 1356 IF DL=0 THEN 1370
PM 1360 PRINT " PLAYER";STR$(DL)
CM 1365 LOCATE 13,30:PRINT " DEA
       LS";:GOTO 1375
DF 1370 PRINT "YOUR  DEAL";
HM 1375 GOSUB 1400
DC 1376 X=CX(DL):Y=CY(DL):GOSUB
       9000
LD 1380 COLOR 7,1:RETURN
MD 1400 COLOR 4,0:LOCATE 15,28:P
       RINT " HIT RETURN ";CHR$
       (7);
JC 1410 WHILE INKEY$<>CHR$(13):W
       END
KC 1415 GOSUB 1450
KG 1430 COLOR 7,1:RETURN
MK 1450 COLOR 0,7:FOR I=12 TO 16
       :LOCATE I,28:PRINT SPC(1
       2):NEXT:RETURN
HI 1465 I=N*2+1:FOR J=0 TO 2:LOC
       ATE X+J,Y:PRINT MID$(N$(
       J),I,2):NEXT:RETURN
LO 1500 FOR I=0 TO 3:SP(P,I)=FC(
       P AND 253):NS(P,I)=0:NEX
       T
QI 1505 FOR I=0 TO 4:S=S(P,I):C=
       C(P,I):SP(P,S)=SP(P,S)+C
       P(C):NS(P,S)=NS(P,S)+1
OM 1510 IF C=2 THEN S=S+2:S=(S/4
       -INT(S/4))*4:SP(P,S)=SP(
       P,S)+6:NS(P,S)=NS(P,S)+1
KN 1515 IF C=5 THEN FOR J=0 TO 3
       :SP(P,J)=SP(P,J)+4:NEXT
QM 1520 NEXT
HC 1525 SS=0:FOR I=0 TO 4:IF NS(
       P,I)=0 THEN SP(P,I)=0:SS
       =SS+1
AF 1530 NEXT:FOR I=0 TO 3:SP(P,I
       )=SP(P,I)+SS:NEXT
NO 1535 IF P<>DL THEN 1550
OC 1540 IF KC=5 THEN SP(P,KS)=SP
       (P,KS)+4
BA 1545 SP(P,KS)=SP(P,KS)+CP(KC)
       :NS(P,KS)=NS(P,KS)+1
BE 1550 RETURN
EG 1600 LO=0:HI=1:XP=14:YP=11:GO
       SUB 1910
BD 1605 IF AN=1 THEN TP=KS
BK 1610 RETURN
NI 1615 LOCATE 14,9:PRINT "loneh
       and";
HM 1616 LO=12:HI=13:XP=14:YP=18:
       GOSUB 1910:LH=0
DC 1618 IF AN=13 THEN LH=1:LOCAT
       E MX(BD),MY(BD):PRINT "l
       onehand";
PI 1619 LOCATE 14,9:PRINT "
         ";
BN 1620 RETURN
JJ 1625 LH=0:IF SP(P,TP)>GA(NS(P
       ,TP)) THEN LH=1
BA 1630 RETURN
NH 1650 IF FNNP(FNNP(P))=DL THEN
         GOSUB 1625:F=LH:GOTO 16
       85
QI 1654 F=0:IF KC=2 THEN GOTO 16
       60
KJ 1655 IF SP(P,KS)>OU(NS(P,KS))
         THEN F=1
CP 1660 IF SP(P,KS)>OB(NS(P,KS))
         THEN F=1
KM 1665 IF (F=0) OR (P<>FNNP(DL)
       ) THEN 1685
FI 1670 SB=CP(KC):IF KC=5 THEN S
       B=3
CC 1675 FOR I=0 TO 3:IF I<>KS TH
       EN IF SP(P,I)>=(SP(P,KS)
       -SB) THEN F=0
HD 1680 NEXT I
PA 1685 IF F=1 THEN TP=KS
EG 1699 RETURN
HG 1700 LO=2:HI=3:XP=14:YP=11:GO
       SUB 1910
DN 1705 IF AN=3 THEN TP=KS
BM 1710 RETURN
IN 1750 IF SP(P,KS)>PU(NS(P,KS))
         THEN TP=KS
DM 1755 RETURN
NA 1800 LO=4:HI=8:XP=14:YP=11:GO
       SUB 1910
```

```
FQ 1801  IF AN-5=KS THEN 1800
GM 1805  IF AN>4 THEN TP=AN-5
BC 1810  RETURN
JD 1850  DF=0:FOR I=0 TO 3:IF I=K
         S THEN 1865
DE 1855  IF SP(P,I)-MS(NS(P,I),PS
         )<DF THEN 1865
GC 1860  DF=SP(P,I)-MS(NS(P,I),PS
         ):TP=I
CC 1865  NEXT
KA 1870  RETURN
DN 1900  FOR I=1 TO 3:FOR J=0 TO
         2:LOCATE MX(I)+J,MY(I):P
         RINT SPACE$(8);
KO 1905  NEXT J:NEXT I
DJ 1907  RETURN
PI 1910  AN=LO
LP 1915  X1=XP:Y1=YP:FOR I=LO TO
         HI:COLOR 7,1:IF I<>AN TH
         EN 1925
JM 1920  IF (AN=LO) OR (HI-LO=1)
          THEN COLOR 1,7:GOTO 1925
          ELSE COLOR ,CO(I-LO-1)
LE 1925  LOCATE X1,Y1:PRINT ME$(I
         );:X1=X1+1:NEXT
OG 1930  K$=INKEY$:IF K$="" THEN
         1930 ELSE IF K$=CHR$(13)
          THEN 1955
DK 1932  K=ASC(RIGHT$(K$,1)):IF K
         <>72 THEN 1940
JL 1935  AN=AN-1:IF AN<LO THEN AN
         =HI
PA 1940  IF K<>80 THEN 1950
BM 1945  AN=AN+1:IF AN>HI THEN AN
         =LO
EG 1950  GOTO 1915
OG 1955  X1=XP:Y1=YP:COLOR 7,1:FO
         R I=LO TO HI:LOCATE X1,Y
         1:PRINT BL$;:X1=X1+1:NEX
         T
LD 1965  RETURN
JG 2000  GOSUB 1250:GOSUB 1220:P=
         FNNP(DL):TP=4:BD=0:KU=0
LK 2005  X=8:Y=13:C=KC:S=KS:GOSUB
          1200:COLOR 7,1
EJ 2007  IF DL<>0 THEN LOCATE MX(
         DL),MY(DL):PRINT "dealer
         "
FQ 2010  GOSUB 1500
DJ 2015  IF P=0 THEN GOSUB 1600:G
         OTO 2040
LG 2016  IF ABS(P-DL)<>2 THEN 202
         0
CG 2017  GOSUB 1625:IF LH=1 THEN
         TP=KS:GOTO 2025
KE 2020  GOSUB 1650
BB 2025  LOCATE MX(P),MY(P)
QJ 2030  COLOR 7,1:IF TP=4 THEN P
         RINT " pass":GOTO 2040
NH 2035  BD=P:PRINT "order up"
HE 2040  P=FNNP(P):IF (P<>DL) AND
          (TP=4) THEN 2010
IH 2045  P=DL:GOSUB 1500:IF TP<>4
          THEN 2105
NC 2050  IF DL=0 THEN GOSUB 1700:
         GOTO 2070
ML 2055  GOSUB 1750:LOCATE MX(DL)
         ,MY(DL)
LB 2060  IF TP=4 THEN PRINT "turn
         ed":LOCATE MX(DL)+1,MY(D
         L):PRINT " down":GOTO 20
         70
CB 2065  BD=P:PRINT "picked":LOCA
         TE MX(DL)+1,MY(DL):PRINT
          "  up"
BA 2070  FOR DE=1 TO 1000:NEXT
IB 2071  IF (BD=0) AND (TP<>4) TH
         EN 2105
DA 2072  X=8:Y=13:GOSUB 9000:IF T
         P<>4 THEN 2105
LN 2073  GOSUB 1900:PS=0
NO 2075  P=FNNP(P)
BA 2080  IF P=0 THEN GOSUB 1800:G
         OTO 2090
DE 2085  GOSUB 1850:LOCATE MX(P),
         MY(P)
OG 2086  FOR DE=1 TO 300:NEXT
OO 2088  IF TP=4 THEN PRINT "  pa
         ss";:GOTO 2090
BJ 2089  BD=P:PRINT RIGHT$(ME$(TP
         +5),8);
EO 2090  IF (P<>DL) AND (TP=4) TH
         EN PS=PS+1:GOTO 2075
QO 2100  GOTO 2109
DD 2105  KU=1:IF (BD=0) AND (DL=2
         ) THEN LH=1:GOTO 2120
IH 2109  IF TP=4 THEN 2140
LG 2110  IF (LH=1) AND (BD<>0) TH
         EN 2120
LM 2111  IF BD=0 THEN GOSUB 1615:
         GOTO 2140
NM 2112  GOSUB 1625
LC 2115  IF LH=0 THEN 2140
LP 2120  LOCATE 1,1:PRINT "loneha
         nd"
BJ 2140  FOR DE=1 TO 1000:NEXT
KB 2145  GOSUB 1900
JN 2150  RETURN
PG 2200  F=-1
NB 2205  F=F+1:IF C(0,F)=-1 THEN
         2205
BO 2210  G=F
QB 2215  COLOR ,7:Y=G*5+4:LOCATE
         21,Y:PRINT "  ":LOCATE 2
         2,Y:PRINT "  ":LOCATE 23
         ,Y:PRINT "  ";
KK 2218  COLOR 10,2:Y=F*5+4:LOCAT
         E 21,Y:PRINT "▚▞":LOCATE
          22,Y:PRINT "▞▚":LOCATE
         23,Y:PRINT "▚▞";
BL 2220  K$=INKEY$:IF K$="" THEN
         2220 ELSE IF K$=CHR$(13)
          THEN 2280
CD 2223  K=ASC(RIGHT$(K$,1))
JG 2225  G=F:IF K<>75 THEN 2250
GK 2230  F=NF(F):IF C(0,F)<0 THEN
          2230
AB 2245  GOTO 2215
FF 2250  IF K<>77 THEN 2275
NA 2255  F=NF(F+2):IF C(0,F)<0 TH
         EN 2255
PG 2270  GOTO 2215
NB 2275  GOTO 2220
MO 2280  COLOR 1,7:RETURN
MM 2300  FOR I=0 TO 4:IF (S(P,I)=
         TP) AND (C(P,I)=2) THEN
         C(P,I)=7:GOTO 2310
AG 2305  IF ((S(P,I) AND 253)=(TP
          AND 253)) AND (C(P,I)=2
         )THEN C(P,I)=6:S(P,I)=TP
GJ 2310  NEXT I
QI 2315  FOR I=0 TO 4:FOR J=0 TO
         3:IF S(P,J)>S(P,J+1) THE
         N 2331
QB 2320  IF S(P,J)=S(P,J+1) THEN
         IF C(P,J)>C(P,J+1) THEN
         2331
BP 2325  T=C(P,J):C(P,J)=C(P,J+1)
         :C(P,J+1)=T
MO 2330  T=S(P,J):S(P,J)=S(P,J+1)
         :S(P,J+1)=T
JM 2331  NEXT J:NEXT I
PB 2335  FOR I=0 TO 4:PT(I)=0:IF
         S(P,I)=TP THEN PT(I)=C(P
         ,I)+10:GOTO 2350
MB 2340  IF C(P,I)=5 THEN PT(I)=9
         :GOTO 2350
FB 2345  IF (S(P,I)<>S(P,NF(I)))
         AND (S(P,I)<>S(P,NF(I+2)
         )) THEN PT(I)=-1
GF 2350  NEXT I
LF 2355  L=99:FOR I=0 TO 4:IF PT(
         I)<L THEN F=I:L=PT(I)
KK 2360  NEXT I:RETURN
DB 2500  FOR I=0 TO 3:FOR J=0 TO
         3:NS(I,J)=0:NEXT J:FOR J
         =0 TO 4:IF C(I,J)<>2 THE
         N 2515
PF 2505  IF S(I,J)=TP THEN C(I,J)
         =7:GOTO 2515
EJ 2510  IF ABS(S(I,J)-TP)=2 THEN
          C(I,J)=6:S(I,J)=TP
MH 2515  NS(I,S(I,J))=NS(I,S(I,J)
         )+1:NEXT J:NEXT I
BM 2520  RETURN
AH 2700  LOCATE 2,2:PRINT "Partne
         r?";:LO=9:HI=10:XP=2:YP=
         12:GOSUB 1910
CN 2705  FC(0)=0:IF AN=10 THEN FC
         (0)=2
KG 2710  LOCATE 2,2:PRINT "Oppone
         nts?";:LO=9:HI=10:XP=2:Y
         P=14:GOSUB 1910
FI 2715  FC(1)=0:IF AN=10 THEN FC
         (1)=2
OH 2720  LOCATE 2,2:PRINT "
               ";:RETURN
AH 3000  FOR I=0 TO 7:FOR J=0 TO
         3:CL(I,J)=0:NEXT J,I:CL(
         2,TP AND 253)=1
EF 3001  FOR I=0 TO 3:SL(I)=0:NEX
         T I
BB 3002  LD=FNNP(DL):DM=4:TR(0)=0
         :TR(1)=0:IF LH=0 THEN 30
         15
FO 3005  IF BD=2 THEN X=20:FOR I=
         0 TO 4:Y=I*5+3:GOSUB 900
         0:NEXT I
EE 3010  DM=FNNP(FNNP(BD))
OI 3011  IF LH=1 THEN IF LD=DM TH
         EN LD=FNNP(LD)
EM 3015  FOR TK=0 TO 4:P=LD:PS=0:
         TL=0:IF DM=P THEN P=FNNP
         (P)
LC 3020  GOSUB 3500:WP=P:IF LH=1
         THEN PS=PS+1
FP 3021  SL(S(P,PC(P)))=1
IC 3025  IF S(P,PC(P))=TP THEN TL
         =1
JL 3030  FOR I=1 TO 3:P=FNNP(P):I
         F P=DM THEN 3060
AH 3035  PS=PS+1:GOSUB 3500:IF TL
         =0 THEN 3050
ED 3040  IF S(P,PC(P))=TP THEN IF
          C(P,PC(P))>C(WP,PC(WP))
          THEN WP=P
PM 3045  GOTO 3060
FC 3050  IF S(P,PC(P))=TP THEN WP
         =P:TL=1:GOTO 3060
BJ 3055  IF S(P,PC(P))=S(WP,PC(WP
         )) THEN IF C(P,PC(P))>C(
         WP,PC(WP)) THEN WP=P
AC 3060  NEXT:FOR DE=1 TO 200:NEX
         T
EH 3065  COLOR 4,0:LOCATE PX(WP),
         PY(WP)+2
CK 3070  PRINT "▚▞";CD$;CL$;"▞▚";N
         L$;CD$;"▚▞";CD$;CL$;"▞▚";
DL 3071  FOR DE=1 TO 2000:NEXT:LD
         =WP:WT=WP AND 253:TR(WT)
         =TR(WT)+1
IO 3072  COLOR 0,4:X=21:Y=31+6*WT
         :N=TR(WT):GOSUB 1465
PA 3075  FOR I=0 TO 3:X=PX(I):Y=P
         Y(I):GOSUB 9000:C(I,PC(I
         ))=-1:NEXT I,TK
NB 3078  LOCATE 1,1:PRINT "
            ";
FA 3080  BT=BD AND 253:LOCATE 15,
         28
CA 3085  COLOR 0,4:IF TR(BT)<3 TH
         EN 3108
MH 3086  IF TR(BT)<5 THEN 3097
KD 3087  PW(BT)=PW(BT)+2+LH*2
CN 3090  IF BT=0 THEN PRINT "  YO
         U  WON  ":LOCATE 16,28:P
         RINT " ALL TRICKS ":GOTO
          3200
BD 3095  IF BT=1 THEN PRINT "COMP
         UTER WON":LOCATE 16,28:P
         RINT " ALL TRICKS ":GOTO
          3200
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EJ 3097 PW(BT)=PW(BT)+1
PB 3100 IF TR(0)>2 THEN PRINT "Y
        OU WON HAND";:GOTO 3200
BA 3105 IF TR(1)>2 THEN PRINT "
         COMPUTER  ":LOCATE 16,2
        8:PRINT "  WON HAND  ":G
        OTO 3200
IC 3108 PW(1-BT)=PW(1-BT)+2
JK 3110 IF TR(0)<3 THEN PRINT "Y
        OU'VE  BEEN":LOCATE 16,2
        8:PRINT "  EUCHRED!  ":G
        OTO 3200
FO 3115 IF TR(1)<3 THEN PRINT "
         COMPUTER  ":LOCATE 16,2
        8:PRINT "  EUCHRED!  "
BC 3200 FOR DE=1 TO 2000:NEXT
BF 3205 RETURN
DK 3500 IF P>0 THEN 3509
HD 3502 COLOR 14,0:LOCATE 15,28:
        PRINT " YOUR  PLAY ";:GO
        SUB 2200
CP 3503 LS=S(LD,PC(LD)):IF (PS=0
        ) OR (S(P,F)=LS) OR (NS(
        P,LS)=0) THEN 3507
DB 3504 GOSUB 2215:GOTO 3503
EI 3505 X=20:Y=F*5+3:GOSUB 9000:
        GOTO 3530
KJ 3507 COLOR 7:LOCATE 15,28:PRI
        NT "              ";
EE 3508 X=20:Y=F*5+3:GOSUB 9000:
        GOTO 3530
PB 3509 IF TK<5 THEN 3515
KB 3510 FOR K=0 TO 4:IF C(P,J)>-
        1 THEN F=I
JO 3512 NEXT K:GOTO 3530
HC 3515 ON (PS+1) GOSUB 4000,410
        0,4200,4200
JD 3530 PC(P)=F:Y=PY(P):X=PX(P):
        C=C(P,F):S=S(P,F):GOSUB
        1200
OC 3535 NS(P,S(P,F))=NS(P,S(P,F)
        )-1:CL(C(P,F),S(P,F))=1
BD 3540 RETURN
GE 4000 IF NS(P,TP)<>5-TK THEN 4
        015
CC 4005 SP=TP:GOSUB 5200:IF F=1
        THEN GOTO 5150
PC 4010 GOTO 5160
MO 4015 IF (LH<>1) OR (BD<>P) TH
        EN 4030
JA 4020 IF NS(P,TP)>0 THEN SP=TP
        :GOTO 5150
PA 4025 GOTO 5050
LN 4030 GOSUB 5000:IF (F=1) AND
        (ABS(BD-P)=2) THEN SP=TP
        :GOTO 5150
EM 4035 GOSUB 5250:IF (F<>1) OR
        (P<>BD) THEN 5050
LG 4040 GOSUB 5200:IF I=1 THEN S
        P=TP:GOTO 5150
PE 4045 IF NS(P,TP)>2 THEN SP=TP
        :GOTO 5160
OF 4050 GOTO 5050
PP 4100 IF NS(P,S(LD,PC(LD)))=0
        THEN 4115
IM 4105 GOSUB 5300:SP=S(LD,PC(LD
        )):IF F=1 THEN 5150
PE 4110 GOTO 5160
BG 4115 IF NS(P,TP)=5-TK THEN SP
        =TP:GOTO 5160
GA 4120 IF NS(P,TP)=0 THEN 5100
CI 4125 IF C(LD,PC(LD))=5 THEN S
        P=TP:GOTO 5160
KB 4130 IF BD<>P THEN SP=TP:GOTO
         5160
QN 4135 GOSUB 5250:IF F=1 THEN S
        P=TP:GOTO 5160
LP 4140 GOTO 5100
GP 4200 IF NS(P,S(LD,PC(LD)))=0
        THEN 4235
KB 4201 SP=S(LD,PC(LD))
OO 4205 IF (SP<>TP) AND (TL=1) T
        HEN 5160
NE 4210 IF ABS(WP-P)<>2 THEN 422
        5
LM 4215 GOSUB 5300:IF F=1 THEN G
        OSUB 5350:IF F=0 THEN 51
        50
QJ 4220 GOTO 5160
KD 4225 GOSUB 5300:IF F=1 THEN 5
        150
QM 4230 GOTO 5160
EC 4235 IF NS(P,TP)<5-TK THEN 42
        70
FN 4245 SP=TP:IF ABS(WP-P)=2 THE
        N 5160
IB 4250 IF TL=0 THEN 5160
HL 4255 GOSUB 5300:IF F=1 THEN 5
        400
AF 4260 GOTO 5160
HB 4270 IF NS(P,TP)=0 THEN 5100
GD 4275 IF ABS(WP-P)<>2 THEN 431
        0
IM 4280 IF (TL=1) OR (PS=3) THEN
         5100
BN 4285 IF C(WP,PC(WP))=5 THEN 5
        100
JM 4290 IF C(WP,PC(WP))<4 THEN S
        P=TP:GOTO 5160
OE 4300 GOSUB 5250:IF F=1 THEN S
        P=TP:GOTO 5160
ML 4305 GOTO 5100
JC 4310 IF TL=0 THEN SP=TP:GOTO
        5160
EB 4315 GOSUB 5300:IF F=1 THEN S
        P=TP:GOTO 5400
LN 4320 GOTO 5100
PA 5000 F=0:FOR A=0 TO 4:IF C(P,
        A)>5 THEN F=1
EB 5005 NEXT A:RETURN
BA 5050 F=-1:FOR A=0 TO 4:IF (SL
        (S(P,A))=0) AND (S(P,A)<
        >TP) THEN IF C(P,A)=5 TH
        EN F=A
KH 5055 NEXT A:IF F>-1 THEN 5070
CF 5060 LC=-1:FOR A=0 TO 4:IF S(
        P,A)<>TP THEN IF C(P,A)>
        LC THEN LC=C(P,A):F=A
CB 5065 NEXT A
BE 5070 RETURN
DO 5100 IF NS(P,TP)>0 THEN 5125
KN 5105 SP=-1:FOR A=0 TO 4
NM 5110 IF S(P,A)<>TP THEN IF (C
        (P,A)=5) AND (NS(P,S(P,A
        ))>1) THEN SP=S(P,A)
JD 5115 NEXT A:IF SP>-1 THEN 516
        0
BC 5120 GOTO 5180
IJ 5125 V=4:F=-1:FOR A=0 TO 4
NN 5126 IF S(P,A)=TP THEN 5135
MF 5130 IF (NS(P,S(P,A))<>1) OR
        (SL(S(P,A))=1) THEN 5135
IA 5131 IF (C(P,A)>=0) AND (C(P,
        A)<V) THEN V=C(P,A):F=A
NJ 5135 NEXT A:IF F=-1 THEN 5180
BN 5140 RETURN
IE 5150 IF PS=3 THEN 5400
MG 5151 V=-1:FOR A=0 TO 4:IF S(P
        ,A)=SP THEN IF C(P,A)>V
        THEN V=C(P,A):F=A
FC 5155 NEXT A:RETURN
PD 5160 V=10:FOR A=0 TO 4
ID 5161 IF S(P,A)=SP THEN IF (C(
        P,A)>=0) AND (C(P,A)<V)
        THEN V=C(P,A):F=A
FF 5165 NEXT A:RETURN
OO 5180 V=10:FOR A=0 TO 4:IF S(P
        ,A)<>TP THEN IF C(P,A)>-
        1 THEN IF C(P,A)<V THEN
        V=C(P,A):F=A
GL 5185 NEXT A:RETURN
PH 5200 HT=8:F=0
CD 5205 HT=HT-1:IF HT>0 THEN IF
        CL(HT,TP)=1 THEN 5205
EJ 5210 IF HT<0 THEN 5240
AC 5215 FOR A=0 TO 4:IF S(P,A)=T
        P THEN IF C(P,A)=HT THEN
         F=1
AF 5220 NEXT A
BP 5240 RETURN
DG 5250 F=1:FOR A=0 TO 4:IF C(P,
        A)>-1 THEN IF (S(P,A)<>T
        P) AND (C(P,A)<5) THEN F
        =0
FE 5255 NEXT A:RETURN
EI 5300 F=0:FOR A=0 TO 4:IF S(P,
        A)=S(WP,PC(WP)) THEN IF
        C(P,A)>C(WP,PC(WP)) THEN
         F=1
EH 5305 NEXT A:RETURN
CA 5350 F=0:FOR A=0 TO 4:IF S(P,
        A)=S(WP,PC(WP)) THEN IF
        C(P,A)-C(WP,PC(WP))=1 TH
        EN F=1
FG 5355 NEXT A:RETURN
IL 5400 D=10:FOR A=0 TO 4
PH 5405 IF S(P,A)=S(WP,PC(WP)) T
        HEN E=C(P,A)-C(WP,PC(WP)
        ):IF (E<D) AND (E>0) THE
        N D=E:F=A
EI 5410 NEXT A:RETURN
FL 8100 K=((J+1)/4-INT((J+1)/4))
        *4:RETURN
IB 9000 COLOR ,1:LOCATE X,Y:PRIN
        T T$NL$T$NL$T$NL$T$NL$T$
        ;:RETURN
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Program 6: Amiga Euchre

```
Euchre:
DEFINT a-z:DEFSNG r,g,b,cy:RANDO
MIZE TIMER
SCREEN 1,320,200,4,1:WINDOW 3,""
,(0,0)-(311,186),16,1:WINDOW OUT
PUT 3:COLOR 3,0
RESTORE PaLetteData:FOR i=0 TO 1
5:READ r,g,b:PALETTE i,r,g,b:NEX
T
PaLetteData:
DATA .2,.2,.9,0,0,0,0,0,0,.8,0,0
DATA .8,.8,.8,0,0,1,1,1,0,.93,.9
3,0
DATA .87,.87,0,0,.8,0,0,1,0,1,1,
0
DATA .3,.3,.3,.5,.5,.5,.6,.6,.6,
.7,.7,.7
GOSUB InitiaLize:GOSUB DispLay:G
OSUB PLayers:GOSUB PickDeaLer
NewHand:
GOSUB Bidding
IF tp=4 THEN
COLOR 0,4:LOCATE 12,29:PRINT "NO
BIDDERS"
LOCATE 13,28:PRINT "HAND  DUMPED
"
GOSUB WaitKey:x=20:FOR i=0 TO 4:
y=i*5+2:GOSUB EraseCard:NEXT
dL=FNnp(dL):x=8:y=12:GOSUB Erase
Card
COLOR ,0:GOSUB CLRMess:GOTO NewH
and
END IF:COLOR 5,4:LOCATE 12,29:PR
INT "TRUMP : "
LOCATE 13,29:PRINT "BIDDER: ";
IF bd=0 THEN
PRINT "you";
ELSE
PRINT "p";RIGHT$(STR$(bd),1)
END IF:PUT(288,88),sb(0,tp),PSET
IF ku<>0 THEN
IF dL<=0 THEN
COLOR 11,2:LOCATE 15,28:PRINT "P
ICK DISCARD"
GOSUB UPickCard:COLOR ,4:LOCATE
15,28:PRINT "              ";
ELSE
GOSUB UDiscard
END IF:c(dL,f)=kc:s(dL,f)=ks:GOS
```

```
UB PutHand
END IF:x=8:y=12:GOSUB EraseCard
GOSUB ResetHand:GOSUB PLayHand:C
OLOR 0,4
IF NOT((pw(0)>9) OR (pw(1)>9)) T
HEN
x=21:y=31:n=0:GOSUB PrintScore
x=21:y=37:n=0:GOSUB PrintScore
x=7:y=31:n=pw(0):GOSUB PrintScor
e
x=7:y=37:n=pw(1):GOSUB PrintScor
e
dL=FNnp(dL):GOSUB ExitLoopPD:GOT
O NewHand
END IF:wt=0:IF pw(1)>=10 THEN wt
=1
x=7:y=28+wt*6:n=1:GOSUB PrintSco
re
x=7:y=31+wt*6:n=pw(wt)-10:GOSUB
PrintScore
FOR de=1 TO 2000:NEXT
GOSUB CLearWindow:COLOR 11,3:LOC
ATE 13,28:PRINT "  YOU";
IF wt=0 THEN PRINT " WIN!  "
IF wt=1 THEN PRINT "LOSE  "
COLOR 4,0:LOCATE 2,2:PRINT "Play
again?"
Lo=11:hi=12:xp=2:yp=14:GOSUB SeL
ection
SCREEN CLOSE 1:WINDOW CLOSE 3
IF an=11 THEN RUN
END

DispLay:
GOSUB InitShapes:WIDTH 40:CLS:CO
LOR ,0
LINE(0,0)-(3,3),2,bf:GET(0,0)-(3
,3),en
LINE(0,0)-(3,3),11,bf:GET(0,0)-(
3,3),nb
GET(4,4)-(40,44),ec:LINE(4,4)-(4
0,44),4,bf
GET(4,4)-(40,44),cb:GET(4,4)-(17
,21),eh:CLS
FOR i=0 TO 3:j=i*2:LINE(216+j,j)
-(311-j,23-j),i+12,bf:NEXT
COLOR 2,4:FOR i=0 TO 6 STEP 2:LI
NE(224,7+i)-(303,7+i):NEXT
LOCATE 2,31:PRINT "EUCHRE":LINE(
224,15)-(303,15)
COLOR 10,2:LOCATE 4,28:PRINT "
POINTS
LOCATE 18,28:PRINT "   TRICKS
"
COLOR 9,2:LOCATE 5,28:PRINT " YO
U   COMP "
LOCATE 19,28:PRINT " YOU   COMP
"
FOR i=0 TO 4:LOCATE 6+i,28:PRINT
w$:LOCATE 20+i,28:PRINT w$;:NEXT

LINE(216,40)-(311,40),9:LINE(216
,152)-(311,152),9
LINE(262,32)-(262,79),9:LINE(262
,144)-(262,191),9
COLOR ,4:LOCATE 11,28:PRINT w$:L
OCATE 17,28:PRINT w$:GOSUB CLear
Window
FOR i=0 TO 3:LINE(216,80+i)-(311
,80+i),i+12
LINE(216,132+i)-(311,132+i),15-i
:NEXT
n=0:x=7:y=31:GOSUB PrintScore:y=
37:GOSUB PrintScore
x=21:y=31:GOSUB PrintScore:y=37:
GOSUB PrintScore
COLOR 4,0:RETURN

InitiaLize:
DIM c(3,4),s(3,4),ms(6,3),cL(7,3
),dc(23),ds(23),sp(3,5),ns(3,5),
me$(15)
DIM en(19),nb(19),eh(75),hb(75),
ec(507),cb(507),sb(30,3)
DEF FNnp(x)=((x+1)/4-INT((x+1)/4
))*4
bL$=SPACE$(10):w$=SPACE$(12):c$=
"9 10J Q K A J J  910 J Q K A J
J"
FOR i=0 TO 3:READ co(i):NEXT:DAT
A 3,2,3,2
FOR i=0 TO 6:READ nf(i):NEXT:DAT
A 4,0,1,2,3,4,0
FOR j=0 TO 3:FOR i=0 TO 5:dc(j*6
+i)=i:ds(j*6+i)=j:NEXT i,j
FOR i=0 TO 3:READ px(i),py(i):NE
XT:DATA 14,12,8,7,2,12,8,17
FOR i=0 TO 3:READ cx(i),cy(i):NE
XT:DATA 18,11,11,4,4,11,11,18
FOR i=0 TO 5:READ cp(i):NEXT:DAT
A 1,1,8,1,2,-1
FOR i=0 TO 13:READ me$(i):NEXT
DATA "pass    ","order up","pass
","pick up","  PASS  ","diamonds
"
DATA "clubs   ","hearts  ","spad
es  ","normal    ","aggressive",
"yes","no ","yes"
FOR i=0 TO 3:READ mx(i),my(i):NE
XT:DATA 1,1,8,3,2,11,8,19
FOR i=0 TO 6:READ ob(i),ou(i),PU
(i),ms(i,0),ms(i,1),ms(i,2),ms(i
,3),ga(i):NEXT
DATA 99,99,99,99,99,99,99,99
DATA 99,99,99,99,99,99,99,99
DATA 99,99,14,14,14,13,13,99
DATA 20,12,8,8,8,8,7,19
DATA 14,0,0,0,0,0,0,16
DATA 0,0,0,0,0,0,0,14
DATA 0,0,0,0,0,0,0,0
FOR i=0 TO 9:READ pt&(i):NEXT
DATA 16768479&,13421772&,1671982
3&,16764879&,13434333&
DATA 16764703&,16768799&,1342179
1&,16768991&,13422559&
RETURN

PutCard:
IF (s=tp) AND (c=6) THEN s=s+2:s
=(s/4-INT(s/4))*4
NC=c*2+1:COLOR co(s),4:px=(y-1)*
8-2:py=(x-1)*8-1
PUT(px,py),cb,PSET::px=px+1:py=p
y+2:PUT(px,py+8),sb(0,s),PSET
px=px+2:py=py-1:PUT(px+22,py+21)
,sb(0,s),PSET
LOCATE x,y:PRINT MID$(c$,NC,2):L
OCATE x+4,y+2:PRINT MID$(c$,NC+1
6,2);
RETURN

PutHand: FOR u=0 TO 4:x=20:y=u*5
+2
c=c(0,u):s=s(0,u):GOSUB PutCard:
NEXT:RETURN

DeaLCards: FOR i=0 TO 23:j=INT(R
ND(1)*24):t=dc(i):dc(i)=dc(j):dc
(j)=t
t=ds(i):ds(i)=ds(j):ds(j)=t:NEXT
:FOR j=0 TO 3:FOR i=0 TO 4
c(j,i)=dc(j*5+i):s(j,i)=ds(j*5+i
):NEXT i,j:kc=dc(20):ks=ds(20):R
ETURN

PickDeaLer:
COLOR 0,4:LOCATE 13,28:PRINT "FI
RST  BLACK":LOCATE 14,29:PRINT "
JACK DEALS"
GOSUB DeaLCards:dL=0:cc=0
LoopPD: c=dc(cc):s=ds(cc):x=cx(d
L):y=cy(dL):GOSUB PutCard
FOR de=1 TO 500:NEXT
IF (dc(cc)=2) AND ((ds(cc) AND 2
53)=1) THEN ExitLoopPD
x=cx(dL):y=cy(dL):GOSUB EraseCar
d
FOR de=1 TO 100:NEXT
cc=cc+1:dL=FNnp(dL):GOTO LoopPD
ExitLoopPD: GOSUB CLearWindow:CO
LOR 0,4:LOCATE 12,29
IF dL<>0 THEN
PRINT " PLAYER";STR$(dL)
LOCATE 13,30:PRINT " DEALS";
ELSE
PRINT "YOUR  DEAL";
END IF:GOSUB WaitKey
x=cx(dL):y=cy(dL):GOSUB EraseCar
d:COLOR 7,1:RETURN

WaitKey: COLOR 3,2:LOCATE 15,28:
PRINT " HIT RETURN ":SOUND 2000,
6
WHILE INKEY$<>CHR$(13):WEND:GOSU
B CLearWindow:COLOR 7,1:RETURN

CLearWindow: COLOR ,4:FOR i=12 T
O 16:LOCATE i,28:PRINT w$:NEXT:R
ETURN

PrintScore:
tx=(y-1)*8:py=(x-1)*8:bt&=1:i&=p
t&(n)
FOR q=0 TO 5:FOR p=0 TO 3:px=tx+
p*4
IF (bt& AND i&)<>0 THEN PUT(px,p
y),nb,PSET ELSE PUT(px,py),en,PS
ET
px=tx+p*4:bt&=bt&*2:NEXT p:py=py
+4:NEXT:RETURN

SetPoints:
FOR i=0 TO 3:sp(p,i)=fc(p AND 25
3):ns(p,i)=0:NEXT
FOR i=0 TO 4:s=s(p,i):c=c(p,i):s
p(p,s)=sp(p,s)+cp(c):ns(p,s)=ns(
p,s)+1
IF c=2 THEN s=s+2:s=(s/4-INT(s/4
))*4:sp(p,s)=sp(p,s)+6:ns(p,s)=n
s(p,s)+1
IF c=5 THEN
FOR j=0 TO 3:sp(p,j)=sp(p,j)+4:N
EXT
END IF:NEXT:ss=0:FOR i=0 TO 4:IF
ns(p,i)=0 THEN sp(p,i)=0:ss=ss+1

NEXT:FOR i=0 TO 3:sp(p,i)=sp(p,i
)+ss:NEXT
IF p=dL THEN
IF kc=5 THEN sp(p,ks)=sp(p,ks)+4

sp(p,ks)=sp(p,ks)+cp(kc):ns(p,ks
)=ns(p,ks)+1
END IF:RETURN

UOrderUp: Lo=0:hi=1:xp=14:yp=10:
GOSUB SeLection
IF an=1 THEN tp=ks
RETURN

ULoneHand: LOCATE 14,9:PRINT "Lo
nehand";
Lo=12:hi=13:xp=14:yp=18:GOSUB Se
Lection:Lh=0
IF an=13 THEN Lh=1:LOCATE mx(bd)
,my(bd):PRINT "Lonehand";
LOCATE 14,9:PRINT "         ";
RETURN

CGoALone: Lh=0:IF sp(p,tp)>ga(ns
(p,tp)) THEN Lh=1
RETURN

COrderUp: IF FNnp(FNnp(p))=dL TH
EN GOSUB CGoALone:f=Lh:GOTO Exit
COU
f=0:IF kc<>2 THEN
IF sp(p,ks)>ou(ns(p,ks)) THEN f=
1
END IF:IF sp(p,ks)>ob(ns(p,ks))
THEN f=1
IF (f=0) OR (p<>FNnp(dL)) THEN E
```

```
xitCOU
sb=cp(kc):IF kc=5 THEN sb=3
FOR i=0 TO 3:IF i<>ks THEN IF sp
(p,i)>=(sp(p,ks)-sb) THEN f=0
NEXT
ExitCOU: IF f=1 THEN tp=ks
RETURN
UPickUp: Lo=2:hi=3:xp=14:yp=10:G
OSUB SeLection
IF an=3 THEN tp=ks
RETURN
CPickUp: IF sp(p,ks)>PU(ns(p,ks)
) THEN tp=ks
RETURN
UMake: Lo=4:hi=8:xp=14:yp=10:GOS
UB SeLection
IF an-5=ks THEN UMake
IF an>4 THEN tp=an-5
RETURN
CMake: df=0:FOR i=0 TO 3
IF i<>ks THEN
IF sp(p,i)-ms(ns(p,i),ps)>=df TH
EN df=sp(p,i)-ms(ns(p,i),ps):tp=
i
END IF:NEXT
RETURN
CLRMess: FOR i=1 TO 3:FOR j=0 TO
2:LOCATE mx(i)+j,my(i):PRINT SPA
CE$(8);
NEXT j,i:RETURN
SeLection:
an=Lo:k$="":WHILE k$<>CHR$(13)
xl=xp:yl=yp:FOR i=Lo TO hi:COLOR
4,0
IF i=an THEN
IF (an=Lo) OR (hi-Lo=1) THEN COL
OR 0,4 ELSE COLOR ,co(i-Lo-1)
END IF:LOCATE xl,yl:PRINT me$(i)
;:xl=xl+1:NEXT
WaitS: k$=INKEY$:IF k$="" THEN W
aitS
IF k$=CHR$(28) THEN
an=an-1:IF an<Lo THEN an=hi
ELSEIF k$=CHR$(29) THEN
an=an+1:IF an>hi THEN an=Lo
END IF:WEND:xl=xp:yl=yp:COLOR 4,
0
FOR i=Lo TO hi:LOCATE xl,yl:PRIN
T bL$;:xl=xl+1:NEXT
RETURN
Bidding:
GOSUB DeaLCards:GOSUB PutHand:p=
FNnp(dL):tp=4:bd=0:ku=0
x=8:y=12:c=kc:s=ks:GOSUB PutCard
:COLOR 4,0
IF dL<>0 THEN LOCATE mx(dL),my(d
L):PRINT "dealer"
5 GOSUB SetPoints
IF p=0 THEN GOSUB UOrderUp:GOTO
20
IF ABS(p-dL)<>2 THEN 7
GOSUB CGoALone:IF Lh=1 THEN tp=k
s:GOTO 10
7 GOSUB COrderUp
10 LOCATE mx(p),my(p):COLOR 4,0
IF tp=4 THEN PRINT " pass":GOTO
20
bd=p:PRINT "order up"
20 p=FNnp(p):IF (p<>dL) AND (tp=
4) THEN 5
p=dL:GOSUB SetPoints:IF tp<>4 TH
EN 45
IF dL=0 THEN GOSUB UPickUp:GOTO
30
GOSUB CPickUp:LOCATE mx(dL),my(d
L)
IF tp=4 THEN PRINT "turned":LOCA
TE mx(dL)+1,my(dL):PRINT " down"
:GOTO 30
bd=p:PRINT "picked":LOCATE mx(dL
)+1,my(dL):PRINT "  up"
30 FOR de=1 TO 2000:NEXT
IF (bd=0) AND (tp<>4) THEN 45
x=8:y=12:GOSUB EraseCard:IF tp<>
4 THEN 45
GOSUB CLRMess:ps=0
35 p=FNnp(p)
IF p=0 THEN GOSUB UMake:GOTO 40
GOSUB CMake:LOCATE mx(p),my(p)
FOR de=1 TO 600:NEXT
IF tp=4 THEN PRINT "  pass";:GOT
O 40
bd=p:PRINT me$(tp+5);
40 IF (p<>dL) AND (tp=4) THEN ps
=ps+1:GOTO 35
GOTO 50
45 ku=1:IF (bd=0) AND (dL=2) THE
N Lh=1:GOTO 60
50 IF tp=4 THEN 70
IF (Lh=1) AND (bd<>0) THEN 60
IF bd=0 THEN GOSUB ULoneHand:GOT
O 70
GOSUB CGoALone
IF Lh=0 THEN 70
60 LOCATE 1,1:PRINT "Lonehand"
70 FOR de=1 TO 2000:NEXT
GOSUB CLRMess:RETURN
UPickCard:
f=0:WHILE c(0,f)=-1:f=f+1:WEND:g
=f
PrintHand: x=(g*5+2)*8+1:PUT(x,1
67),eh,PSET:x=(f*5+2)*8+1:PUT(x,
167),hb,PSET
GetKeyUPC: k$=INKEY$:IF k$="" TH
EN GetKeyUPC ELSE IF k$=CHR$(13)
THEN ExitUPC
g=f:IF k$<>CHR$(31) THEN 100
90 f=nf(f):IF c(0,f)<0 THEN 90
GOTO PrintHand
100 IF k$<>CHR$(30) THEN GetKeyU
PC
110 f=nf(f+2):IF c(0,f)<0 THEN 1
10
GOTO PrintHand
GOTO GetKeyUPC
ExitUPC: RETURN
UDiscard:
FOR i=0 TO 4
IF (s(p,i)=tp) AND (c(p,i)=2) TH
EN
c(p,i)=7
ELSE
IF ((s(p,i) AND 253)=(tp AND 253
)) AND (c(p,i)=2)THEN c(p,i)=6:s
(p,i)=tp
END IF:NEXT
FOR i=0 TO 4:FOR j=0 TO 3
IF NOT(s(p,j)>s(p,j+1)) THEN
IF s(p,j)=s(p,j+1) THEN IF NOT(c
(p,j)>c(p,j+1)) THEN
t=c(p,j):c(p,j)=c(p,j+1):c(p,j+1
)=t
t=s(p,j):s(p,j)=s(p,j+1):s(p,j+1
)=t
END IF
END IF:NEXT j,i
FOR i=0 TO 4:pt(i)=0
IF s(p,i)=tp THEN
pt(i)=c(p,i)+10
ELSE
IF c(p,i)=5 THEN
pt(i)=9
ELSE
IF (s(p,i)<>s(p,nf(i))) AND (s(p
,i)<>s(p,nf(i+2))) THEN pt(i)=-1
END IF
END IF:NEXT
L=99:FOR i=0 TO 4:IF pt(i)<L THE
N f=i:L=pt(i)
NEXT:RETURN
ResetHand:
FOR i=0 TO 3:FOR j=0 TO 3:ns(i,j
)=0:NEXT:FOR j=0 TO 4
IF c(i,j)=2 THEN
IF s(i,j)=tp THEN
c(i,j)=7
ELSE
IF ABS(s(i,j)-tp)=2 THEN c(i,j)=
6:s(i,j)=tp
END IF
END IF:ns(i,s(i,j))=ns(i,s(i,j))
+1:NEXT j,i
RETURN
PLayers:
LOCATE 2,2:PRINT "Partner?";:Lo=
9:hi=10:xp=2:yp=12:GOSUB SeLecti
on
fc(0)=0:IF an=10 THEN fc(0)=2
LOCATE 2,2:PRINT "Opponents?";:L
o=9:hi=10:xp=2:yp=14:GOSUB SeLec
tion
fc(1)=0:IF an=10 THEN fc(1)=2
LOCATE 2,2:PRINT "           ";:R
ETURN
PLayHand:
FOR i=0 TO 7:FOR j=0 TO 3:cL(i,j
)=0:NEXT j,i:cL(2,tp AND 253)=1
FOR i=0 TO 3:sL(i)=0:NEXT
Ld=FNnp(dL):dm=4:tr(0)=0:tr(1)=0
:IF Lh<>0 THEN
IF bd=2 THEN x=20:FOR i=0 TO 4:y
=i*5+2:GOSUB EraseCard:NEXT
dm=FNnp(FNnp(bd))
IF Lh=1 THEN IF Ld=dm THEN Ld=FN
np(Ld)
END IF:FOR tk=0 TO 4:p=Ld:ps=0:t
L=0:IF dm=p THEN p=FNnp(p)
GOSUB PLayCard:wp=p:IF Lh=1 THEN
ps=ps+1
sL(s(p,pc(p)))=1
IF s(p,pc(p))=tp THEN tL=1
FOR i=1 TO 3:p=FNnp(p):IF p=dm T
HEN 130
ps=ps+1:GOSUB PLayCard:IF tL=0 T
HEN 120
IF s(p,pc(p))=tp THEN IF c(p,pc(
p))>c(wp,pc(wp)) THEN wp=p
GOTO 130
120 IF s(p,pc(p))=tp THEN wp=p:t
L=1:GOTO 130
IF s(p,pc(p))=s(wp,pc(wp)) THEN
IF c(p,pc(p))>c(wp,pc(wp)) THEN
wp=p
130 NEXT:FOR de=1 TO 400:NEXT
x=px(wp):y=py(wp):GOSUB Winner
FOR de=1 TO 3000:NEXT:Ld=wp:wt=w
p AND 253:tr(wt)=tr(wt)+1
COLOR 2,3:x=21:y=31+6*wt:n=tr(wt
):GOSUB PrintScore
FOR i=0 TO 3:x=px(i):y=py(i):GOS
UB EraseCard:c(i,pc(i))=-1:NEXT
i,tk
COLOR ,0:LOCATE 1,1:PRINT "
";
bt=bd AND 253:LOCATE 15,28
COLOR 2,3:IF NOT(tr(bt)<3) THEN
IF NOT(tr(bt)<5) THEN
pw(bt)=pw(bt)+2+Lh*2
IF bt=0 THEN PRINT "  YOU  WON
":LOCATE 16,28:PRINT " ALL TRICK
S ":GOTO 140
IF bt=1 THEN PRINT "COMPUTER WON
":LOCATE 16,28:PRINT " ALL TRICK
S ":GOTO 140
END IF:pw(bt)=pw(bt)+1
IF tr(0)>2 THEN PRINT "YOU WON H
AND";:GOTO 140
IF tr(1)>2 THEN PRINT "  COMPUTE
R  ":LOCATE 16,28:PRINT "  WON H
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AND  ":GOTO 140
END IF:pw(1-bt)=pw(1-bt)+2
IF tr(0)<3 THEN PRINT "YOU'VE  B
EEN":LOCATE 16,28:PRINT "  EUCHR
ED!  ":GOTO 140
IF tr(1)<3 THEN PRINT "  COMPUTE
R  ":LOCATE 16,28:PRINT "  EUCHR
ED!  "
140 FOR de=1 TO 4000:NEXT
RETURN

PLayCard:
IF p<=0 THEN
COLOR 11,2:LOCATE 15,28:PRINT "
YOUR  PLAY ";:GOSUB UPickCard
150 Ls=s(Ld,pc(Ld))
IF NOT((ps=0) OR (s(p,f)=Ls) OR
(ns(p,Ls)=0)) THEN
GOSUB PrintHand:GOTO 150
x=20:y=f*5+2:GOSUB EraseCard:GOT
O 160
END IF:COLOR ,4:LOCATE 15,28:PRI
NT "              ";
x=20:y=f*5+2:GOSUB EraseCard:GOT
O 160
END IF:IF tk>=5 THEN
FOR k=0 TO 4:IF c(p,j)>-1 THEN f
=i
NEXT:GOTO 160
END IF:ON (ps+1) GOSUB 4000,4100
,4200,4200
160 pc(p)=f:y=py(p):x=px(p):c=c(
p,f):s=s(p,f):GOSUB PutCard
ns(p,s(p,f))=ns(p,s(p,f))-1:cL(c
(p,f),s(p,f))=1
RETURN

4000 IF ns(p,tp)<>5-tk THEN 4015

sp=tp:GOSUB 5200:IF f=1 THEN GOT
O 5150
GOTO 5160
4015 IF (Lh<>1) OR (bd<>p) THEN
4030
IF ns(p,tp)>0 THEN sp=tp:GOTO 51
50
GOTO 5050
4030 GOSUB 5000:IF (f=1) AND (AB
S(bd-p)=2) THEN sp=tp:GOTO 5150
GOSUB 5250:IF (f<>1) OR (p<>bd)
THEN 5050
GOSUB 5200:IF i=1 THEN sp=tp:GOT
O 5150
IF ns(p,tp)>2 THEN sp=tp:GOTO 51
60
GOTO 5050
4100 IF ns(p,s(Ld,pc(Ld)))=0 THE
N 4115
GOSUB 5300:sp=s(Ld,pc(Ld)):IF f=
1 THEN 5150
GOTO 5160
4115 IF ns(p,tp)=5-tk THEN sp=tp
:GOTO 5160
IF ns(p,tp)=0 THEN 5100
IF c(Ld,pc(Ld))=5 THEN sp=tp:GOT
O 5160
IF bd<>p THEN sp=tp:GOTO 5160
GOSUB 5250:IF f=1 THEN sp=tp:GOT
O 5160
GOTO 5100
4200 IF ns(p,s(Ld,pc(Ld)))=0 THE
N 4235
sp=s(Ld,pc(Ld))
IF (sp<>tp) AND (tL=1) THEN 5160

IF ABS(wp-p)<>2 THEN 4225
GOSUB 5300:IF f=1 THEN GOSUB 535
0:IF f=0 THEN 5150
GOTO 5160
4225 GOSUB 5300:IF f=1 THEN 5150

GOTO 5160
4235 IF ns(p,tp)<5-tk THEN 4270
sp=tp:IF ABS(wp-p)=2 THEN 5160
IF tL=0 THEN 5160
GOSUB 5300:IF f=1 THEN 5400
GOTO 5160
4270 IF ns(p,tp)=0 THEN 5100
IF ABS(wp-p)<>2 THEN 4310
IF (tL=1) OR (ps=3) THEN 5100
IF c(wp,pc(wp))=5 THEN 5100
IF c(wp,pc(wp))<4 THEN sp=tp:GOT
O 5160
GOSUB 5250:IF f=1 THEN sp=tp:GOT
O 5160
GOTO 5100
4310 IF tL=0 THEN sp=tp:GOTO 516
0
GOSUB 5300:IF f=1 THEN sp=tp:GOT
O 5400
GOTO 5100
5000 f=0:FOR a=0 TO 4:IF c(p,a)>
5 THEN f=1
NEXT:RETURN
5050 f=-1:FOR a=0 TO 4:IF (sL(s(
p,a))=0) AND (s(p,a)<>tp) THEN I
F c(p,a)=5 THEN f=a
NEXT:IF f>-1 THEN 5070
Lc=-1:FOR a=0 TO 4:IF s(p,a)<>tp
THEN IF c(p,a)>Lc THEN Lc=c(p,a)
:f=a
NEXT
5070 RETURN
5100 IF ns(p,tp)>0 THEN 5125
sp=-1:FOR a=0 TO 4
IF s(p,a)<>tp THEN IF (c(p,a)=5)
AND (ns(p,s(p,a))>1) THEN sp=s(p
,a)
NEXT:IF sp>-1 THEN 5160
GOTO 5180
5125 v=4:f=-1:FOR a=0 TO 4
IF s(p,a)=tp THEN 5135
IF (ns(p,s(p,a))<>1) OR (sL(s(p,
a))=1) THEN 5135
IF (c(p,a)>=0) AND (c(p,a)<v) TH
EN v=c(p,a):f=a
5135 NEXT:IF f=-1 THEN 5180
RETURN
5150 IF ps=3 THEN 5400
v=-1:FOR a=0 TO 4:IF s(p,a)=sp T
HEN IF c(p,a)>v THEN v=c(p,a):f=
a
NEXT:RETURN
5160 v=10:FOR a=0 TO 4
IF s(p,a)=sp THEN IF (c(p,a)>=0)
AND (c(p,a)<v) THEN v=c(p,a):f=a

NEXT:RETURN
5180 v=10:FOR a=0 TO 4:IF s(p,a)
<>tp THEN IF c(p,a)>-1 THEN IF c
(p,a)<v THEN v=c(p,a):f=a
NEXT:RETURN
5200 ht=8:f=0
5205 ht=ht-1:IF ht>0 THEN IF cL(
ht,tp)=1 THEN 5205
IF ht<0 THEN 5240
FOR a=0 TO 4:IF s(p,a)=tp THEN I
F c(p,a)=ht THEN f=1
NEXT
5240 RETURN
5250 f=1:FOR a=0 TO 4:IF c(p,a)>
-1 THEN IF (s(p,a)<>tp) AND (c(p
,a)<5) THEN f=0
NEXT:RETURN
5300 f=0:FOR a=0 TO 4:IF s(p,a)=
s(wp,pc(wp)) THEN IF c(p,a)>c(wp
,pc(wp)) THEN f=1
NEXT:RETURN
5350 f=0:FOR a=0 TO 4:IF s(p,a)=
s(wp,pc(wp)) THEN IF c(p,a)-c(wp
,pc(wp))=1 THEN f=1
NEXT:RETURN
5400 d=10:FOR a=0 TO 4
IF s(p,a)=s(wp,pc(wp)) THEN e=c(
p,a)-c(wp,pc(wp)):IF (e<d) AND (
e>0) THEN d=e:f=a
NEXT:RETURN

EraseCard: PUT((y-1)*8-2,(x-1)*8
-1),ec,PSET:RETURN

Winner:
xl=y-1:yl=x-1:x=(xl+2)*8:y=(yl+2
)*8+3:xl=xl*8-3:yl=yl*8-2
CIRCLE (x,y),8,0:PAINT (x,y),0
FOR i=1 TO 100:NEXT
FOR i=1 TO 3:LINE (xl-i,yl-i)-(x
l+i+38,yl+i+42),i+5,b:NEXT
FOR i=3 TO 1 STEP -1:CIRCLE (x,y
),i*2,i+5:PAINT (x,y),i+5:NEXT
r=1:FOR i=0 TO 5:r=r-.07:cy(i)=r
:NEXT
FOR i=1 TO 50:FOR p=1 TO 200:NEX
T:j=i MOD 6
PALETTE (i MOD 3)+6,cy(j),cy(j),
0:NEXT
FOR i=3 TO 1 STEP -1:LINE (xl-i,
yl-i)-(xl+i+38,yl+i+42),0,b:FOR
j=1 TO 50:NEXT j,i
CIRCLE (x,y),8,4:PAINT (x,y),4
RETURN

InitShapes:
RESTORE InitShapes
FOR j=0 TO 3:FOR i=0 TO 30:
READ a$:sb(i,j)=VAL("&H"+a$):NEX
T i,j
RESTORE Hand:FOR i=0 TO 75:
READ a$:hb(i)=VAL("&H"+a$):NEXT:
RETURN

Diamond: DATA B,9,3,400,E00,1F00
,3F80,7FC0
DATA 3F80,1F00,E00,400,400,E00,1
F00,3F80
DATA 7FC0,3F80,1F00,E00,400,FBE0
,F1E0,E0E0
DATA C060,8020,C060,E0E0,F1E0,FB
E0,0

CLub: DATA B,9,3,0,0,0,0,0,0
DATA 0,0,0,0,E00,1F00,1F00,7FC0
DATA FFE0,FFE0,75C0,E00,1F00,F1E
0,E0E0,E0E0
DATA 8020,0,0,8A20,F1E0,E0E0,0

Heart: DATA B,9,3,71C0,FBE0,FFE0
,FFE0,7FC0
DATA 3F80,1F00,E00,400,71C0,FBE0
,FFE0,FFE0
DATA 7FC0,3F80,1F00,E00,400,8E20
,400,0
DATA 0,8020,C060,E0E0,F1E0,FBE0,
0

Spade: DATA B,9,3,0,0,0,0,0,0
DATA 0,0,0,0,400,400,E00,1F00
DATA 3F80,7FC0,75C0,E00,1F00,FBE
0,FBE0,F1E0
DATA E0E0,C060,8020,8A20,F1E0,E0
E0,0

Hand:
DATA E,12,4,0,2C0,960,15A0,588
DATA A3C,23C,20C,413C,2054,1168,
58,120
DATA 40,140,2A0,540,AA0,600,340,
1960
DATA CA0,CA8,46AC,66A4,66A4,37EC
,1FFC,FF8
DATA FF8,FF0,FF0,17E0,7E0,F60,AA
0,FFFC
DATA FFFC,FFFC,FFFC,FFFC,FFFC,FF
FC,FFFC,FFFC
DATA FFFC,FFFC,FFFC,FFFC,FFFC,FF
FC,FFFC,FFFC
DATA FFFC,600,FC0,3FE0,3FE0,1FF8
,DFFC,EFFC
DATA EFFC,FFFC,7FFC,3FF8,1FF8,1F
F0,1FF0,1FE0
DATA FE0,F60,AA0,0
```

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Readers' Feedback

The Editors and Readers of COMPUTE!

If you have any questions, comments, or suggestions you would like to see addressed in this column, write to "Readers' Feedback," COMPUTE!, P.O. Box 5406, Greensboro, NC 27403. Due to the volume of mail we receive, we regret that we cannot provide personal answers to technical questions.

Overseas Telecomputing

In reference to M. H. Trenker's letter in the November 1986 issue of COMPUTE!, I would like to provide some additional information. I have been using American-built Commodore and Zenith computer systems in West Germany without any modifications except for suitable stepdown power transformers. Some people might think that they will no longer have access to the CompuServe information service after they move to Europe. That's not true. Here in Germany, you can access CompuServe through a German telephone system called Datex-P.

Charles H. Pease, Jr.

Thanks for the advice. Mr. Trenker's letter about using a U.S. computer system in Poland has generated a blizzard of mail from COMPUTE! readers who use Commodores, Apples, Ataris, IBM PCs, and many other systems in virtually every corner of the globe. The next two letters contain additional information about telecomputing outside the United States and Canada.

Your readers should know that direct-connect modems purchased in the United States do not work in Germany, since the phones use a different current and do not have modular jacks. The simplest solution is to use a modem with acoustic couplers rather than direct-line connections.

Sgt. Randall Harper

This letter is based on my own experience and that of many members of my users group who have bought Commodore computers in the United States and brought them to countries with 220V/50 Hz current. Basiçally, all of your explanations are right. A complete system will work flawlessly with only a stepdown transformer. Beware of voltage *converters*, however; I have damaged a printer beyond repair with such a device. Two points should be added. First, a U.S. Commodore computer (except the Amiga) can use a 220V 1541 or 1571 disk drive without harm. Second, many European countries do not provide grounded outlets; since the 1541/1571 disk drive may not work correctly unless grounded, you may need to ground the device yourself.

For telecommunications, most European countries use the CCIT rather than the Bell standard. This may make a Bell-standard modem useless except for communicating with a BBS back in the United States. In some countries, the use of a modem not supplied by the local telephone company is a felony. An exception is Israel, where the Bell standard is accepted. The phone outlets are different, but you can purchase Bell phone connectors at electronics stores.

Dr. Alexander Burcat
Technion Commodore User's Group
Haifa, Israel

Cleaner Than Clean

This is in reference to the letters about the Atari BASIC INPUT statement in the October and December 1986 issues. One disadvantage of substituting INPUT #16 for INPUT in an existing program is that you have to edit every INPUT statement manually. For anyone who has BASIC XL, there's an easier way. The SET statement allows you to specify what character BASIC uses for the INPUT prompt. Thus, SET 2,32 replaces the question mark with a space, character 32. The second number is the ATASCII value of the character you want to use.

Garry Kaiser

Thank you for the information. Atari owners should note that this method works only with BASIC XL, the extended BASIC from OSS Precision Software. If you have BASIC XL, you can put a single SET statement at the beginning of a program without having to change every INPUT statement in the code.

More Amiga BASIC Tips

In the December 1986 installment of "Readers' Feedback," you answered a reader's question about the LIBRARY command and .bmap files in Amiga BASIC. Your answer is correct. However, there is an easier way to take care of the problem without changing directories with CHDIR or always putting the .bmap file in the current directory. When Amiga BASIC encounters a LIBRARY statement, it first looks in the current directory to find the designated .bmap file. If the file is not found, BASIC then looks in the LIBS subdirectory of the disk that you booted with. Thus, you can simply copy all the needed .bmap files to the LIBS subdirectory of the disk you use to boot the computer. The system automatically prompts you to insert the correct disk if it isn't currently in the drive.

David Grothe

Thank you for the additional information. To minimize disk-swapping, particularly on single-drive systems, many Amiga owners make a special work disk for use with BASIC. Here's how to do it: Make a copy of the Workbench disk and rename the disk; then copy Amiga BASIC onto it. Finally, copy the .bmap files you need into the LIBS subdirectory of your work disk. If you boot up with that disk, BASIC and the .bmap files can all be accessed without swapping disks.

A slight disadvantage of this method is that the whole-disk copy includes many files that are rarely, if ever, needed for BASIC programming. If you get rid of nonessential files, you'll have much more space for BASIC programs. For instance, you can gain about 160,000 bytes of free space by deleting the clock and the DEMOS, SYSTEM, and UTILITIES subdirectories. The DEVS/PRINTERS subdirectory contains 13 different printer drivers, which range anywhere from 1084 to 5248 bytes in size: You can free up even more disk space by eliminating unneeded driver files from this subdirectory. The command subdirectory (C) contains DOS commands that few people use in connection with BASIC: For example, the ED, EDIT, and SAY commands take up nearly 47,000 bytes of extra space in all.

To delete a file, open a CLI window from the Workbench and type DELETE followed by the name of the file you want to eliminate. The ALL command lets you DELETE everything in a designated subdirectory. For instance, DELETE DEMOS

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ALL gets rid of everything in DEMOS, including the subdirectory itself and all associated .info files. If you don't know what a file does, it's best to leave it on the disk. Many of the files and subdirectories on the Workbench disk are needed to boot the system and use BASIC.

Seeing Double

I have just recently purchased an Atari 520ST. When I turned it on and loaded BASIC, I typed ?FRE(0) to find out how much memory I had for programming. The computer printed the number 186704. As I began to write a program, I noticed the bytes being whittled away very quickly. I also own a Commodore 64 and have noticed that it's quite efficient when storing a BASIC program. What does the ST do with memory when it stores BASIC? On the ST, this line takes up 68 bytes of memory:

10 ?"I'm your faithful computer"

Dale Zwicker

ST BASIC stores two copies of the program in memory concurrently. The first copy is tokenized, *meaning that keywords are compressed into one- or two-byte tokens. The second copy is in ASCII form and consists of the characters which you typed in when entering each line. It's difficult to imagine a justification for keeping a complete untokenized copy of the program in memory. Virtually every other version of BASIC stores the program only in the more compact tokenized form, expanding the tokens into BASIC words like PRINT only when you LIST the program or save it in ASCII form.*

When we entered the example line on various STs around our office, BASIC consistently required 70 bytes to store the line. Out of curiousity, we booted up GFA BASIC, the new BASIC from Germany, now marketed by MichTron (see "ST Outlook" elsewhere in this issue), and entered the same line. That version of BASIC stores the same line in only 32 bytes. A few bytes can be accounted for by the fact that GFA BASIC doesn't use line numbers. But the major difference clearly derives from the fact that GFA BASIC stores only one copy of the program, not two.

By the way, the example line you chose illustrates one of the worst possible cases. Counting the quotation marks, the line contains 28 ASCII characters which aren't compressed even in the tokenized copy of the program. Thus, the tokenized version of the line is only slightly smaller than the ASCII version. Many BASIC lines consist mainly of keywords, however, which would tend to make the tokenized version considerably smaller.

We found another puzzling anomaly while testing ST BASIC's memory consumption. Enter NEW, then go to the EDIT window and type in the example line and press RETURN. Go to the COMMAND window and enter ?FRE(0). If you return to the EDIT window and press RETURN over the same line, BASIC loses a few more bytes, even though nothing new has been added to the program. If you continue to reenter the same line, BASIC uses up more and more memory, even though the program is functionally identical. Each reentry of the line uses up anywhere from five to seven bytes of memory.

Copying Machine Language Programs

I subscribe to the COMPUTE! Commodore disk and find that I have several programs that I can't copy to another disk. All of them must be loaded with ,8,1 rather than ,8. The 64 user's manual is no help, and Commodore 64 BASIC has no special command for saving machine language programs. My grandsons spent a lot of time during their last visit playing "High Rise" and "Miami Ice." They are not as careful with disks as I am, and I shudder to think what they would say if one of those programs were lost and I had no backup copy. Can you help?

Elmer O. Pease

Before you attempt to copy any machine language program, you must find out where it loads into memory. The article accompanying each COMPUTE! program indicates whether it is a nonrelocating program that needs special handling or a program like SpeedScript, *which can be handled like a BASIC program.*

Some Commodore 64 ML programs can be copied without any special tricks because they are designed to load at the same address as a BASIC program (2049 decimal, $0801 hexadecimal). SpeedScript *is one such program: It can be loaded with LOAD "SPEEDSCRIPT",8 and saved with SAVE "SPEEDSCRIPT",8. As a rule, if the instructions for a program indicate that you can load it with ,8 and start it by typing RUN, it can be handled like a BASIC program. Simply load it as usual, insert a new disk, and save it as you would any BASIC program. If you LIST a program of this type, you will usually see a line like 10 SYS2061.*

Other machine language programs need to load at a different address. Such programs are called nonrelocating *because the computer automatically loads them back into the same memory area they were saved from. You can identify this type of program because the instructions tell you to load it with ,8,1 instead of ,8. A nonrelocating program also starts with a SYS command rather than RUN.*

Commodore 64 BASIC does not include a BSAVE command for saving a relocating program. But there is an easy way to make new copies of such programs, using "MLX," the machine language entry program published frequently in COMPUTE!. Simply load the program into MLX, insert a new disk, and save the program exactly as you would when typing it in from MLX. MLX is included on every COMPUTE! disk and also appears in issues of COMPUTE! that contain programs to be typed in with MLX. This procedure requires that you know the beginning and ending addresses for the program; that information is contained in the accompanying article.

If you don't know the starting and ending addresses for a program, run this program and enter the name of the file when prompted. It reads the program's load address and calculates its ending address based on the number of bytes in the file. Once you know the addresses, you can make a copy of the program with MLX as described above.

```
100 PRINT "ENTER FILENAME":INP
    UT F$
110 F$="0:"+F$:T$=",P,R":OPEN
    {SPACE}15,8,15,"I0":GOSUB 2
    00
120 IF ER AND ER<>62 THEN PRIN
    T ER; ER$; TR; SE:CLOSE 3:C
    LOSE 15:END
130 IF ER=62 THEN T$=",S,R":GO
    SUB 200
140 IF ER=62 THEN T$=",U,R":GO
    SUB 200
150 IF ER THEN PRINT "CAN'T OP
    EN ";F$;" FOR READING":CLOS
    E 15:END
160 GET#3,LO$:GET#3,HI$:SA=ASC
    (LO$+CHR$(0))+256*ASC(HI$+C
    HR$(0))
170 PRINT "STARTING ADDRESS:";SA
180 GET#3,X$:IF ST=0 THEN SA=S
    A+1:GOTO 180
190 PRINT "ENDING ADDRESS:
    {2 SPACES}";SA:CLOSE 3:CLOS
    E 15:END
200 CLOSE 3:OPEN 3,8,3,F$+T$:I
    NPUT#15, ER, ER$, TR, SE:RE
    TURN
```

BASIC 7.0, the BASIC used on the Commodore 128, includes a BSAVE command that lets you save the contents of any memory area. Again, you must know the starting and ending addresses of the area to save. Here is the general syntax for BSAVE:

BSAVE "*filename*", D*drive number*, B*bank number*,P*start address* TO P*end address*

This command takes several parameters. The parameters for drive number *and* bank number *are optional. If you omit them, BASIC uses drive 0 and memory bank 15 as defaults. You must always supply the* start address *and* end address. *For example, this statement BSAVEs the block of memory in locations 3584–4096 (in bank 0) in a disk file named "SAMPLE":*

BSAVE "SAMPLE", B0, P3584 TO P4096

80-Column Hi-Res Graphics For 128

The *128 Programmer's Reference Guide* states that it is possible to do multicolor bitmapping on the 80-column screen if you reduce the size of the screen by 2000 bytes. Could you publish a program that does this and that plots both screen and color pixels?

L. K. Snyder

Although the 128's BASIC 7.0 uses only the VIC (40-column) video chip for high-resolution graphics, the VDC chip that generates the 80-column screen display can also produce bitmapped displays. This feature isn't mentioned in the System Guide *that comes with the 128, although it is covered briefly in the* 128 Programmer's Reference Guide. *In the example provided in the* Programmer's Reference Guide, *the foreground and background colors are the same for the entire screen, so the display can have only two different colors. The VDC can't produce a multicolor bitmapped (hi-res) display in the same sense that the VIC chip can—the VIC multicolor bitmapped display can use up to four different colors within each 4 × 8–pixel area, while the VDC chip's bitmapped display can use only two different colors within each 8 × 8–pixel area—but the VDC bitmapped display can have more than just two different colors.*

*To understand why the two-color bitmapped display is easier to set up, you need to know a little about how VDC bitmapped displays work. The standard VDC bitmapped screen is 640 pixels wide by 200 pixels tall. Each pixel is controlled by a single bit in the area of VDC memory known as the bitmap. Thus, 128,000 bits (640 * 200), or 16,000 bytes, are required to bitmap the entire screen. When a bit in the bitmap is set to 0, the corresponding pixel takes the background color. When a bit in the bitmap is set to 1, the pixel takes the foreground color. The layout of the bitmap is much more straightforward than the VIC's arrangement. The first byte of bitmap memory controls the leftmost eight pixels on the top screen line. The next byte controls the next eight pixels to the right, and so on.*

For controlling colors, the pixels are grouped into an array of 8 × 8–pixel character positions. Each character position has a corresponding location in the area of VDC RAM called attribute memory. *In bitmapped mode, the lower four bits of each attribute memory location specify the foreground color for the corresponding character position, while the upper four bits specify the background color for the position. Thus, even though a character position can have only 2 different colors, each position can have independent colors, and all 16 available colors can be used in the display. Here's the problem with that system: The standard VDC display has 25 horizontal rows of 80 character positions per row, so attribute memory normally occupies 2000 (80 * 25) bytes. However, the 16,000-byte bitmap requires nearly all of the 16K (16,384 bytes) of available VDC RAM. There's not enough room for attribute memory in addition to the bitmap. The* Programmer's Reference Guide *example offers the easiest solution to this dilemma. The VDC allows attribute memory to be disabled, in which case the foreground and background colors for all screen positions can be specified in VDC internal register 26. Although this limits you to only 2 different colors in the display, it does allow a full 128,000-pixel screen.*

The alternative solution, alluded to in the Programmer's Reference Guide, *is to reduce the size of the bitmap sufficiently to make room for attribute memory. The VDC is a highly programmable chip. Although the standard VDC screen is 80 columns by 25 rows (640 dots by 200 lines), you change the display to any height and width by changing the appropriate VDC internal registers. For example, if you reduce the display size to 80 columns wide by 22 rows tall (640 × 176 pixels), then 14,080 bytes will be required for the bitmap and 1760 bytes will be required for attribute memory, so both will fit in the available 16K. The VDC register system is too complex to explain in detail here, but the following program illustrates the necessary steps to create full-color bitmapped graphics on the 80-column screen. The program is adapted from one in* Mapping the Commodore 128, *from COMPUTE! Books, which provides a thorough discussion of VDC register operations.*

Operate this drawing program with a joystick plugged into port 2. Press the fire button to move without drawing. Press B to change the background color and F to change the foreground color. The color changes affect all pixels in each subsequent character position you move through. You can press H to home the drawing point to the center of the screen, C to clear the screen, and P to change the border color.

(For instructions on entering this program, please refer to "COMPUTE!'s Guide to Typing In Programs" elsewhere in this issue.)

```
EE 100 GRAPHIC 0:FAST
QP 105 REM ** SCREEN EDITOR RO
       M ROUTINES
RQ 110 WR=DEC("CDCC"):RR=DEC("
       CDDA")
PX 115 REM ** SET DEFAULT COLO
       RS
MF 120 BC=2:FC=11:PC=9:SYS WR,
       PC,26
CC 125 REM ** SET SCREEN HEIGH
       T TO 22 ROWS
XB 130 SYS WR,22,6
PH 135 REM ** MOVE ATTRIBUTE M
       EMORY TO ADDRESS 10480
ME 140 CM=14080:CH=INT(CM/256)
       :CL=CM-(CH*256):SYS WR,
       CH,20:SYS WR,CL,21
PH 145 REM ** TURN ON BITMAPPE
       D DISPLAY
HE 150 SYS RR,,25:RREG A:SYS W
       R,(A AND 63) OR 192,25
FD 155 REM ** CLEAR BITMAP AND
        ATTRIBUTES
MJ 160 SYS RR,,24:RREG A:SYS W
       R,A AND 127,24
DH 170 SYS WR,0,18:SYS WR,0,19
       :SYS WR,0,31
FK 180 FOR I=1 TO 56:SYS WR,25
       5,30:NEXT
KG 190 SYS WR,CH,18:SYS WR,CL,
       19:SYS WR,BC*16,31
JP 200 FOR I=1 TO 7:SYS WR,255
       ,30:NEXT
DR 205 REM ** SET HOME COORDIN
       ATES
EC 210 X=320:Y=88
GH 215 REM ** CHECK FOR KEYPRE
       SS
JS 220 GET K$:ON INSTR("BFPCH"
       ,K$) GOTO 230,240,250,1
       60,210:GOTO 260
DC 230 BC=(BC+1) AND 15:GOTO 3
       30
HS 240 FC=(FC+1) AND 15:GOTO 3
       30
AR 250 PC=(PC+1) AND 15:SYS WR
       ,PC,26
JJ 255 REM ** READ JOYSTICK
GP 260 D=JOY(2):IF D=0 THEN 22
       0:ELSE B=D AND 128:D=D
       {SPACE}AND 15
GG 265 REM ** CALCULATE NEW PO
       SITION
RD 270 Y=Y+(D<3 OR D=8)-(D>3 A
       ND D<7):IF Y<0 THEN Y=1
       75:ELSE IF Y>175 THEN Y
       =0
KG 280 X=X-(D>1 AND D<5)+(D>5)
       :IF X<0 THEN X=639:ELSE
        IF X>639 THEN X=0
KH 290 IF B THEN 330
XP 295 REM ** SET PIXEL
QR 300 AD=INT(X/8)+80*Y:AH=INT
       (AD/256):AL=AD-(AH*256)
HJ 310 SYS WR,AH,18:SYS WR,AL,
       19:SYS RR,,31:RREG A
BA 320 SYS WR,AH,18:SYS WR,AL,
       19:SYS WR,A OR 2↑(7-(X
       {SPACE}AND 7)),31
SJ 325 REM ** SET FOREGROUND A
       ND BACKGROUND COLORS
RJ 330 AD=CM+INT(X/8)+80*(INT(
       Y/8)):AH=INT(AD/256):AL
       =AD-(AH*256)
PE 340 SYS WR,AH,18:SYS WR,AL,
       19:SYS WR,(BC*16)+FC,31
PJ 350 GOTO 220
```

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Little Computer People

Neil Randall

Requirements: Atari ST, Apple II-series (64K minimum), Amiga, and Commodore 64 computers.

In 1985, Activision introduced a unique concept in computer gaming. The original version of *Little Computer People*, available for the Commodore 64, Atari eight-bit machines, and Apple II series, was so popular that many people bought several copies. In 1986, versions for the Amiga and Atari ST were released. Neither a game nor an applications program, *Little Computer People* is as purely entertaining as anything on the market. Its greatest appeal is undoubtedly to children, but in its short lifetime it has managed to capture many adult imaginations as well.

The premise behind *Little Computer People* is extremely simple. Inside every computer live several small people. They do not speak our language, but they live a day-to-day existence that resembles ours. The problem is, they have no home. What *Little Computer People* does, therefore, is provide them with a house to live in and someone to take care of them.

That someone, as you might expect, is you. When you first start the program, you are asked to sign a very attractive guestbook and provide the current time and date. Then a house appears on the screen, cut away to reveal the contents of several rooms. On the ground floor is a kitchen, with table, chair, refrigerator, sink, and water cooler, and a living room with fireplace and telephone. The second floor has a bedroom, bathroom, and computer room. Up the stairs to the top floor there is a large room with a television and stereo, a piano, a desk with typewriter, and a filing cabinet.

Keeping Him Happy

After a short wait, your LCP (Little Computer Person) appears. He will enter the front door, check the place out, then leave. Shortly, he will return with his luggage and his dog. Your job, now that you've provided him with a home, is to keep him happy. To do so, you must make sure he has food and water, provide food for his dog, and pay attention to him. The first three are easy. Control-F (in the Atari ST version, the one used for this review) drops food at the front door, Control-W adds a glass of water to the cooler, and Control-D leaves food for the dog. Your LCP will feed himself and the dog without your prompting.

Your LCP will be in one of four states. *Happy* means just that. *Content* means his life is okay, but it could be better. If his face is sad, you should cheer him up immediately, and if you don't feed him or give him water, he will turn green and lie sick in bed. To boost your LCP's mood, you can call him on the phone (but be prepared not to understand a word he says), you can "pet" him, or you can leave a record for him at the front door. When he retrieves the record, he will take it up to the stereo and play it. You can listen with him.

Another mood booster is playing games. You can either ask him to play, by typing in the request, or wait for him to knock on your screen. He will then offer to play one of several games. Anagrams is a word-unscrambling game, with you doing the descrambling. Card War is the children's card game "War." If you play 5-Card-Draw Poker against him, he will let you win just often enough to think you can beat him. The same applies to Blackjack. Finally, Word Puzzles has you fill in the blanks to a word in a sentence he prints on the screen. All the games are fun to play, and the LCP appreciates the attention.

Again in response to your request, or purely on his own, the LCP will either play the piano (he's pretty good) or sit at the typewriter and send you a letter. The letter is always addressed to you, and you will quickly discover how well-mannered your LCP really is. You can, at any time, type in a request to the LCP, to which he may or may not respond. If he does, he nods his head and does as he is asked. Writing is the only way to communicate with him, though, since he does not speak English.

An Everyday World

What you do most of the time, though, is watch your LCP spend his day. He will light a fire and read a book in the living room, or he will feed the dog in the kitchen. He works in the computer room and sleeps in the bedroom, and when he closes the bathroom door he will emerge to the sound of a toilet flushing. Much of his time he spends watching television or playing music, and he seems to spend an inordinate percentage of his life walking up and down the stairs. He eats, drinks, sleeps, reads, entertains himself, and takes care of his dog. In other words, his days are much like many of ours: not very exciting, but pleasant and, if you are good to him, fulfilling.

By now I'm sure you see the enormous and subtle educational appeal of *Little Computer People*. To watch a child care for the LCP, writing letters to it and playing games with it, is a marvelous way to pass a few hours a week. To a child, a sick LCP is a matter of life or death; a happy one is cause for rejoicing. The program provides neither the competitiveness of computer games nor the unrealistic time distortion of television, as the LCP lives a pretty normal life in a pretty normal house. The child will learn to care for and about the LCP, and there's not much more you could ask of a computer program.

Activision has included one other brilliant feature in *Little Computer People*, but I suspect that most people, like me, will take a while to appreciate it. There is only one Little Computer Person on the disk. To get another, you have to go buy a new disk. Now, to those of us used to starting a game over from scratch when something goes wrong, or when we grow tired of it, this feature is initially disappointing. At least I found it so. But when I thought about it, I began to realize that this is solidly in keeping with the rest of the design. You *can't* change LCPs, because you have made a commitment to caring for the one you already have. The LCP simulates a little person inside the computer, one which the child must take care of even if he would like to have somebody else. One of the criticisms about simulations as a whole is that they encourage noncommitment be-

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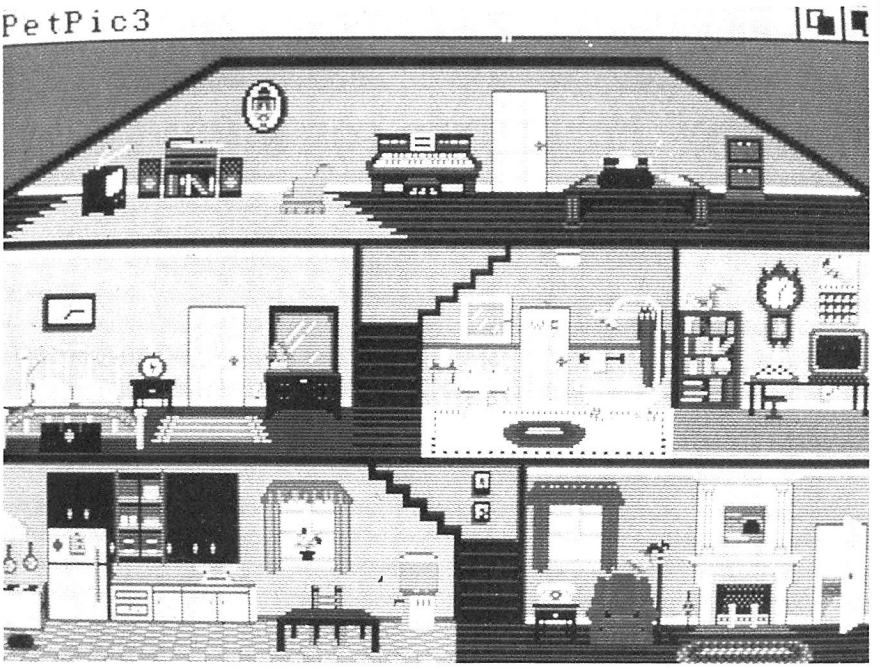
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cause nothing is irrevocable. Activision, in a flurry of brilliance, decided not to let that happen. As a design decision it is unusual, but it is one worth considerable praise.

Is *Little Computer People* for everyone? No, no more than any other computer product is. It is, however, for anyone seeking to encourage the growing trend in entertainment software towards real-life simulation. In the past year the people at Activision have given us *Alter Ego* and *Little Computer People*, and in doing so demonstrated a willingness to buck the trends and let entertainment software find its own course. They are to be applauded for this, because without the willingness, such innovations as *Little Computer People* would not exist. It is a delightful program.

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A view of the cutaway house in Little Computer People *(Amiga version).*



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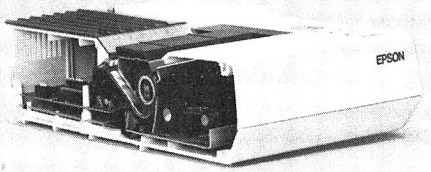
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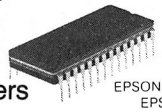
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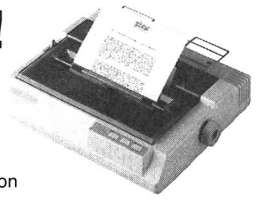
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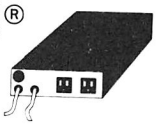
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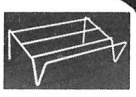
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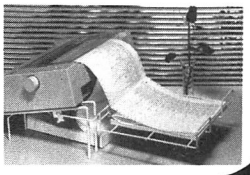
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Certificate Maker And Walt Disney Card & Party Shop

Karen McCullough

Requirements: Apple II series (64K minimum) and Commodore 64. Certificate Maker *also has an IBM PC (and compatibles) version.*

Conceptually, *Certificate Maker* and *Walt Disney Card & Party Shop* are indirect offspring of Brøderbund's classic home printing program, *The Print Shop*. They use a similar simple, menu-oriented approach to design and setup, with no decisions being final until you actually print. And they enable your computer to produce professional-looking items you couldn't otherwise create at home.

Certificate Maker's name says it all: The program prints certificates. That's the only thing it does, but it performs that function very well. Although it trades some flexibility for ease of use, it's difficult to think of an award the program couldn't handle.

The designers have broken the process of certificate creation into four steps. You begin by selecting a template, or basic format, for the certificate. The template may include a headline and various graphic designs. With more than 200 available in the package, including several all-purpose and blank designs, there's a certificate for every imaginable occasion.

The second step is to choose a border. Each of the 24 available designs is displayed on screen as its title is highlighted, and there's an attractive assortment. Third, for templates that don't have a predesigned title, you enter title font style and the text. Five fonts (in two sizes) are available; they're acceptably good looking, but one could wish for a wider choice.

The last step is to choose a font for, and enter, the body text. How much body text is available depends on the font style and size chosen. That done, you enter a date and signature line and tell it to print. Printer setup follows a trend found today in many programs: You choose your equipment from the lists displayed, and the program configures itself.

Certificate Maker has several features worth mentioning. The names file option allows you to create a list of names and ask the program to print a certificate for each. Several lists of names can be edited and saved on a separate disk (be aware, though, that in the Apple version this must be a ProDOS formatted disk). When you run the printer-setup test, it prints four blocks that represent the corners of the certificate to help you position the paper correctly.

Disney On Paper

Walt Disney Card & Party Shop has taken a different approach and added flexibility at the cost of some friendliness. The *Card & Party Shop* lets you create a full line of paper goods for a child's party: invitations, place cards and mats, wrapping paper, banners, and so on, or cards and signs for other purposes.

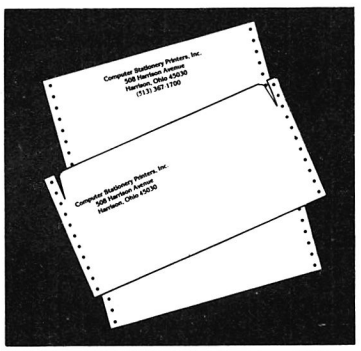
For most items you can choose a predesigned layout or create your own. If you stick to predesigned pieces, the creation process is simple: Choose a design and print it. The variety is sufficient; you could have several different parties using just the designs available from the program.

Card & Party Shop lets you do a great deal more, but you'll have to spend some time with the manual learning how. In general, the manual is clear, but it has a propensity for referring you to other pages for discussions of various features.

The program offers six typefaces, but that's misleading; the variety is more in size than style, and the style is

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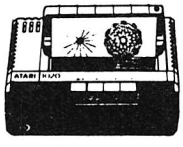
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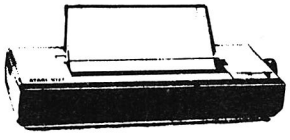
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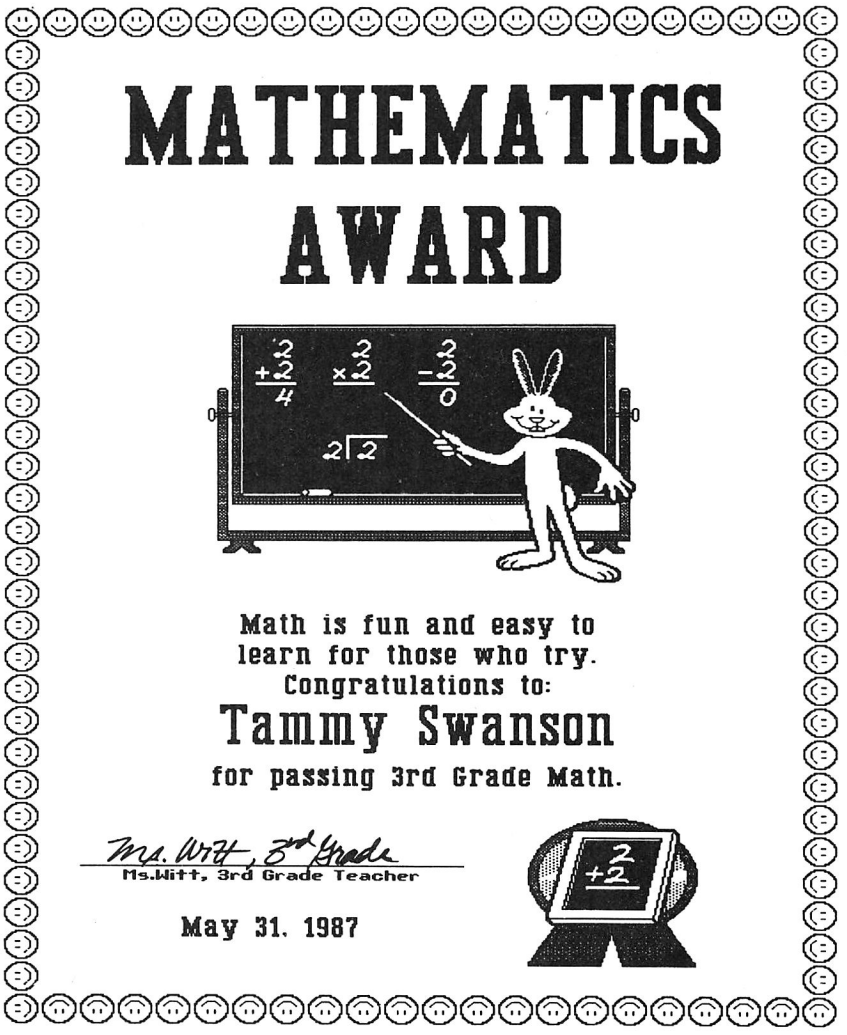
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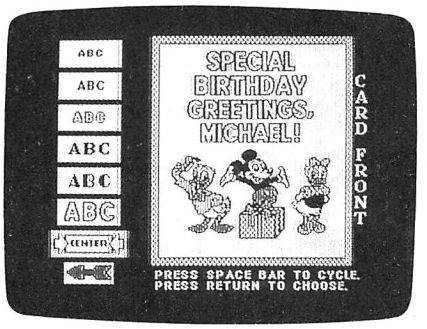
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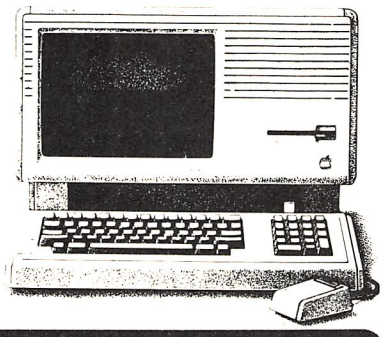
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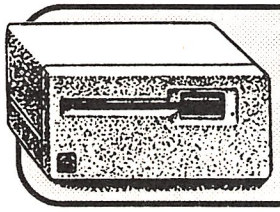
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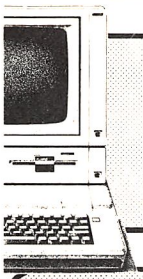
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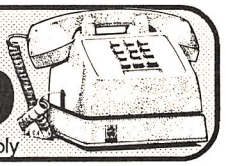
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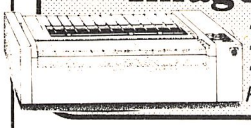
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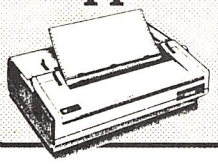


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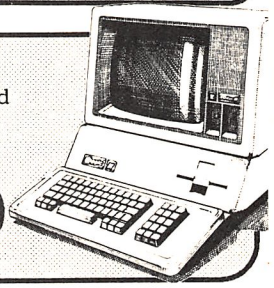
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Roadwar 2000

James V. Trunzo

Requirements: Apple II-series computers, with a 48K minimum, and Commodore 64 computer; versions under way for Atari ST and IBM PC and compatibles.

America has become a battleground; the word "civilization" is rapidly becoming as much an anachronism as the concept of peace. Bacterial warfare, insidiously brought into the country and spread by fanatics whose hatred of the United States was greater than their fear of death, has reduced this once-great nation into a state of anarchy where rule goes to whoever has the power to enforce it. In the year 2000, it is the road warriors who control the land. But there is hope.

Of course, in *Roadwar 2000*, a recent release from Strategic Simulations, you are that hope. A patriotic leader and one of the few people who know of the plan to cure the deadly bacteria and, in the process, return control of the country to what is left of the Federal Government, you must recruit a road gang, build it into a force, and begin taking over the major cities, one by one. By doing so, you will be able to locate the eight scientists who jointly hold part of the formula for the vaccine that will destroy the deadly microbes that have crippled a nation. It goes without saying that the job will be both dangerous and difficult.

A Sprawling Adventure

Roadwar 2000 is a sprawling adventure game whose battleground covers the entire continental United States, Mexico, and the Bahama Islands. The idea for the game obviously grew out of the very popular Mad Max movies, but SSI has successfully expanded the concept of the road warrior into a full-fledged, multi-faceted adventure game. The game includes a wide variety of possibilities and requires the player to think just as shrewdly in noncombat situations as he or she does while fighting. Though combat will be both necessary and frequent, the player must never lose sight of the primary goal: locating the eight scientists hidden around the country.

As a leader of a road gang, you must not only direct your force in combat but also provide for them—which means arming and feeding each man. Therefore, you must know when, where, and how to forage for food, medicine, and weapons. You must make decisions on how and when to recruit more members into your road gang, particularly the "specialists" like military advisors, politicians, and doctors. Each one of these specialists will perform a particular function. A top-notch drill sergeant, for example, will decrease desertions, train your men to fight better, and increase the chances of promotions for your lowly escorts.

Handling your forces is obviously an important task, but it is equally important to know how to handle your vehicles. As the title implies, if you control the highways, you control the country. Without well-equipped, well-fueled transportation, you won't survive. *Roadwar 2000* offers 15 vehicle types with which to work, each rated individually in 24 different categories that run the gamut from number of tires to handling ability. Motorcycles and compacts are easy on gas and highly maneuverable, but are reduced to using hit-and-run tactics in combat. A bus, on the other hand, can be turned into a real war wagon and transporter, if you have a good supply of fuel and spare tires. Your decisions on the make-up of your road gang's vehicles spell the difference between success and failure in many cases.

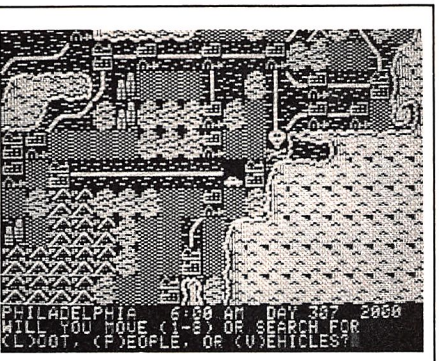
Deadly Encounters

As you crisscross the country, exploring 120 cities and dealing with over 30 types of terrain, you must learn to trade, talk, or fight with a truly eclectic group of people: Foot Gangs might take the form of mercenaries, street gangsters, armed rabble, mobs of the needy, or even cannibals; and any of these types can be found in what remains of once-thriving cites.

Residents, while more stable in most cases, aren't always what they seem either. Those National Guardsmen might be lawful or they might be renegades; those friendly masses awaiting your envoys might be The Reborn who want only peace, or Satanists waiting to bushwack you. Bureaucrats who control municipalities will want you to pay for the privilege of passing through their city or town, and Survivalists are notoriously trigger-happy and suspicious of strangers. And for every healer you meet, there's a diseased, psychotic Mutant, the result of nuclear explosions.

Not that the roads are any safer. Many of the "types" already mentioned have vehicles, too, and are more than willing to give you special attention as you cruise the highways.

When combat occurs, and it will, the fighting can be resolved in several ways. The player may opt for Abstract, Tactical, or Quick combat, each having its own advantages and disadvantages. If you choose to forego detailed road combat, the resolution of the encounter is Abstract. The computer rapidly compares all pertinent data of the opposite forces (number and type of vehicles, men involved, weapon availability, and so on) and displays the bloody results: number of men lost, vehicles lost and/or damaged.



Roadwar 2000 *is a futuristic battle adventure that takes you across the continental U.S. and into Mexico and the Bahamas.*

If you prefer detailed, graphic combat, you are given a subchoice of allowing the computer to handle deployment of vehicles and allocation of weapons or of taking care of these details yourself. Once this has been decided and acted upon, tactical combat begins. You are then required to choose movement and targets for each of your vehicles. Your options are many. Even ramming and boarding may occur.

A compromise choice is Quick combat. Here the player is given the flavor of full tactical combat, but sacrifices many of the options available under Tactical combat. No boarding or capturing of an enemy's vehicle may occur during Quick combat, for example.

Roadwar 2000 combines the excitement of individual combat with the strategy and tactics of a campaign to give the player the best of both worlds. Throw in the aesthetically pleasing graphics and the variety that guarantees a long shelf life, and you have yet another successful product from SSI.

Roadwar 2000
Strategic Simulations (SSI)
1046 N. Rengstorff Avenue
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$39.95

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Computers and Society

David D. Thornburg, Associate Editor

Demons And Events, Part 2

Last month we started to explore the world of event-driven programming. As I mentioned at that time, event-driven programs are different from traditional computer programs in that the computer can be made to check the status of certain events automatically, without expressly checking for these events in a loop.

For example, a traditional computer program that searches for certain events may have a loop that looks something like this:

```
1000 if button-down then do-button-event
1010 if joystick then move-cursor
1020 if keypress then accept-text
1030 if end-of-line then word-wrap
1040 go to 1000
```

The program will run in this loop forever until one of the tested conditions comes true, at which point the appropriate subroutine gets executed.

In event-driven programs, various conditions are tested at the beginning of each line of the program, no matter where these lines are or what they are doing. Once an instruction turns on the checking of an event, that event is looked for all the time, unless the program specifically disables the event checking.

Events And The Mac

Macintosh programming with languages like ZBASIC consists of setting up the starting windows and menus, creating subroutines to handle various events, turning on the event checking, and then spending the rest of the time running in a simple loop. An example might be:

```
1000 REM SAMPLE PROGRAM
1010 GOSUB "SETUP MENUS"
1020 GOSUB "SETUP START
     WINDOW"
1030 ON MENU GOSUB "HANDLE
     MENUS"
1040 ON DIALOG GOSUB "HANDLE
     DIALOG"
1050 ON MOUSE GOSUB "HANDLE
     MOUSE"
1060 ON BREAK GOSUB "STOP
     PROGRAM"
1070 MENU ON : DIALOG ON : MOUSE
     ON : BREAK ON
1080 GOTO 1080
1090 END

...

2000 "SETUP MENUS"

...and so on
```

When this program is run, the starting instructions are executed in sequence. Lines 1030 through 1060 indicate which subroutines are to be executed when a particular event occurs. The event checking is turned on in line 1070, and the program then enters a loop in line 1080.

At this point, the event checker looks to see what is happening from the user's perspective each time line 1080 is executed. If the user pulls down a menu and selects an item, the subroutine HANDLE MENUS is executed. This routine has the task of finding out which menu item has been selected and of taking the appropriate action. Once this task has been completed, the routine returns to line 1080.

An interesting feature of event-driven programming is that events are checked for at the beginning of each line, no matter where in the program the event takes place. For example, if the user has selected a menu item and then presses the "break" key, this event will be detected, even if the computer is running a routine for another event.

An Event-Handling Routine

Once an event has occured and control is passed to a special subroutine, special functions can be used to tell what happened. For example, a menu-handling routine written in ZBASIC for the Macintosh may look something like this:

```
"HANDLE MENUS"
whichmen = MENU(0)
whichitem = MENU(1)
IF whichmen = 1 AND whichitem = 1
   THEN "open file"
.
.
.
RETURN
```

Each event (for example, selecting a menu item, moving the mouse, or clicking in a window) has its own special set of functions that can be used in subroutines to find out exactly what happened. Based on the output of these functions the programmer can make the program do what he or she wants it to do.

Events And Other Computers

Event-driven programming is by no means limited to the Macintosh. As I mentioned last month, my first experience with this method of programming came through my exposure to Atari Logo on the old model 400. The *Quick BASIC* compiler from Microsoft for the MS-DOS computers supports events. Event-driven programming languages are becoming available for most popular computers.

In fact, you probably have at least one event loop running in every program you write. If your computer lets you stop a program by pressing CTRL-C, you are experiencing the result of an event—the pressing of a special key. Typically this event is checked for automatically, even if you don't want it to be!

The Advantages Of Events

Writing event-driven programs requires a slight philosophical shift in thinking from that used when writing traditional programs. Rather than thinking about the program from the programmer's perspective, the software author has to be constantly thinking about the user. The user is going to perform some activities—typing on a keyboard, moving a mouse, and so forth. Each of

these activities is going to be initiated by the user, and it is the job of the program to respond appropriately to these external events.

This style of programming facilitates the creation of programs where the user can jump from activity to activity without having to be carried through a rigid sequence of steps dictated by the programmer.

Problems With Events

Event-driven programs are tricky to debug when you first start learning how to write them. One of the disciplines I found essential was to disable events (with commands like MENU OFF) while they were being handled.

And, since you can't always know which line is being executed when an event is detected during the program run, the programmer gives up a certain amount of control over the ultimate interaction between the user and the program.

Why Bother?

Event-driven programs have a special feel when you run them. It is as though the programmer has anticipated the user's every move and desire and is ready to do anything at any time. It is true that this same feel can be created by programmers using just about any language including hand-crafted machine code, but the special features of languages that support events make it easy to put the user in charge.

To my way of thinking, the central task facing any computer programmer is to write programs that make the computer disappear from the user's consciousness. A well-written program lets the computer fade into the background, allowing the user to touch the application itself rather than face a burdensome interaction with a clumsy machine.

There are no easy rules that can be used to show how to create applications that meet this goal. A good programmer is a magician who suspends reality and creates the illusion that the user is interacting with a document, a magic kingdom, a drawing, a piece of music, a financial calculation, interstellar travel, or just about anything except the physical reality of the computer through which this fiction is being created.

We who write and design programs are in the fantasy and magic business. Languages that support events make our job just a bit easier.

Dr. Thornburg's most recent product is Calliope™ *a "nonlinear" idea processor for the Apple IIe, c,* GS, *Macintosh and MS-DOS computers. He welcomes letters from readers and can be reached in care of this magazine.*©

COMPUTE!

Disk Fix For IBM

This file recovery utility from the January 1987 issue (p. 77) is seriously flawed. *Do not attempt to use this program.* "Disk Fix" does not properly recover deleted files, and will in many cases scramble a portion of the disk directory. We regret any inconvenience that may have resulted from the use of this program, and we ask that you immediately delete any copies you may have made. The program is also on the COMPUTE! Disk for November, December, and January, and should be deleted from that disk as well.

Disk Fix will damage the disk directory when used on a disk containing more than 32 programs or one formatted other than double-sided with nine sectors per track. If you suspect that your disk directory has been damaged by this program, you can recover lost files using the DOS utility program RECOVER.COM, which is on your DOS master disk. Refer to your DOS manual for information on using RECOVER.

Using COMPUTE!'s IBM Disk

The label on the COMPUTE! Disk containing IBM programs from the November and December 1986 and January 1987 issues gives instructions for transferring the DOS system files to the disk. However, if you attempt to follow these instructions, you'll receive the following message:

No room for system on destination disk

This occurs because the disk was not properly formatted to accept the DOS files. However, the disk is still fully functional; this oversight in no way affects the operation of the programs on the disk. Simply boot using another disk, load BASIC, insert the COMPUTE! Disk, and enter

RUN "MENU"

If you would prefer to have the COMPUTE! programs on a bootable disk, simply copy all the files from the COMPUTE! Disk to one that already contains the DOS system files. If you are unfamiliar with the syntax for the COPY command, refer to your DOS manual.

Amiga Jigsaw

The listing for this program from the February 1987 issue (p. 48) was accidentally rearranged. The program should start with the line in the second column which reads **DEFINT a-z**. All lines prior to this one should appear between the line in the third column which reads **cLast=nocoLs.pzL-1: rLast=nrows.pzL-1** and the following one, **seLection.made=true**. If you entered the program as listed, you can use the cut-and-paste features of the BASIC editor to move the block of lines to its proper position.

©

Microscope

Sheldon Leemon

A reader has written to complain about inaccuracies in a recent column on the Apple IIGS, which stated that the computer can't use current, inexpensive 5¼-inch Apple drives. Actually, the whole truth is that the GS comes with a built-in disk controller that doesn't work with the old drives, but it's possible to override it by plugging your old disk controller card into the proper slot. Of course, the old drives probably can't use ProDOS 16, so while you can run the old software with them, they may not do you much good for the new 16-bit software.

While I hope this sets the record straight, I tend to doubt that the prior column did much to hurt Apple IIGS sales. For one thing, Apple hasn't been able to produce enough to send dealers more than a couple of units each. Rumor has it that one of the problems is that Ensoniq can't produce enough of the custom sound chips that provide one of the more innovative features of the new computer. One good thing about this delay is that it provides time for a lot of third-party support to develop. In fact, I've already seen ads for a $200 3½-inch disk drive for the GS from Central Point. That should really put this "cheap disk" controversy to rest.

****

Although there was no official price reduction on the Apple IIc when the IIGS was introduced, price slashing at the dealer level has been almost frenzied as of late. One chain has been selling off its excess inventories through a discount outlet for about $550 retail, which is about $400 less than list price. And in view of Apple's strict enforcement of a ban on mail order sales of its computers, it was pretty shocking to see the Apple IIc and ImageWriter printer being offered for under $1000 in an ad on the back cover of the latest catalog from C.O.M.B. liquidators. It looks like somebody doesn't believe that the "Apple II forever" slogan applies to the IIc.

****

A lot of industry "experts" have said that IBM "legitimized" the personal computer when it came out with the PC. What they may have meant is that IBM's contribution is so big, heavy, and expensive, that the businessman can buy one without fear that his associates will confuse his new personal productivity tool with the "toy" computers sold by mass merchandisers. If that's the case, those same experts may soon be saying that Hyundai has "illegitimized" the PC. The large Korean manufacturing concern, whose most visible marketing effort in this country so far has centered around an extremely inexpensive automobile, has now boldly gone where no PC has gone before—Toys "R" Us.

Hyundai's entry into the highly competitive and extremely crowded PC-compatible field is called the Blue Chip. The marketing strategy for the computer is simple, but likely to be effective: Take a solidly built machine with a one-year warranty from a well-known company and sell it for a price that's just a little bit above what you'd pay to import the parts from the Far East and put it together yourself. This package is so attractive that Hyundai has already signed up hundreds of small independent computer retailers as Blue Chip dealers, as well as lining up quite a number of mass merchants and discounters. So it came as no great shock when I saw a full-page ad from Toys "R" Us in my Sunday newspaper advertising the Blue Chip, a fully IBM PC–compatible computer, for $699.

Being fortunate enough to live in Detroit, one of the four Toys "R" Us test markets for the Blue Chip, I hurried over to see for myself. Just as I had assumed, there was the Blue Chip, sitting inside the same glass showcase as the Commodore 128 and 64 and the Atari 520 ST. Next to the case was a stack of brochures which listed the features of the machine, including a 512K 4.77-MHz motherboard, one 5¼-inch drive, an AT-style keyboard (with the left Shift key in its proper place), built-in serial and parallel ports, six full-size slots, and a 130-watt power supply. Unlike most clones, the Blue Chip is packaged in an attractive case that is much smaller than that of the IBM PC, and it has the power switch right in front, where you can reach it. The $700 price includes a Hercules-compatible monochrome graphics adapter, but not the monochrome monitor, which costs $90 extra. Still, for less than $800 you get a working PC system made by a reputable company and a money-back guarantee that it will run all of your IBM software—from a store where you can get a 30-day over-the-counter-exchange if it doesn't work. For the money, only the Tandy 1000 series comes close.

While this is a pretty attractive package, it remains to be seen whether Toys "R" Us can sell a "real" PC. The price is certainly comparable to that of the other computers the store sells. A one-drive Commodore 128 system with color monitor sells there for $820, and the color Atari 520 ST system with one drive, for $880. But despite the store's assurances in a brochure that Toys "R" Us has trained sales people and the largest selection of home computers, I still wasn't quite convinced. Maybe it was the fact that the brochure was covered with the logos of home computers like the Mattel Aquarius, the Coleco Adam, and the Texas Instruments 99/4A. ©

Arlan R. Levitan

Packet-Switching Rule Changes

This column is difficult for me to write. This particular one. Over the years regular readers of Telecomputing Today and I have learned more about telecommunications and laughed at ourselves in good measure along the way. I'm not laughing right now.

One of the fundamental building blocks of today's low-cost telecommunications is the availability of reasonably priced packet-switching services. Packet-switching networks, such as those run by Telenet, Tymnet, CompuServe, and General Electric, allow personal computer users to access remote computers with a local phone call. Telenet's popular PC Pursuit service, which gives computer hobbyists virtually unlimited access to BBSs all over the country for $25 a month, plus local phone charges, is possible only because it takes advantage of an existing packet network during off-hours.

The Federal Communications Commission is considering reregulating packet-switching networks. Among the changes being considered is the elimination of free local telephone access to those networks. Under the new rules, packet-switch providers would have to pay access fees to local telephone companies. A similar arrangement currently in place requires long-distance service providers such as AT&T, MCI, and Sprint to pay access charges for connection to local phone networks.

Potentially A Major Impact

"If this occurs, it might eventually double-or triple the costs to those using packet-switching networks to access commercial online databases and information services, and triple or quadruple the costs to those using Telenet's PC Pursuit," says Philip M. Walker, vice president and regulatory counsel for Telenet Communications.

"In terms of cost impact," Walker said, "if we had to pay local access charges, it would cost us about $3.60 an hour at the originating end, for calls made by users to online databases and information services like CompuServe and The Source.

"And with PC Pursuit, for which we have out-dial modems, we would have to pay not only $3.60 per hour access fees at the originating end, but also $4.80 at the terminating end, a total of about $8 or $9. Obviously, to survive, we would have to add those additional charges to our current fees and pass them on to our consumers," Walker said.

According to Walker, FCC approval of changes being considered under the reregulation initiative (called Computer III by the FCC) "would really have a major impact on anyone using a packet-switching service to access online bulletin boards, databases, or information services aimed at the residential user. They are just going to get creamed if this happens."

Who's pushing for the new rules? It appears to be the local Bell Operating Companies (BOCs, a.k.a. your phone company). But to be fair, things may not be as gloomy as Walker paints them. The entry of the BOCs into the packet arena may bring cheap, high-speed packet service to the home user (such as that which is available via Pacific Telesys's project Victoria). The present packet switchers may fear that the cost of converting their current networks to new technology will be prohibitively expensive, making it difficult for them to compete with the BOCs.

Express Your Views

Why is writing this so hard for me? I spent over eight years of my life working for one of the Bell Operating Companies. My wife still does. Many of my friends have, as they say within the BOCs, "bell-shaped" heads. I was proud of the quality of nation's phone system and how well the system worked. I, and many other Bell employees, had mixed feelings about divestiture of AT&T. To me, the most positive aspect of deregulation of the phone system was the subsequent wave of cheap, high-quality telephones with lots of nifty features.

We already have cheap modems. Lots of them. I find it difficult to have a positive attitude about saddling the packet switchers, and in turn, their users, with additional tariffs that may add significant cost to accessing information services and bulletin boards (via services like Telenet's PC Pursuit).

I strongly feel that the changes engendered within the FCC's "Computer III" rules should not be rushed into law. We all need more information than is currently available in the public forum to make an intelligent, informed decision on this matter.

Even with the limited information that is currently available, I'm sure that some of the readers of this column feel the proposed changes would be a positive move. Others, at this time, may have difficulty seeing any benefit to the telecomputing hobbyist.

The FCC will reportedly vote on the new rules by the end of March 1987. Regardless of your feelings, I urge you to express your views to the Federal Communications Commission by writing:

The Honorable Mark Fowler
Chairman
Federal Communications Commission
Washington, DC 20554

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When Buying A New Computer: Don't Ask Me!

I teach afternoon and evening teacher workshops at Cahaba Heights Elementary School in Birmingham, Alabama. One day before the workshops I had been teasing the secretaries in the school office about a phone call I expected to get from a "Mystery Personality." The secretaries' guesses about the personality ranged from Tom Selleck to Ronald Reagan. Rick Lazenby, the school's principal, made several visits to my classroom to try to trick me into divulging the mystery caller's name. But I wouldn't talk.

That night, right in the middle of my workshop, with teachers gathered all around me, Rick burst into the room and announced, "David Hartman, from *Good Morning America*, just called you on the phone, and I hung up on him. You didn't tell me who was calling, so I thought it was a crank call."

"Aacck!!" I said.

Expert Advice

Rick delighted in the look of panic on my face and said, "Ha! Ha! Just a joke! David's still on the phone. You can take it down in my office." I said goodbye to my startled teachers and flew out of the room, raced down the school corridors to Rick's office, and picked up the phone. Why was David calling me? Maybe he wanted to ask me back on his show. But I was wrong. "This is a personal call," said David, in his warm and very famous voice at the other end of the phone. "I want to buy my family a personal computer for Christmas. Any good ideas?"

"Sure!" I blurted. "The Apple IIGS!" I started to describe to David all the wonderful things about the new Apple computer, including its 4000 colors, its 15 musical instrument "voices," its 256K memory, its compatibility with other Apple II computers, and its Macintosh interface. As I spoke, I heard David agreeing at the other end, and I knew he was sold.

However, when my heart stopped racing and I had caught my breath, I suddenly had a quick flashback. Only the week before, I had been preparing for a press conference to launch my Multi-Media Classrooms project with 26 Alabama and Canadian schools. Apple's regional office in Nashville, Tennessee, had loaned us a IIGS for the press conference, but neither my efforts nor the efforts of the Apple officials and the local Apple dealers could make it work.

There was nothing wrong with the computer. It was just too new. No one was sure how to plug in the 5¼-inch disk drives along with the (daisychained) 3½-inch drives. We had copies of lots of software, made at the dealers with an old IIc (ProDos) utilities disk, but it turned out the software was uncopyable, and we ended up with blank disks. The two Bose speakers promised some unbelievable sounds, but were strangely silent since we didn't have the right demo programs. And although we loved the new AppleColor RGB monitor, all we could put on it was a black-and-white "Meet Mr. Mouse" demo program.

No one was to blame. I was still in love with the IIGS. But I realized, talking to David Hartman, that it was not the computer I should be recommending for Christmas 1986.

A Quick Turnabout

So I did a quick 180-degree turn and started peddling the Apple IIe. "You've heard the Apple motto, 'Apple II Forever'?" I asked, still upbeat. "Well, you can get an Apple IIe, a veteran machine that runs over ten thousand programs; then early next year you can go to a dealer and have your IIe turned into a IIGS—for only about four hundred dollars."

"But what's wrong with the IIGS?" David asked, a little taken aback after my fancy footwork.

"Nothing," I said, torn between my great excitement about the IIGS and my teachers' continuing lack of success in finding special software to make it shine. "Remember," I said, "the IIGS is just a baby. Give it a few months to grow up."

David thanked me and hung up. And when I hung up at my end I felt great, because, for once, I didn't feel guilty about my "expert" advice.

It is the average consumer's misfortune that a "praise first, criticize later" cycle in some computer journals follows the introduction of almost every new computer. We journalists, editors, and experts have the responsibility to be watchdogs for our readers. After all, we get to see new machines weeks or months before they are on the market, and we get to hear the inside gossip of corporate executives and computer designers before it becomes public knowledge.

But, far too often, we fall down on the job. We accept manufacturers' hype on their machines as fact, and we unconditionally support a new computer launch with excited fanfare and warm accolades.

Are we journalists an unethical bunch, in secret conspiracy with computer vendors and software publishers? No. However, we are computer enthusiasts, and we are sometimes guilty of letting our enthusiasm and fascination with computers blind us to the shortcomings of some new products. I think in view of David's needs, I gave him balanced advice. ©



The Beginners Page

C. Regena

Getting Started With A Printer

A printer was the first peripheral I got for my computer. As a programmer I find a printer a necessity. I need listings to keep track of my program because I usually compose at the computer and I have always felt safer having a hardcopy listing of my program in addition to a disk or cassette copy.

After you have all the cables properly connected and the ribbon and paper loaded, you are ready to test your printer. To get a listing of a BASIC program on a printer, the standard command is LLIST. BASICs differ; you should check your manual. The LLIST and LPRINT commands described here work in IBM, Amiga, Atari ST BASICs, among others. LPRINT also works in eight-bit Atari BASIC. (See below for Apple, Commodore, TI, and other styles of printer access.) The command works just like the LIST command.

A Simple Example

Now let's try having the computer print something on the printer. You may want to refer to my previous columns on PRINT statements. Instead of using the standard PRINT command, use LPRINT to go to a printer. (You may want to PRINT to the screen and LPRINT to the printer.) Anything your computer allows you to do with the PRINT command you can probably do with LPRINT—for example:

```
200 LPRINT "HELLO"
210 LPRINT TAB(9);"INDENT HERE"
220 LPRINT A,B,C$
230 LPRINT X;"PLUS";Y;" = ";X+Y
240 LPRINT USING "###.##";D
```

Now you can read in information from data or enter numbers from input, make a few calculations, and then print a report. You can print a simple message using the printer, then perhaps make a dozen copies of it by using a FOR-NEXT loop or running the program several times. You can create printer graphics by using LPRINT statements with various symbols in quotation marks or string variables. And you can even print your own user-group letterhead, plus address labels for all the members. Using a printer adds much more to your use for a computer.

Here's a short example to print out some homework. Suppose you are given a homework assignment to calculate the areas of triangles. The formula for the area is ½ (base × height). Once you know the formula the assignment is simply a matter of using different numbers for each problem. Let's have the computer do your homework.

```
100 REM TRIANGLES
110 PRINT "WHAT IS YOUR NAME?"
120 INPUT N$
130 LPRINT N$:LPRINT:LPRINT
140 NP=1
150 PRINT:PRINT
160 PRINT "ENTER 0 TO END"
170 INPUT "BASE = ",B
180 IF B=0 THEN 280
190 INPUT "HEIGHT = ",H
200 AREA=B*H/2
210 PRINT:PRINT "AREA =";AREA
220 LPRINT:LPRINT:LPRINT
230 LPRINT NP;TAB(8);"BASE =";B
240 LPRINT TAB(8);"HEIGHT =";H
250 LPRINT TAB(8);"AREA =";AREA
260 NP=NP+1
270 GOTO 150
280 LPRINT:LPRINT:LPRINT
290 END
```

This is just a simple program to get you started using a printer. You can get an idea of how LPRINT is used. LPRINT with nothing else in the statement will print a blank line to the printer. LPRINT TAB(8) will indent eight columns before starting to print. You may either print a message in quotes or a variable.

Special Codes, Special Features

Most printers have many features. You can probably change print styles (italics, boldface, compressed print, expanded print, underlining, and so on). Again, consult your printer manuals to learn how to change print styles or to use special features of that particular printer.

Some of the ASCII character codes have special meanings for printers, and you can print the CHR$( ) to perform those functions. For example, LPRINT CHR$(13) is like pressing the RETURN key to get to the next line. For most printers, LPRINT CHR$(12) is *top of form*, which moves the paper to the top of the next page.

Most printers use a combination of *escape sequences* to change print styles. The ASCII code for ESC (escape) is 27, so you can LPRINT CHR$(27) and the code for your particular style. For example, on some Epson printers you can select letter-quality printing with

```
LPRINT CHR$(27) "x" CHR$(1)
```

Within a program I like to set E$ equal to CHR$(27) to save typing if I am using a lot of escape codes:

```
100 E$=CHR$(27)
```

Printing Alternatives

Not every version of BASIC provides the LLIST and LPRINT statements. Among those that do not are the Commodore and Apple. On Commodore computers you need to open a communication channel to the printer, then direct output to that channel. For example, Commodore computers use this sequence of commands in lieu of LLIST:

OPEN 4,4	open file 4 to printer (device 4)
CMD 4	direct output to printer
LIST	list program on printer
PRINT#4:CLOSE 4	redirect output to screen

In place of LPRINT, you open a channel to the printer, then print to that channel:

```
10 OPEN 4,4
20 PRINT#4,"HELLO"
30 PRINT#4
40 CLOSE 4
50 END
```

For the Apple II series, you would use the following sequence in lieu of LLIST (assuming that your printer interface was installed in slot 1, the most common configuration):

```
PR#1      direct output to printer
LIST      list program on printer
PR#0      redirect output to screen
```

In place of LPRINT in programs, you must use CHR$(4) to redirect output to the slot where the printer interface is installed:

```
10 PRINT CHR$(4)"PR#1"
20 PRINT "HELLO"
30 PRINT CHR$(4)"PR#0"
```

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ST Outlook

Philip I. Nelson, Assistant Editor

Who Is That Man, And Why Is He Smiling?

This month's program demonstrates a rarely mentioned graphics feature of the ST: software sprites. The program creates a file named SPRITE.PRG, an assembly language program that runs from the desktop. After you've run the filemaker, go to the desktop and double-click SPRITE.PRG. When the desktop returns to normal, press Alternate-Help. Three sprites—little men with pipes in their mouths—cruise effortlessly around the desktop, rebounding when they approach the screen borders. To get rid of the sprites, reboot with the reset button.

What's My Line?

The ST has no special hardware to display sprites—independent, movable images—on the screen. However, the mouse pointer is an object that behaves much like a sprite, moving anywhere on the screen without disrupting images that lie in its path. The sprites in this demo program are created via the same system routines which the ST uses to display its mouse pointer. Specifically, an ST software sprite is a creature of the *line A* assembly language interface which provides graphics support for GEM.

Line A operations are handled in an interesting way. The 68000 microprocessor generates an exception, or error condition, under a variety of special circumstances. Some exceptions are true errors; on the ST, these cause cherry bombs to appear on the screen. Others are purposely left undefined for the system programmer's use. In the ST's operating system, exception 10 ($A) is used to implement 16 low-level graphics operations. These commands allow you to draw lines and polygons, plot and unplot points, copy text or other images, draw and erase a software sprite, and hide, show, or transform the shape of the mouse pointer.

The term *line A* refers to the fact that each opcode starts with $A. The *draw sprite* operation ($A00D) draws a sprite on the screen and saves an image of the underlying area in a buffer. The *undraw sprite* operation ($A00C) restores a saved image from the buffer to its previous screen location, effectively erasing the sprite. Together, these commands allow you to move an object nondestructively by erasing and redrawing it in a series of locations.

Time Slices And Transparency

SPRITE.PRG moves the sprites as a background process during the ST's vertical blank interrupt, so they're largely invisible to GEM. You can open and close windows, make menu selections, and even run programs. There *are* some cosmetic conflicts, however, which we'll explain in a moment.

The vertical blank interrupt—the interval during which the monitor's electron beam returns from the bottom to the top of the screen—gives the computer tiny slices of time in which to perform background chores such as reading its keyboard. The ST provides a simple means for installing a program as a task to be performed during the vertical blank interval. In the system variable area is a job queue with eight slots. Ordinarily, one slot is occupied and seven are vacant. During each vertical blank, the computer scans the queue and performs the tasks found in occupied slots. To install the working portion of SPRITE.PRG as a background task, we simply find a vacant slot in the queue and store our program's address there. Henceforth, the ST executes our code once each vertical blank. (This simple demo program takes some installation shortcuts, assuming that the queue appears in its usual location and that it contains at least one vacant slot.)

Running on the interrupt allows our sprites to operate with a reasonable degree of transparency. However, since GEM doesn't know that they're present, some conflicts are inevitable. SPRITE.PRG takes pains to insure that its sprites don't restore unwanted data to the underlying screen when their paths cross. But the system also redraws the mouse pointer—itself a software sprite—during each vertical

blank. The ST doesn't know when and where our sprites are drawn, and the sprites pay no attention to the mouse pointer's peregrinations. Thus, conflicts may occur when the sprites and the pointer move through the same turf simultaneously. The pointer can restore part of a sprite after the sprite has already moved to another spot, or a sprite can restore part of the pointer after the pointer has moved elsewhere. Other screen changes (especially scrolling, which moves a big chunk of screen in a hurry) can also cause the sprites to deposit bits and pieces of themselves on the screen.

These conflicts are due entirely to the fact that SPRITE.PRG runs on the interrupt rather than as a conventional program. In an arcade-type game or other program that doesn't run in the background, you have control of all screen events and can easily prevent such occurrences.

By the way, please don't perform any important work—especially disk operations—while SPRITE.PRG is active. Driving a program on the interrupt slows the whole system to a certain extent, and disk drives are notoriously sensitive to timing disruptions.

Ozymandias With A Pipe?

Just who is the man with the pipe? I didn't draw the shape from scratch: It comes straight out of an example in the Atari development system documentation. If the face doesn't look familiar, run this ST BASIC program:

```
10    ? CHR$(28);CHR$(29)
20    ? CHR$(30);CHR$(31)
```

What's this jovial fellow doing in the ST's character set? I've never seen an official explanation, but perhaps some pipe-smoking Ozymandias at Atari simply decided to immortalize himself in ROM. Your guess is as good as mine.

More About BASIC

Finally, here's a quick update on a couple of previous topics. GFA BASIC programs are not compiled, as implied in the January 1987 column, but interpreted. Chalk that one up to my misreading of a German language user's manual. In the meantime, GFA has put the finishing touches on its compiler, which transforms GFA BASIC programs into stand-alone assembly language programs that run from the desktop. (Uncompiled GFA BASIC programs can run only from the editor/interpreter or the run-only interpreter.) The manufacturer claims that compiled GFA BASIC runs benchmarks like the Sieve of Eratosthenes as fast or faster than other compiled ST languages (Pascal, C, and the like).

English language versions of GFA BASIC and the *GFA BASIC Compiler* are now available in the United States from MichTron (576 S. Telegraph, Pontiac, MI 48053). Meanwhile, Atari maintains a profound silence on the subject of when—if ever—we might see an improved version of ST BASIC.

SPRITE.PRG Filemaker

```
100   close:open "R",1,"\SPRITE.PRG",8
110   field #1,8 as x$:for j=1 to 80
120   y$="":for k=1 to 8
130   read z$:byt=val("&H"+z$):y$=y$+chr$(byt)
140   c=c+1:chk=chk+c+byt:next
150   lset x$=y$:r=r+1:put 1,r:next
160   close:if chk=245927 then end
170   print "Typing error in DATA":kill "\SPRITE.PRG"
180   DATA 60,1A,0,0,1,D6,0,0
190   DATA 0,66,0,0,3,40,0,0
200   DATA 0,0,0,0,0,0,0,0
210   DATA 0,0,0,0,20,6F,0,4
220   DATA 2C,3C,0,0,1,0,DC,A8
230   DATA 0,C,DC,A8,0,14,DC,A8
240   DATA 0,1C,42,A7,3F,3C,0,20
250   DATA 4E,41,5C,8F,23,FC,0,0
260   DATA 1,7A,0,0,5,2,20,7C
270   DATA 0,0,4,CE,4A,90,67,4
280   DATA 58,88,60,F8,22,7C,0,0
290   DATA 0,5C,20,89,33,FC,0,0
300   DATA 0,0,2,3C,2F,0,3F,3C
310   DATA 0,20,4E,41,5C,8F,42,67
320   DATA 2F,6,3F,3C,0,31,4E,41
330   DATA 48,E7,FE,F8,4A,79,0,0
340   DATA 2,3C,67,2,60,5E,4A,79
350   DATA 0,0,4,EE,66,0,1,4
360   DATA 33,FC,0,1,0,0,2,3C
370   DATA 70,4,42,42,41,F9,0,0
380   DATA 2,42,43,F9,0,0,2,4E
390   DATA 72,64,D4,7C,0,12,D2,42
400   DATA 31,81,0,0,33,81,0,0
410   DATA 55,40,6A,EC,12,39,0,0
420   DATA 4,4C,E3,49,20,7C,0,0
430   DATA 1,E6,33,F0,10,0,0,0
440   DATA 2,5A,20,7C,0,0,1,EC
450   DATA 33,F0,10,0,0,0,2,5C
460   DATA 60,0,0,B0,70,4,61,0
470   DATA 0,F4,55,40,6A,F8,42,40
480   DATA 41,F9,0,0,2,42,32,30
490   DATA 0,0,B2,79,0,0,2,5A
500   DATA 6D,14,41,F9,0,0,1,D6
510   DATA 32,30,0,0,C3,FC,FF,FF
520   DATA 31,81,0,0,60,A,B2,79
530   DATA 0,0,1,E2,6E,2,60,E2
540   DATA 41,F9,0,0,2,4E,32,30
550   DATA 0,0,B2,79,0,0,2,5C
560   DATA 6D,14,41,F9,0,0,1,DC
570   DATA 32,30,0,0,C3,FC,FF,FF
580   DATA 31,81,0,0,60,A,B2,79
590   DATA 0,0,1,E4,6E,2,60,E2
600   DATA 41,F9,0,0,2,42,43,F9
610   DATA 0,0,1,D6,32,30,0,0
620   DATA 34,31,0,0,D2,42,31,81
630   DATA 0,0,41,F9,0,0,2,4E
640   DATA 43,F9,0,0,1,DC,32,30
650   DATA 0,0,34,31,0,0,D2,42
660   DATA 31,81,0,0,61,12,B0,7C
670   DATA 0,4,67,6,54,40,60,0
680   DATA FF,60,4C,DF,1F,7F,4E,75
690   DATA 2F,0,41,F9,0,0,2,42
700   DATA 33,F0,0,0,0,0,2,3E
710   DATA 41,F9,0,0,2,4E,33,F0
720   DATA 0,0,0,0,2,40,24,7C
730   DATA 0,0,2,5E,32,3C,0,85
740   DATA C0,C1,D5,C0,41,F9,0,0
750   DATA 1,F2,30,39,0,0,2,3E
760   DATA 32,39,0,0,2,40,A0,D
770   DATA 20,1F,4E,75,2F,0,45,F9
780   DATA 0,0,2,5E,32,3C,0,85
790   DATA C0,C1,D5,C0,A0,C,20,1F
800   DATA 4E,75,0,2,0,2,0,2
810   DATA 0,2,0,2,0,2,0,A
820   DATA 0,1E,1,2C,2,6C,2,6C
830   DATA 0,B4,0,B4,1,76,0,0
840   DATA 0,0,0,1,0,0,0,F
850   DATA 7,F0,7,F0,F,F8,F,F8
860   DATA 1F,FC,1F,EC,1F,FC,18,4
870   DATA 1F,FC,18,4,1F,FC,10,4
880   DATA 1F,FC,1E,3C,1F,FC,17,54
890   DATA 1F,FC,11,4,F,F8,B,28
900   DATA F,F8,D,D8,7,F8,6,28
910   DATA 7,F0,7,D0,2F,F0,2E,10
920   DATA 39,E0,39,E0,38,0,38,0
930   DATA 0,0,0,22,18,A,1E,16
940   DATA A,6,22,8,6,8,16,A
950   DATA 8,14,A,A,8,14,A,6
960   DATA 14,6,2A,8,6,8,6,E
970   DATA 6,6,E,0,0,0,0,0
```

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Sheldon Leemon

The Sidecar Arrives

In what may be a record-breaking event for Commodore (or for any other computer company), the Sidecar has been delivered in the same year in which it was announced. A scant eight months after I first saw the earliest prototypes at Comdex, one has arrived at my local Amiga dealer. And I must say that I'm impressed, and even a little excited about this clonelet.

The Sidecar is an IBM PC add-on for your Amiga. Unlike the Transformer, Commodore-Amiga's noble, flawed experiment with software-only emulation, the Sidecar isn't just an IBM PC emulator. It's an actual PC that plugs into your Amiga. It has an 8088 processor running at the standard 4.77 MHz speed, a socket for an 8087 math coprocessor, 256K of PC RAM (expandable to 512K on the motherboard), a built-in 5¼-inch 360K disk drive, three full-sized IBM-type expansion slots, and the Phoenix BIOS, famed for its close compatibility to IBM's BIOS. The box is physically about half as wide as the Amiga itself, a couple of inches higher, and a couple of inches deeper. It plugs into the expansion port on the Amiga's right side, but it's almost a complete stand-alone PC. The IBM applications it runs are loaded off the Sidecar disk drive into Sidecar RAM, and are executed by the Sidecar 8088 processor. The machine depends on the Amiga only for its screen display, which the Amiga manages and displays in a window on the Amiga monitor.

If the Sidecar is little more than a PC clone, why shouldn't the Amiga owner who wants PC compatibility just buy a cheap clone and be done with it? For the answer to this question, we turn to the *SY* section of a dictionary, where we find the words *symbiosis* and *synergy*. Symbiosis is defined as "the living together of two dissimilar organisms in close association, especially where this is advantageous to both." Synergy is defined as "the simultaneous action of separate agencies which, together, have greater total effect than the sum of their individual effects." Both of these terms apply to the Sidecar and its relationship to the Amiga.

A good example is the Sidecar's ability to share a hard disk with the Amiga. One of the first things I did with the Sidecar was to plug in a 21-megabyte hard disk on a card into one of the expansion slots. By using partitioning programs on the PC side, I put aside 9 megabytes of hard disk space for the Amiga, and 12 megs for PC DOS. The Amiga side mounts as device jh0:. The *j* is for Janus, the name which the Amiga operating system calls the Sidecar. Janus was the Roman god of beginnings and endings, and is pictured as having two faces, one in front and the other in back of his head, so that he's able to look in both directions at once.

By changing the startup-sequence file, you can mount the hard disk automatically each time the Amiga boots up, but since the drive has to be mounted before it can be read, there's no way to boot the Amiga from the hard disk. The performance of the hard disk, while not blindingly fast, was respectable. Amiga BASIC, which loaded in ten seconds from the floppy, came up in five from the disk, about as fast the Micro Forge hard disk for the Amiga. And this was a slow hard disk card (about 85 milliseconds access time)—faster ones are available. Even without the speedup, though, the convenience of having all your system files at hand can't be beat.

A Full-Speed PC

The Amiga also adds small, but nice, enhancements to the PC side. The Amiga handles the Sidecar display like any other Amiga task. The display can run in a window, with horizontal or vertical scroll bars, or in a full-screen borderless display that looks just like a PC. Since the Amiga is handling the display, you aren't limited to the 16 colors of the IBM monitor. A menu on the PC window allows you to select anywhere from 2 to 16 colors for the PC display, and to choose those colors from any of the 4096 offered by the Amiga. Although two-color screens are updated the fastest, even the 16-color screens seem to scroll as quickly as the standard PC screen. (All Sidecar operations checked out at full PC speed.)

If you choose a four-color screen, the PC window appears on the Workbench screen, where it can overlap other Amiga task windows. With any other color resolution, the display appears on its own screen. The Amiga provides emulation of both the monochrome and color displays, though only one can be active at a time. In addition, you may open up multiple windows on the same display. This allows you to bring up part of a spreadsheet display, freeze it in one window, and look at another part of the spreadsheet in another window at the same time. Of course, putting the Sidecar display on the Amiga doesn't make the PC multitask—not even Microsoft can do that.

And since both processors can communicate with one another through shared RAM, it's possible that in the future we'll see genuine hybrid programs that run on both processors simultaneously, or that use the Amiga for its great graphics display and the optional 8087 math coprocessor in the Sidecar for number crunching. ©

IBM Personal Computing

Donald B. Trivette

Two Winners And A Loser

The Print Shop by Brøderbund Software is a nifty little program that lets you design greeting cards, signs, letterhead stationery, banners, and almost anything else involving graphics. The software comes with a "how-to" booklet, although you won't really need it to produce attractive results. The package also contains a small quantity of bright yellow fan-fold paper and equally bright envelopes most suitable for making YIELD signs.

I spent only 20 minutes putting together a handsome birthday card from the large assortment of canned borders, symbols, and fonts. More ambitious and artistically inclined users can create their own symbols and pictures. My card had a border of sea shells and the words "Happy Birthday" in an outlined Art Deco font superimposed over a penguin. It was attractive enough that I planned to send along a copy to be reproduced with this column. Only after I completed it did I realize that my letter-quality, formed-letter printer couldn't print graphics. If you have a dot-matrix printer that supports graphics, a PC or PCjr with 128K, a double-sided disk, and $60, you've got all you need for *The Print Shop*. It's not desk-top publishing, but it *is* a winner.

For Jr. Only

Here's a winner for PCjr owners. *The Junior Report* is a national newsletter published monthly just for PCjr users. The issue I saw was 18 pages long and had both a nice selection of letters to the editor as well as detailed reviews of programs and hardware designed just for the PCjr. One reader wrote in and related how he bought a new printer, identical to the one IBM sold for $200, from a TV auction for just $37. A short article reviewed a memory-expansion product for the PCjr that fits inside the original case instead of in a sidecar. A year's subscription is $18 from The PCjr Club, P.O. Box 95067, Schaumburg, IL 60195.

Not So Delicious

The ad is a real eye catcher: A wooden chopping board is arrayed with fresh vegetables, an IBM PC monitor in the background displays a tempting dish of shrimp on an elegant place setting. "Ah! Dinner at Eight," the ad promises, "A software collection offering instant access to the delectable recipes of the country's finest restaurants." The advertisement is a winner; unfortunately, the program is not.

Dinner at Eight claims to be a database program for recipes—software to guide a cook to any of hundreds of dishes from outstanding restaurants. You begin by browsing through a list of basic food groups—vegetables, poultry, lamb, seafood—and then, once you've settled on a specific dish, the program is supposed to scale the proportions up or down to fit your needs and print out a shopping list as well as directions for the preparation of the meal. In addition, it offers a way to add your own recipes to its files, although that is not a sensible option in my own case.

The program is structured somewhat like a famous spreadsheet program—commands are displayed across the top of the screen, and you select an item by moving the cursor and pressing the Enter key. But the implementation is so poor that I was completely lost. The first command in the list is EDITION. This is the command you must select in order to read the master recipe file; in other words, this is the equivalent of File Retrieve. Since this command is usually used just once, it makes little sense for it to be in the first, the default, position.

Although that's a minor annoyance, *Dinner at Eight* has some major flaws. I finally figured out enough of the menu structure to select "Bay Shrimp in Sour Cream," but trying to adjust the recipe to serve two instead of four was needlessly cumbersome. Then I tried to print the ingredients and instructions, but for some reason the program refused to work with either my NEC 3550 printer or my Xerox 4045 laser printer. I can overlook incompatibility with the laser printer, which has some nonstandard commands, but cannot forgive a program that won't print on the NEC, which uses standard IBM/Epson commands. Nor are the flaws limited to the program—the data is also questionable. The recipe did not tell me whether to cook the shrimp or mix them raw with the sour cream and other ingredients; it didn't even tell me whether to peel them or use them in the shells. The recipe, incidentally came from a good, but not nationally famous, restaurant in San Francisco. In fact, none of the restaurants I saw credited in the program would be on a list of the nation's top ten establishments.

The ad—"And may we suggest a companion wine with your meal?"—implies that the program includes a wine selection guide. I hoped that it might recommend a half dozen suitable types and vintages. No, selecting the Wines command displayed only a few screens of general information about various types of wines, but nothing specific for Bay Shrimp and Sour Cream.

Dinner at Eight, by Rubicon Publishing, is a good idea marred by defective data, bad design, and worse programming. ©

INSIGHT: Atari

Bill Wilkinson

Corrected File Conversions

Well, this month marks a historic occasion for those of us at Optimized Systems Software. March 1981 was the month we introduced our first Atari-oriented products: BASIC A+, EASMD, and OS/A+ (called CP/A until a lawyer for DRI objected—maybe we could have fought them if we had had more than $2.98 in our checking account). We finished those products off in record time and presented them at the West Coast Computer Faire. We managed to sell 17 (yes, that is 3 less than 20) packages at about $120 each (that was cheap in those days), and we decided then and there we could stay in business for another month (maybe even two).

Well, the months kept passing like that. OSS has never been a wildly successful company—selling languages for a computer on which fewer than 10 percent of all owners actively program is not conducive to instant wealth—but we have always had some loyal followers. As I have mentioned here before, I started writing this column because I saw some questions in COMPUTE! about Atari software internals that I thought needed some answers. But I wouldn't have even gotten interested in reading COMPUTE! if we hadn't started OSS. See? All things are related when you look deep enough.

Unified We Stand

Speaking of software internals and answers.... In the recent issues of COMPUTE! there are a pair of programs which purport to convert standard Atari binary object files into either strings ("Stringing Atari Machine Language," September 1986) or DATA statements ("ML Write for Atari," January 1987). Both of these programs have a common limitation which was not mentioned in the articles accompanying them: You *must* use them *only* with single-segment binary files. How do you know if a particular binary file consists of only a single segment? Glad you asked.

The program which accompanies this article is a simple little utility that analyzes any standard Atari binary file, printing the first and last address of each segment as it goes. When the program asks for the complete file name, you should enter the name of a binary file, including the disk drive specifier and extension (for example, *D1:RAMDISK.COM*). Watch the resultant screen display. If addresses for more than one file segment are displayed, then you may *not* use the programs described in those articles for this file.

Exception: If the addresses are *all* contiguous (that is, if the starting address of a segment is exactly one more than the ending address of the prior segment and if this holds true for all segments), you can use this file *if* you unify it first. I discussed segmented files in my April 1986 column and presented a unifying program there. Unfortunately, the program accompanying that article was misprinted, so you have to look in the article titled "Custom Characters for Atari *SpeedScript*" by Charles Brannon in the May 1986 issue (pages 88–90) for a corrected version of the file unifier.

If you are not comfortable with the hex addresses printed by the segment-checking program, you may view decimal addresses instead by replacing lines 110 *through* 150 below with just this one line:

```
110 PRINT "SEGMENT: ";START;"
    THROUGH ";QUIT
```

And one last caution: Though not mentioned in the article, machine language code placed in strings (as in the September 1986 article) *must* be intrinsically relocatable. Many of the routines floating around on BBSs and in user-group libraries are indeed relocatable, but don't rely on this always being so. Test these routines in strings (or *any* machine language routines, for that matter) only *after* you have made sure you have saved your program and after you have put a junk diskette in the drive. (If you have an Indus drive or other drive that you can protect from the front panel, setting the protection is another adequate safeguard.)

Binary File Segment Checker

```
FI 10 REM **** BINARY FILE S
      EGMENT CHECKER ***
IG 20 DIM FILE$(20),HEX$(16)
      :HEX$="0123456789ABCDE
      F"
OE 30 GRAPHICS 0
BI 40 PRINT "COMPLETE FILE N
      AME";:INPUT FILE$
BH 50 OPEN #1,4,0,FILE$
OG 60 TRAP 200:GET #1,LOW:GE
      T #1,HI
KK 70 IF HI=255 AND LOW=255
      THEN GET #1,LOW:GET #1
      ,HI
KI 80 START=LOW+256*HI
EL 90 TRAP 40000:GET #1,LOW:
      GET #1,HI
IG 100 QUIT=LOW+256*HI
AL 110 PRINT "FILE SEGMENT:
       ";
JC 120 HEX=START:GOSUB 230
MB 130 PRINT " THROUGH ";
EJ 140 HEX=QUIT:GOSUB 230
CD 150 PRINT
EK 160 FOR ADDR=START TO QUI
       T
DA 170 GET #1,JUNK
PD 180 NEXT ADDR
DJ 190 GOTO 60
JP 200 REM *** GET HERE ON E
       ND OF FILE ***
DN 210 IF PEEK(195)<>136 THE
       N PRINT "UNEXPECTED E
       RROR # ";PEEK(195)
GL 220 END
PH 230 REM *** HEXPRINT SUBR
       OUTINE ***
IJ 240 DIV=4096
BE 250 FOR DIGIT=1 TO 4:TEMP
       =INT(HEX/DIV)
AK 260 PRINT HEX$(TEMP+1,TEM
       P+1);
OD 270 HEX=HEX-DIV*TEMP:DIV=
       DIV/16
EK 280 NEXT DIGIT
HL 290 RETURN                 ©
```

3-D Surfaces For Amiga

Martin Staley

Written entirely in Amiga BASIC, this graphically impressive program allows you to plot three-dimensional shapes on the screen in any color combination you like. By making small changes, you can view the object from any vantage point or plot an entirely different graph.

One of the most popular traditional applications for computer graphics is to plot three-dimensional graphs on the screen. That description may sound dull, but the resulting shapes are often quite beautiful in their own right as well as educational. The Amiga's outstanding graphics capabilities and fast processing speed make it ideal for such activity.

"3-D Surfaces for Amiga" provides a convenient, powerful tool for anyone interested in creating such pictures. It draws 3-D graphs as *mesh perspectives*. That is, the shapes appear as rectangular grids that have been pushed up or down in various places to create a variety of different shapes (see photos). The program permits you to change many different aspects of the picture, including the fineness of the mesh, screen resolution, observation angle, low and high bounds of the function that creates the picture, and, of course, the function itself.

Type in and save the program. Before you run it, open the BASIC output window to the entire size of the screen and make sure you are using the high-resolution (640 × 400) screen. Since the program requires quite a bit of memory, it's best not to run any other programs while it's in operation.

Using The Program

The program begins by computing all the data it needs to plot the current function. This process can take a while, depending on the complexity of the shape. To inform you of its progress, the program prints a counter value on the screen. When the calculations are complete, the program draws the shape on the screen.

Once the shape is finished, you can change any of the screen colors by moving the color sliders in the upper left corner of the screen with the mouse pointer. To move a slider, place the mouse pointer on the slider, hold down the left mouse button, then move the slider to the desired spot.

You can stop the program if necessary by selecting the *Quit* option from the *Actions* menu. This option automatically restores the original palette colors and closes the hi-res screen for your convenience.

Creating New Shapes

This program is designed to give you great flexibility in plotting your own 3-D pictures. Apart from color changes (see above), this is done by changing one or more of the parameters defined at the beginning of the program. The best way to learn about these parameters is to experiment on your own. All of the controlling parameters are located immediately following the labels *Parameters* and *Equation*. If you're familiar with this type of activity, the comments in these lines may give you enough information to plot your own graphs. The remainder of this article discusses in more detail the significance and use of these parameters.

Change The Equation

Each image created by this program is a two-dimensional representation of an equation or mathematical function. It is the equation, more than any other factor, which controls the ultimate appearance of the graph. It's defined with the DEF FN statement in the line immediately after the label *Equation*. DEF FN, as you may know, creates a user-defined function for later use in the

program in which it appears. To change the function, simply replace the portion on the right side of the equal sign (=). The result can be an entirely new shape. Here are some interesting functions to try:

```
(x^2+5*y^2)*EXP(1-x^2-y^2)/2-SIN
(3*x^2y^2)/(x^2+y^2)
-x^3/10-(SIN(1-x^2-y^2)+COS(1-x^
2-y^2))/2
SIN(3*x)*SIN(3*y)/5+.7*SIN(2*x^2
+3*y^2)/(x^2+y^2)
COS(3*x)+2*SIN(x^2+y^2)/(x^2+y^2
)-x/2
.3*(SIN(x^2+y)+COS(y^2+x))
(SIN(4*x^2+y^2)+2*SIN(x*y))/(4*x
^2+y^2)
SIN(3*x)+SIN(3*y)
```

In each case, the new function definition should be substituted for the portion of the DEF FN statement that lies on the right side of the equal sign. For instance, to use the last example definition, the line following the label *Equation* should read as follows:

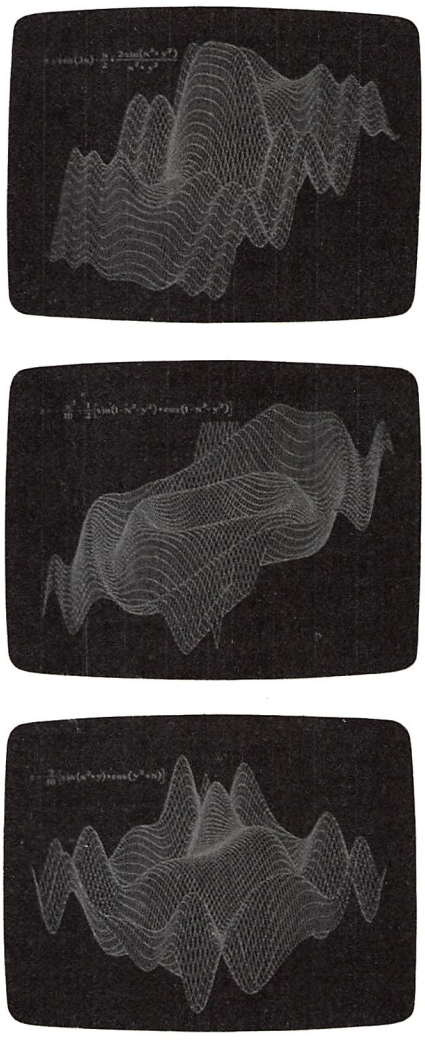
```
DEF FNz(x,y)=SIN(3*x)+SIN(3*y)
```

The Plot Thickens

The first two variables in the *Parameters* section, *m* and *n*, control the number of grid rectangles in the *x* (horizontal) and *y* (vertical) directions. Simply put, these values control the fineness of the rectangular mesh of which the graph is composed. If you increase the value of *m* and/or *n*, the plot appears thicker and more finely detailed. The finer the resolution, the better the graph looks. However, more detailed plots take longer to create. Conversely, smaller values make the graph look coarser and less substantial. The coarser the mesh, the less time it takes to complete the necessary calculations. Setting both values to 31 is a reasonable tradeoff between time and accuracy.

Since the program utilizes two 2-dimensional arrays based on *m* and *n*, the values of these two variables are limited by the amount of available memory. On a 512K Amiga, I've used values as high as 75. At this degree of accuracy, the program requires about ten minutes for calculations; however, the results are worth it.

The values of *m* and *n* need not be equal. However, they should be set to an odd number. Both of these points are discussed in more detail below.



These photos illustrate some of the many three-dimensional plots you can create with "3-D Surfaces for Amiga."

Resolution

The next variable, *res*, controls the screen resolution. If *res* equals 1, the program draws the graph on Amiga BASIC's default 640 × 200 output window. Before you run the program in this mode, be sure to stretch the window to the full screen size, since the image will fill nearly all the available space. If you set *res* to 2, the program opens a custom output window in 640 × 400 resolution before it draws. The memory requirements of this window probably make it unusable on a 256K Amiga. Graphs drawn in the lower resolution always look coarser than those drawn in the highest resolution, particularly when the mesh size is small. However, even lower resolution screens look quite good.

Accuracy

The variable *gt* stands for *graph type*. It controls the accuracy of the plot by selecting one of two drawing algorithms (formulas). The first algorithm draws a good estimate of the shape. The second algorithm draws the shape in actual, exact perspective from any direction, angle, and distance. Each method has advantages and disadvantages. The estimate method is less complex, more reliable, and faster. The exact perspective method is slower and requires many more intensive calculations (which can lead to error messages on rare occasions). However, drawing in exact perspective allows you to view a shape from different observation points. The estimate method causes some inaccuracy in the vertical scale, but exact perspective uses correct proportions, taking into account the fact that pixels (dots) on the Amiga screen are square, not round.

Aspect And Height

Two of the parameter variables are used only with the estimate drawing method (see preceding section). The variable *asp* controls the apparent *x*-*y* ratio of the graph as it appears on the screen, regardless of the bounds you specify. Aspects that are too large or too small (say, larger than four or smaller than one-fourth) have the side effect of downgrading the quality of the estimate (the graph may look slightly distorted). The variable *h* controls the height factor, which affects the graph's vertical appearance. In general, height factors of less than 100 tend to make the apparent observation point higher in the *z* direction; as a result, graphs look a bit stubbier than expected. Larger height factors have the opposite effect (lower observation points and taller graphs). By enlarging the height factor, you can emphasize a graph's vertical qualities.

Observation Angle And Distance

The graph's perspective is controlled by three parameter variables: *theta*, *phi*, and *d*. The variable

theta equals the observation angle from the *x-y* axis moving counterclockwise in the *x-y* plane as viewed from the positive *z* direction. The variable *phi* is the observation angle with respect to the *x-y* plane. This variable is set up for both angles to be in degrees; if you would rather use radians, remove the conversions in the second program line under the label *Equations*. Any observation angle is possible if you keep *theta* in the range −180 to 180 and keep *phi* in the range −90 to 90. Other values may be used; however, it's usually best to keep the angle more than about 1/10 degree away from any positive or negative multiple of 90 degrees (including 0) to avoid overflow errors in the computation. Such extreme observation angles aren't very interesting, anyway, since you tend to lose most of the graph's three-dimensional quality.

The variable *d* controls the distance of the observation point—in the direction of the direction angles—from the graph's center (the point whose coordinates are the average *x*, *y*, and *z* coordinates of all the computed function values). The only formal restriction for *d* is that it cannot be zero. However, it should be large enough to place you a reasonable distance from the shape. Observing the graph from an extremely close location is a bit like viewing the Mona Lisa by putting your eye one millimeter away from the canvas. In addition, extremely small values for *d* can actually locate the observation point "inside" the graph. The program assumes that all graph points are within a 180-degree field of view while looking toward the center. If *d* is so close to the center that not all of the graph's points are within this view, the program's output is garbage. It's best to make *d* large enough so that the observation point is beyond the bounds of the function as specified by the four parameters discussed in the next section. Incidentally, specifying a very large distance won't make the graph look significantly smaller. As the distance becomes larger, perspective qualities such as the presence of a vanishing point become less pronounced. To avoid wasting screen resolution, the program always stretches the perspective until either the horizontal or vertical dimension becomes too large to fit on the screen.

Bounds

The next four parameter variables set the low and high bounds of the graph in the *x* and *y* dimensions. This simply means that the four sides of the graph will be along those edges.

Equation Notes

The most important parameter, of course, is the equation contained in the DEF FN statement. When defining new functions, keep in mind that the computer can't perform some operations, such as dividing by zero or taking the square root of a negative number. However, functions which have what's known as a *limiting value* on the interval can usually be plotted. There are many rational functions whose numerators become zero at the same time their denominators reach zero; and the ratio can be finite. But the computer doesn't know this and still generates a *Division by zero* error unless it just misses the coordinate in question.

To compute function values, the program increments between the low and high *x* bounds, and between the low and high *y* bounds, in step sizes such that a total of $m+1$ different *x* values and $n+1$ different *y* values are eventually put in the equation. If the increment sizes and the low and high bounds are such that the offending point is skipped, everything should work correctly. Odd values for *m* and *n* seem to work best, but problems are still rare when even values are used.

For instance, the function Z = SIN(X)/X + SIN(Y)/Y should have a value of two when X and Y both equal zero; but the computer will generate an error message at that point. If you try this function with the *x* and *y* bounds both set between −10 and 10, the computer tries to evaluate the function at coordinate (0,0) if *m* and *n* are 20, but not if *m* and *n* are 21. The computer simply happens to skip coordinate (0,0) if it increments between −10 and 10 in step sizes needed to create a 21 × 21 grid. But it lands on the point and tries to compute a corresponding function value if the grid is 20 × 20.

For some equations, the CLEAR,60000 statement in the second program line may cause an *Out of memory* error. You may be able to avoid this error by reducing the value in the CLEAR statement. That change reduces the amount of space available for BASIC arrays and variables, which may make it necessary to decrease the value of *m* and/or *n* as well.

3-D Surfaces For Amiga

For instructions on entering this program, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
CLEAR,60000&:DEFINT i,j
pi=3.1415927#:e=2.7182818#
Parameters:
m=31:n=31              ' mesh size
= m*n
res=1                  ' resolutio
n: 1=640*200, 2=640*400
gt=1                   ' graph typ
e: 1=estimate, 2=real
asp=1                  ' y/x ratio
of graph (only for gt=1)
h=150                  ' height fa
ctor      (only for gt=1)
theta=30 :phi=20       ' observati
on angles in degrees (only for g
t=2)
d=100                  ' distance
from graph center      (only for g
t=2)
lox=-3 :hix=3          ' low & hig
h bounds in x direction
loy=-3 :hiy=3          ' low & hig
h bounds in y direction
Equation:
DEF FNz(x,y)=SIN(x^2+3*y^2)/(x^2
+y^2)+(x^2+5*y^2)*EXP(1-x^2-y^2)
/2
theta=theta*pi/180:phi=phi*pi/18
0  ' conversion: degrees to radi
ans
a=d*COS(phi)*COS(theta)
b=d*COS(phi)*SIN(theta)
c=d*SIN(phi)
GOSUB Check
DIM xc(m+1,n+1),yc(m+1,n+1)
tx=(hix-lox)/m:ty=(hiy-loy)/n
PRINT:PRINT "computing values...
"
LOCATE 4,7:PRINT m+1
IF gt=1 THEN GOSUB Estimate:ELSE
GOSUB True
Draw:
IF res=2 THEN SCREEN 1,640,400,2
,4:WINDOW 2,"graph",,15,1:ELSE C
LS
DIM v(15),rgb(3,2)
p=0
Rc:
FOR c=0 TO 3
READ r,g,b:PALETTE c,r,g,b
rgb(c,0)=r:rgb(c,1)=g:rgb(c,2)=b
NEXT c
DATA 0,0,0,.14,.14,.14,0,0,0,0,0
,1
COLOR 2,3
FOR x=dfx TO dtx  STEP sx
FOR y=dfy TO dty STEP sy
x1=xc(x,y):x2=xc(x,y+1):x3=xc(x+
1,y+1):x4=xc(x+1,y)
```

```
yl=yc(x,y):y2=yc(x,y+1):y3=yc(x+
1,y+1):y4=yc(x+1,y)
AREA (x1,yl):AREA (x2,y2):AREA (
x3,y3):AREA (x4,y4):AREAFILL
LINE (x1,yl)-(x2,y2),3:LINE (x2,
y2)-(x3,y3),3
LINE (x3,y3)-(x4,y4),3:LINE (x4,
y4)-(x1,yl),3
NEXT y
NEXT x
Colors:
FOR n=0 TO 15:v(n)=11+7.54*n:NEX
T n
col=0:x1=11:x2=11:x3=11
IF res=1 THEN WINDOW 3,"colors",
(0,0)-(130,50),18,-1
IF res=2 THEN WINDOW 3,"colors",
(0,0)-(130,50),18,1
WINDOW OUTPUT 3
PRINT "R":PRINT "G":PRINT "B":PR
INT:PRINT "C"
LINE (0,0)-(130,0):LINE (0,8)-(1
30,8)
LINE (0,16)-(130,16):LINE (0,24)
-(130,24)
LINE (10,0)-(10,50):LINE (11,25)
-(40,50),0,bf
LINE (40,25)-(70,50),1,bf:LINE (
70,25)-(100,50),2,bf
LINE (100,25)-(130,50),3,bf:LINE
(11,1)-(19,7),3,bf
LINE (11,9)-(19,15),3,bf:LINE (1
1,17)-(19,23),3,bf
i=20:LINE (20,32)-(30,42),1,bf
MENU 1,0,1,"Action":MENU 1,1,1,"
Quit":MENU ON
Loop:
IF MENU(0)=1 AND MENU(1)=1 THEN
WINDOW CLOSE 3:MENU RESET:SCREEN
CLOSE 1:STOP
END IF
x=MOUSE(1):y=MOUSE(2):IF MOUSE(0
)>=0 THEN c1=1:c2=1:c3=1:GOTO Lo
op
IF x>10 AND x<131 THEN IF y>24 A
ND y<51 THEN Getcol:ELSE GOTO Ch
eck1
GOTO Loop
Check1:
arg=.1260504*x-1.386551:IF y<1 O
R y>7 OR c1=0 THEN Check2
LINE (11,1)-(130,7),0,bf:LINE (v
(arg),1)-(v(arg)+8,7),3,bf:x1=v(
arg)
rgb(col,0)=arg/15:PALETTE col,rg
b(col,0),rgb(col,1),rgb(col,2)
c1=1:c2=0:c3=0:GOTO Loop
Check2:
IF y<9 OR y>15 OR c2=0 THEN Chec
k3
LINE (11,9)-(130,15),0,bf:LINE (
v(arg),9)-(v(arg)+8,15),3,bf:x2=
v(arg)
rgb(col,1)=arg/15:PALETTE col,rg
b(col,0),rgb(col,1),rgb(col,2)
c1=0:c2=1:c3=0:GOTO Loop
Check3:
IF y<17 OR y>23 OR c3=0 THEN Loo
p
LINE (11,17)-(130,23),0,bf:LINE
(v(arg),17)-(v(arg)+8,23),3,bf:x
3=v(arg)
rgb(col,2)=arg/15:PALETTE col,rg
b(col,0),rgb(col,1),rgb(col,2)
c1=0:c2=0:c3=1:GOTO Loop
Getcol:
LINE (i,32)-(i+10,42),col,bf
IF x<40  THEN i=20 :LINE (i,32)-
(30,42),1,bf :col=0:GOTO Nst
IF x<70  THEN i=50 :LINE (i,32)-
(60,42),2,bf :col=1:GOTO Nst
IF x<100 THEN i=80 :LINE (i,32)-
(90,42),3,bf :col=2:GOTO Nst
i=110:LINE (i,32)-(120,42),0,bf:
col=3
Nst:
LINE (11,1)-(130,23),0,bf:LINE (
10,8)-(130,8):LINE (10,16)-(130,
16)
c=1
FOR n=0 TO 2:t1=111*rgb(col,n)+1
1
LINE (t1,c)-(t1+8,c+6),3,bf:c=c+
8
NEXT n
GOTO Loop
Check:
m=INT(m):n=INT(n)
asp=ABS(asp):h=ABS(h)
IF res<>1 AND res<>2 THEN res=1
IF res=1 THEN ht=186:hht=93
IF res=2 THEN ht=386:hht=193
IF lox>hix THEN SWAP lox,hix
IF loy>hiy THEN SWAP loy,hiy
dfx=1:dtx=m:sx=1:dfy=1:dty=n:sy=
1
IF gt<>2 THEN gt=1
IF res<>2 THEN res=1
IF gt=2 THEN
IF a<0 THEN dfx=m:dtx=1:sx=-1
IF b<0 THEN dfy=n:dty=1:sy=-1
END IF
RETURN
Estimate:
m1=310/m:m2=160/m:n1=310/n:n2=16
0/n:rd=180/pi
x=240/SQR(1+asp^2):y=240*asp/SQR
(1+asp^2)
spx=310+.8886207*(x-y):spy=hht-.
4586429*(x+y)
x1=1.777241*x/m:x2=1.777241*y/n:
y1=.9172858*x/m:y2=.9172858*y/n
i=0:x=lox-tx
WHILE i<m+1
i=i+1  :LOCATE 5,7:PRINT i;
x=x+tx :j=0:y=loy-ty
WHILE j<n+1
j=j+1
y=y+ty
xc(i,j)=(spx+x2*j-x1*i)
yc(i,j)=spy+y2*j+y1*i-h*FNz(x,y)
IF yc(i,j)<smin THEN smin=yc(i,j
)
IF yc(i,j)>smax THEN smax=yc(i,j
)
WEND
WEND
IF smax<ht AND smin>0 THEN RETUR
N
avg=(smax+smin)/2:smax=smax-avg:
smin=smin-avg:mult=ht/(smax-smin
)
FOR x=1 TO m+1
FOR y=1 TO n+1
yc(x,y)=mult*(yc(x,y)-avg)+hht
NEXT y
NEXT x
RETURN
True:
DEF FNc(a,b,c,x,y,z)=(x*(b*(b-y)
+c*(c-z))+(x-a)*(b*y+c*z))/d
DEF FNang(x,y,z)=(px*x+py*y+pz*z
)/(dp*SQR(x^2+y^2+z^2))
px=FNc(a,b,c,0,0,10):py=FNc(b,a,
c,0,0,10):pz=FNc(c,b,a,10,0,0)
dp=SQR(px^2+py^2+pz^2)
i=0:x=lox-tx
WHILE i<m+1
i=i+1  :LOCATE 5,7:PRINT i
x=x+tx :j=0:y=loy-ty
WHILE j<n+1
j=j+1
y=y+ty
xc(i,j)=FNz(x,y):sum=sum+xc(i,j)
WEND
WEND
avg=sum/((m+1)*(n+1)):ym=loy-ty-
(loy+hiy)/2
i=0:x=lox-tx-(lox+hix)/2
WHILE i<m+1
i=i+1  :LOCATE 6,7:PRINT i
x=x+tx :j=0:y=ym
WHILE j<n+1
j=j+1:y=y+ty:z=xc(i,j)-avg
d=a*(a-x)+b*(b-y)+c*(c-z)
xc=FNc(a,b,c,x,y,z)
yc=FNc(b,a,c,y,x,z)
zc=FNc(c,b,a,z,y,x)
rad=SQR(xc^2+yc^2+zc^2)
s=1
IF SGN(a)<>SGN(yc*pz-zc*py) THEN
s=-1
ELSEIF SGN(b)<>SGN(zc*px-xc*pz)
THEN
s=-1
ELSEIF SGN(c)<>SGN(xc*py-yc*px)
THEN
s=-1
END IF
cs=FNang(xc,yc,zc):sn=SQR(1.0000
1-cs^2)
xc(i,j)=s*rad*sn:yc(i,j)=-rad*cs
IF xc(i,j)>xmax THEN xmax=xc(i,j
)
IF xc(i,j)<xmin THEN xmin=xc(i,j
)
IF yc(i,j)>ymax THEN ymax=yc(i,j
)
IF yc(i,j)<ymin THEN ymin=yc(i,j
)
WEND
WEND
ax=(xmax+xmin)/2:ay=(ymax+ymin)/
2
IF res=1 THEN
hzy=93
IF ((ymax-ymin)/(xmax-xmin))>(6.
75/10.25) THEN
my=168/(ymax-ymin):mx=168/(ymax-
ymin)*2.200899
ELSE
my=602/(xmax-xmin)/2.200899:mx=6
02/(xmax-xmin)
END IF
ELSE
hzy=193
IF ((ymax-ymin)/(xmax-xmin))>(6.
875/10.25) THEN
my=368/(ymax-ymin):mx=368/(ymax-
ymin)*1.092089
ELSE
my=602/(xmax-xmin)/1.092089:mx=6
02/(xmax-xmin)
END IF
END IF
FOR x=1 TO m+1
FOR y=1 TO n+1
xc(x,y)=315+mx*(xc(x,y)-ax)
yc(x,y)=hzy+my*(yc(x,y)-ay)
NEXT y
NEXT x
RETURN
```

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Fixing Atari Revision-B BASIC

Barry Hart

This article includes a fast, convenient way to fix the bugs in Revision B of Atari BASIC. The program works on all Atari 800XL computers which have Revision-B BASIC, and on 600XL computers with memory expansion to 64K. A disk drive is required.

As many people are aware, the version of Atari BASIC known as Revision B—the version built into most Atari 600XL and 800XL computers—contains several serious bugs. The later, debugged version of Atari BASIC is known as Revision C. To find out which version you have, type

PRINT PEEK(43234)

and press RETURN. If the computer prints 96, you have Revision B, the bad version of BASIC. If it prints 234, you have Revision C, so no fixes are required.

The programs included in this article eliminate all of the bugs in Revision-B BASIC. Enter and save Program 1; then run it. The program creates an AUTORUN.SYS file on disk. (Before you run this program, make sure that the disk in the drive does not already contain an AUTORUN.SYS file that you want to save. The AUTORUN.SYS file created by Program 1 will overwrite any existing AUTORUN.SYS file already on the disk.) When you boot the computer with a disk containing this file, the program first checks to see whether the XL's built-in BASIC is enabled. If an external cartridge is present, or if no cartridge is present, the program does nothing at all. This feature prevents crashes when other cartridges are in use. If built-in BASIC is enabled, the program copies BASIC from ROM to underlying (normally unused) RAM, then makes the changes needed to fix all of the Revision-B bugs.

This program should cause no problems with the vast majority of BASIC programs. However, it may conflict with programs that modify CASINI (memory locations 2–3) or the microprocessor's stack at locations 256–511. Very few programs modify those areas. A program might also crash the system if it POKEs new values into the cartridge space at 40960–49151, since that is where the RAM copy of BASIC resides.

When you're using a RAM-based version of BASIC, it is advisable to lower the value in the RAMTOP pointer (location 106). Some graphics commands may attempt to alter memory above RAMTOP, which would disrupt the RAM version of BASIC. You can protect BASIC by using one of the following statements near the beginning of your program:

POKE 106, PEEK(106)−4: GRAPHIC *n*
(for graphic modes 0–6)

POKE 106, PEEK(106)−16: GRAPHIC *n*
(for graphic modes 7–11)

In either case, *n* is the number of the mode you'll be using.

A Patch For DOS

Program 2 is not necessary to use the special AUTORUN.SYS file, but it can be handy if you use DOS 2.0 or 2.5. Since the AUTORUN.SYS file works by switching out the ROM version of BASIC, you cannot normally return to the RAM version of BASIC from the DOS menu using option B (RUN CARTRIDGE). Selecting option B from the DOS menu generates an error message (NO CARTRIDGE). Program 2 makes a minor alternation to the DUP.SYS file which allows DOS option B to work normally with the file created by Program 1. Before you run Program 2, insert a disk containing the DOS 2.0 or 2.5 DUP.SYS file and the AUTORUN.SYS file created by Program 1. *Do not* use Program 2 to change the DUP.SYS file on any disk which doesn't contain the AUTORUN.SYS file created by Program 1. Use Program 2 only on copies of the DUP.SYS file, not on the version of DUP.SYS on your original DOS disk. If you ever delete the AUTORUN.SYS file that fixes BASIC, you'll need to replace the patched DUP.SYS file with a copy of the original version.

If you don't use Program 2, then you must press RESET or use DOS option M (RUN AT ADDRESS) to run the patched BASIC in RAM at location A000 (40960).

Note that Program 1 is intended only for 600XL and 800XL model Atari computers with Revision-B BASIC built in. Memory expansion to 64K is required to use the program on the 600XL; otherwise there will be no RAM under ROM for the program to use. The program does

not work at all on the Atari 400, 800, or 1200XL, all of which use BASIC in a cartridge and do not include RAM under ROM. Although Program 1 will work on XE models, it is unnecessary, since all XE computers come with Revision-C BASIC built in. In addition, some of the last XLs produced use Revision-C BASIC instead of Revision B.

While these programs solve the Revision-B bugs, it is possible to obtain a cartridge containing Revision-C BASIC, which would eliminate the need for the AUTORUN.SYS file. For information, write to:

Atari Customer Relations
P. O. Box 61657
Sunnyvale, CA 94088

For instructions on entering these programs, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

Program 1: AUTORUN.SYS Filemaker

```
FM 10  OPEN #1,8,0,"D:AUTORUN
       .SYS":FOR I=1 TO 110:R
       EAD J:PUT #1,J:NEXT I
BJ 20  DATA 255,255,0,1,97,1,
       173,1,211,9,2,141,1,21
       1,76,64,21,165,6,74,14
       4,81,173,250,3,208,76,
       168,133,214,169,160
FD 30  DATA 133,215,169,32,13
       3,216,173,1,211,9,2,17
       0,202,202,142,1,211,17
       7,214,232,232,142,1,21
       1,145,214,200,208,239
AL 40  DATA 230,215,198,216,2
       08,233,169,234,141,223
       ,168,141,226,168,169,2
       40,141,224,168,169,17,
       141,225,168,140,41
CO 50  DATA 187,165,12,141,9,
       1,165,13,141,10,1,132,
       12,200,132,13,96,226,2
       ,227,2,11,1
```

Program 2: DUP.SYS Patcher

```
KF 10  XIO 36,#1,0,0,"D:DUP.S
       YS":OPEN #1,12,0,"D:DU
       P.SYS"
MA 20  FOR X=1 TO 2026:GET #1
       ,Y:NEXT X:FOR X=1 TO 5
       5:READ Y:PUT #1,Y:NEXT
        X
PL 30  CLOSE #1:XIO 35,#1,0,0
       ,"D:DUP.SYS"
LN 50  DATA 164,6,136,240,35,
       172,253,191,169,170,14
       1,253,191,205,253,191,
       208,22,74,141,253,191,
       205,253,191,208,13,140
BC 60  DATA 253,191,169,63,16
       2,39,32,181,49,76,182,
       32,173,252,191,208,241
       ,173,253,191,240,236,2
       34,234,234,234,234
```

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Custom Characters For Atari XL And XE

S. M. Baugh

This program demonstrates a short, elegant method of creating custom characters on Atari XL and XE computers (except for the 1200XL).

Many computer users have use for an alternate character set. Custom characters give any program a polished, professional look and they are an absolute necessity for foreign language applications. They can also be used to create graphics in games and educational programs. This program demonstrates an efficient technique for creating custom characters on the newer XL and XE Atari computers.

Type in the program and save a copy; then run it. After a short delay, the computer clears the screen and prints all the printable characters. To switch from normal characters to a set of Greek and Hebrew characters, press CTRL-4. Uppercase characters are changed to Greek letters and lowercase characters become Hebrew characters (the order is as logical as possible: *A* becomes alpha or aleph, *F* becomes phi or pe, and so on). Press CTRL-4 again to switch back to the normal characters.

Alternate Character Sets

A character set is simply a collection of patterns that define the shape of each character. The Atari's normal character set is contained in ROM (Read Only Memory). To create custom characters, you must put a new character set somewhere in memory, then tell the computer to use the new patterns in place of the old ones. The first order of business, then, is to decide where to put the new character set.

On older 400 and 800 Atari computers, the memory area from locations 49152–53247 ($C000–$CFFF) is unused. On XL and XE models, this area is used by the operating system. Part of this memory, the zone from 52224–53247 ($CC00–$CFFF), contains an international character set which you can switch on with the statement POKE 756,204.

The international set is useful for certain purposes, but not if you want something like a complete set of foreign language characters. Ideally, you could just POKE your own

character set into locations 52224–53247 and perform the POKE to switch to the new set. On XL and XE computers, however, this area is ROM which you can't change with POKEs.

The answer is suggested in Appendix 12 of *Mapping the Atari*, by Ian Chadwick. The program copies the operating system from ROM into RAM and turns off the ROM so that the computer "sees" the underlying RAM. Once this is done, we simply POKE the new character set into the area formerly occupied by the international characters. An advantage of this technique is that the new characters don't decrease the amount of memory available for your own programming.

Turning ROM into RAM permits all sorts of customizing. There is actually room for four new character sets if you use the ROM space ordinarily used for graphics characters. Of course, you can also replace the Greek and Hebrew definitions with characters of your own. *Mapping the Atari* explains how to create new character definitions.

To switch character sets under program control, use POKE 756,204. This program uses a little trick to let you do the same thing by pressing CTRL-4 when in immediate mode. Evidently, Atari used parts of the older 1200XL operating system in the operating system for the newer XL and XE computers. The XL/XE keyboard scanning routine looks for function keys that exist only on the 1200XL. One of the 1200XL's function keys is used to switch character sets. The POKE in line 110 simply substitutes the CTRL-4 key combination for that function key. Once this has been done, the computer automatically toggles between the two character sets when you press CTRL-4, just as it would if you pressed the function key on a 1200XL.

Custom Characters For Atari XL And XE

For instructions on entering this program, please refer to "COMPUTE!'s Guide to Typing In Programs" elsewhere in this issue.

```
FB 10 REM Alternate characte
      r sets
PG 20 GRAPHICS 2+16:? #6;"
      {6 SPACES}ROM/RAM":? #
      6;"{5 SPACES}CHARACTER
      S"
EC 30 ? #6;" ":? #6;"  CONVE
      RTING ROM..."
EJ 40 RESTORE 1000
JK 50 FOR L=1536 TO 1635:REA
      D D:POKE L,D:NEXT L
BC 60 U=USR(1536)
NH 70 ? #6;" ":? #6;"
      {3 SPACES}CHANGING SET
      S..."
HP 80 ? #6;" "
BB 90 FOR L=52488 TO 52695:R
      EAD D:POKE L,D:NEXT L
DE 100 FOR L=52992 TO 53207:
       READ D:POKE L,D:NEXT
       L
IN 110 POKE 64661,152
KC 120 FOR J=32 TO 252
PF 130 IF (J<125 OR J>127) A
       ND (J<155 OR J>159) T
       HEN PRINT CHR$(J);
BO 140 NEXT J
AG 150 PRINT :PRINT :PRINT "
       PRESS CTRL-4 TO SWITC
       H CHARACTER SET"
MO 160 REM MACHINE LANGUAGE
       DATA
FE 1000 DATA 169,0,133,203,1
        33,205,169,192,133,2
        04,169,64,133,206,16
        0,0,177,203,145
MO 1010 DATA 205,200,208,249
        ,230,206,230,204,240
        ,12,165,204,201,208,
        208,237,169,216,133,
        204
LL 1020 DATA 208,231,8,120,1
        73,14,212,72,169,0,1
        41,14,212,173,1,211,
        41
OG 1030 DATA 254,141,1,211,1
        69,192,133,206,169,6
        4,133,204,177,203
JL 1040 DATA 145,205,200,208
        ,249,230,204,230,206
        ,240,12,165,206,201,
        208,208,237,169,216,
        133,206
PN 1050 DATA 208,231,104,141
        ,14,212,40,104,96
EH 1998 REM GREEK DATA
DK 2000 DATA 0,0,60,108,108,
        108,54,0
AM 2010 DATA 0,60,108,126,10
        2,118,124,96
IH 2020 DATA 0,0,99,182,24,2
        4,108,199
DP 2030 DATA 0,28,48,28,102,
        102,60,0
QF 2040 DATA 0,0,60,96,124,9
        6,60,0
BH 2050 DATA 24,24,126,219,2
        19,126,24,24
QK 2060 DATA 0,0,51,94,12,24
        ,48,48
JC 2070 DATA 0,0,252,102,102
        ,102,102,6
LN 2080 DATA 0,0,48,48,48,52
        ,28,0
JH 2090 DATA 0,60,102,126,10
        2,102,60,0
IM 2100 DATA 0,0,102,108,120
        ,108,102,0
EL 2110 DATA 0,192,96,48,24,
        44,103,0
MI 2120 DATA 0,0,102,102,102
        ,102,127,96
IK 2130 DATA 0,0,230,102,102
        ,124,112,0
CK 2140 DATA 0,0,60,102,102,
        102,60,0
BG 2150 DATA 0,0,127,182,54,
        54,54,0
AD 2160 DATA 0,0,24,24,0,0,0
        ,0
KK 2170 DATA 0,0,124,102,102
        ,124,96,96
EI 2180 DATA 0,0,63,108,108,
        108,56,0
AN 2190 DATA 0,0,126,152,24,
        24,24,0
GJ 2200 DATA 0,0,238,102,102
        ,108,56,0
EM 2210 DATA 0,24,219,90,90,
        90,60,24
KH 2220 DATA 0,0,102,195,219
        ,219,126,0
FI 2230 DATA 48,28,48,30,48,
        112,62,6
NN 2240 DATA 0,0,60,102,56,1
        2,6,28
JE 2250 DATA 96,30,112,96,96
        ,56,12,56
AE 2260 DATA 0,0,24,24,0,0,0
        ,0
JH 2998 REM HEBREW DATA
BG 3000 DATA 0,102,52,24,44,
        38,99,0
HN 3010 DATA 0,126,6,6,6,6,1
        27,0
ON 3020 DATA 0,254,102,102,1
        02,102,102,0
NA 3030 DATA 0,127,6,12,12,1
        2,12,0
BN 3040 DATA 0,124,82,66,66,
        36,60,0
HP 3050 DATA 0,238,102,54,30
        ,12,56,96
AB 3060 DATA 0,60,12,12,12,2
        2,115,0
JD 3070 DATA 0,126,6,102,102
        ,102,102,0
PH 3080 DATA 0,126,102,102,1
        02,102,126,0
BB 3090 DATA 0,60,12,24,24,2
        4,24,24
HN 3100 DATA 0,126,6,6,6,6,1
        26,0
IB 3110 DATA 192,64,126,126,
        6,4,24,24
IA 3120 DATA 0,96,62,70,134,
        134,158,0
NN 3130 DATA 0,60,12,12,12,1
        2,60,0
EL 3140 DATA 0,126,38,66,66,
        102,60,0
BK 3150 DATA 0,126,38,118,6,
        6,126,0
LE 3160 DATA 0,126,6,102,108
        ,120,96,96
CA 3170 DATA 0,126,6,6,6,6,6
        ,0
EO 3180 DATA 0,214,82,82,82,
        126,60,0
HL 3190 DATA 0,126,38,38,38,
        102,102,0
LJ 3200 DATA 0,126,38,118,6,
        6,6,6
AO 3210 DATA 0,119,18,22,12,
        6,126,0
NK 3220 DATA 0,60,12,12,12,1
        2,12,0
BN 3230 DATA 0,119,50,22,28,
        12,12,12
DB 3240 DATA 0,60,12,24,0,0,
        0,0
KO 3250 DATA 0,60,8,24,24,24
        ,24,0
```

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Applecoder

Adam Levin

Are you concerned about file security? This Applesoft BASIC utility allows you to encode any sequential text file in a way that makes it almost impossible for someone to crack.

"Applecoder" is an Applesoft BASIC program which encodes any Apple sequential text file using a key supplied by you. This allows you to create securely encoded versions of text files which you can keep on disk, knowing that you are the only one able to make the file readable again. Or, if you share the key with a friend, you can both exchange encoded files on disks or over a modem. Using Applecoder makes it nearly impossible to decode a text file without knowing the exact steps taken to encode the file. With multiple encoding and other techniques, you can make it even more difficult for anyone else to decipher the contents of the file.

Using Applecoder

Type in Applecoder (Program 1), save a copy to disk, and then run it. Applecoder begins by asking whether you want to encode or decode a file. Press E to encode or D to decode. Then you must enter the name of the file you wish to convert. If you're not sure of the file's name, press the question mark key (?) to display a disk catalog. Once you have entered the name of the input file, you are prompted to enter the disk slot and drive number where the file is located. You must then repeat this procedure for the output file. To direct the output to the screen rather than to a disk file, enter SCR as the output filename. Screen output allows you to preview the results immediately without having to write the file to disk and view it later. Among other things, this is handy for reading a decoded letter.

Now you must supply a key to encode or decode the file. Of course, if you are decoding a file, you must supply the same key that was used to encode it previously. The key can be any rational number in the range $1 * 10^{-38}$ to $1 * 10^{38}$. (The last number is a one followed by 38 zeros.) If you like, the key value can be entered in scientific notation. In that notation, the same numeric range is expressed as 1E−38 to 1E+38.

This large numeric range gives you a multitude of keys from which to choose. It is suggested that you pick a key value that is easy for you to remember, but hard for others to guess.

Once you have entered the key, Applecoder prompts you to insert the disk in the drive. Press Return to begin the conversion. If you specified a disk filename for the conversion, Applecoder displays the line which it is currently converting. If you have chosen SCR for screen output, the program directs all converted output to the monitor.

Because an encoded output file is the same size as the original file, Applecoder cannot handle a file that occupies more than one-half of a disk on a single-drive system. If you have two drives, Applecoder can handle any file that fits on a disk.

How Random Is Random?

Applecoder relies on the fact that the RND function returns numbers that appear random, but are actually created with a predictable mathematical formula. A better name for such numbers is *pseudorandom* numbers. Whenever you supply a negative value with RND, that number is used to *seed* the random number generator routine. Subsequent uses of RND with a positive value will yield predictable numbers based on the value of the original seed.

The key which you supply to Applecoder is used to seed the random number generator. The program then reads the file one character at a time; for each non-control character in the file, Applecoder gets a pseudorandom number with the RND function and adds it to the character's ASCII value. This creates an output file which is the same length as the input file, but

where each noncontrol character is changed in a seemingly random fashion. The control characters (0–31 and 128–159) are not altered, thus the file can still be handled by word processing or telecommunications programs.

The best way to learn how this works is to go ahead and encode a text file with the SCR option, to display it on the screen. Note that any given word, though it may appear many times in the original file, will be different every time it appears in the encoded file. Since all Apple II computers use the same RND function, an encoded text file created with Applecoder can be decoded by any other Apple II running the same program—assuming, of course, that the other Apple user has the correct key.

Advanced Applecoding

An encoded file of this type is extremely difficult to break, since you would have to run a program like Applecoder repeatedly and enter different keys until you happened upon one that yielded text instead of random garbage.

If you're still not convinced, enter and run Program 2, "Filemaker," and try to decode the file by guessing the correct key value. Program 2 creates a short text file named STRANGE. After you create the STRANGE file, run Applecoder with the SCR option and try entering different keys. When you're convinced that it's not easy to discover a key through random guessing, try the value 340.897.

To make a file even more secure, you can doubly encode it. For instance, say that you wish to encode a file named ABCD and produce a final output file named WXYZ. The first step is to encode it as usual, giving the output file a name like TEMP, since it is only a temporary, intermediate file. Then the TEMP file is encoded, giving the output file the name WXYZ. When that step is complete, the TEMP file can be deleted.

At this point the WXYZ file can be decoded only by someone who has *both* keys. In multiple decoding, it makes no difference which key you use first. For instance, say that the file was encoded with the keys 119 and 1206.41, in that order. The file is decoded correctly if you decode with 119 and then decode with 1206.41, or if you use the reverse order. This rule applies no matter how many times the file has been encoded.

Multiple encoding makes a file virtually impossible to crack by random guessing. Imagine yourself trying to crack the first stage of a triply encoded file. After the first attempt at decoding, there is no way to know whether the results are correct, since the product of the first decoding is another encoded file. And you have no rational way to tell how many decodings may be necessary.

Another useful method is to *back-code* the file. In this case, you select the decode (D) option for an unencoded file. Then, to recover the original text you must use the encode (E) option. A would-be snooper has no idea that it's necessary to encode—rather than decode—the file in order to restore the original contents.

Applecoder works only with sequential text files. However, any Applesoft or Integer BASIC program that can be executed with EXEC is actually a text file which can be manipulated with Applecoder.

Of course, it's important to remember which key or keys you used to encode each file in the first place. And while Applecoder makes a file useless to others, it doesn't prevent them from deleting or garbling the file. To be absolutely safe, you may want to keep an unmodified copy of the original file in some secure location.

Modifications

Here are a few modifications which will make the program more convenient for some users. If you have only one disk drive, change lines 170, 190, and 210 as shown here:

```
170 PRINT D$ + "CATALOG": RET
    URN
190 IS = 6:ID = 1
210 OS = 6:OD = 1
```

This modification assumes that your drive is in slot 6 and drive 1. If your system is different, change the 6 and 1 in lines 190 and 210 accordingly.

Line 170 contains the only CATALOG command in the program; if you have ProDOS and want to change it to CAT, this is the place.

Apple uses the null character, CHR$(0), to indicate the end of data when reading and writing text files. Applecoder, like most programs that handle text files, knows it has reached the end of a file when the null character appears. Text files normally contain a null only as the last character in the file. You should avoid placing a null character—or CHR$(128), which is equivalent to a null—in text files. If the encoded version of a file is unexpectedly shorter than the original, check to make sure that the original doesn't contain a hidden null.

For instructions on entering these programs, please refer to "COMPUTE!'s Guide to Typing In Programs" elsewhere in this issue.

Program 1: Applecoder

```
B1 100 RTN = 13: REM ASCII VALUE
       OF CHARACTER MEANING 'EN
       D OF LINE'
D5 110 D$ = CHR$ (4):BL$ = CHR$
       (7): REM DISK ACCESS : BE
       LL CHAR.
22 120 ZR = 0:PF = .5:WN = 1:EI
       = 8:TW = 20:TT = 32:NF =
       95:OH = 100:OTE = 128:SX
       = 160:TFF = 255: REM THE
       USE OF THESE VARIABLES SP
       EEDS UP THE 'ENCODE/DECOD
       E' LOOP.
60 130 KY = 0: ONERR GOTO 590
F2 140 TEXT : HOME : HTAB (13):
       PRINT "APPLECODER": POKE
       34,1
DF 150 REM  ** GET USER INPUT **
41 160 ED = FRE (0): HOME : PRIN
       T : HTAB (8): PRINT "<E>N
       CODE OR <D>ECODE ";: GET
       A$: PRINT A$: ON A$ < > "
       E" AND A$ < > "D" GOTO 16
       0:ED = 1:ED = ED - 2 * (A
       $ = "D"): GOTO 180
EC 170 INPUT "SLOT #, DRIVE # FO
       R CATALOG: ";S$,DR$: ON S
       $ < "1" OR S$ > "7" OR DR
       $ < "1" OR DR$ > "2" GOTO
        170: PRINT D$ + "CATALOG
       ,S" + S$ + ",D" + DR$: RE
       TURN
DD 180 PRINT : PRINT "NAME OF IN
       PUT FILE:  '?' FOR CATALO
       G.": INPUT IN$: ON IN$ =
       "?" GOSUB 170: IF LEN (IN
       $) > 15 OR LEFT$ (IN$,1)
       < "A" THEN 180
BB 190 PRINT "SLOT#, DRIVE# OF "
       ;IN$;": ";: INPUT S$,DR$:
        ON S$ < "1" OR S$ > "7"
       OR DR$ < "1" OR DR$ > "2"
        GOTO 190:IS = VAL (S$):I
       D = VAL (DR$)
98 200 PRINT : PRINT "NAME OF OU
       TPUT FILE: ": PRINT "'SCR
       ' WILL SEND OUTPUT TO SCR
       EEN ONLY.": INPUT OT$: ON
        OT$ = "?" GOSUB 170: ON
```

```
      LEN (OT$) > 15 OR LEFT$ (
      OT$,1) < "A" GOTO 200: IF
       OT$ = "SCR" THEN PRINT "
      OUTPUT TO SCREEN.": GOTO
      230
16 210 PRINT "SLOT#, DRIVE# OF "
      ;OT$;": ";: INPUT S$,DR$:
       ON S$ < "1" OR S$ > "7"
      OR DR$ < "1" OR DR$ > "2"
       GOTO 210:OS = VAL (S$):O
      D = VAL (DR$)
F1 220 IF IN$ = OT$ AND IS = OS
      AND ID = OD THEN PRINT :
      PRINT BL$"FILENAMES MUST
      DIFFER!": PRINT "DISASTRO
      US RESULTS OCCUR OTHERWIS
      E.": GOTO 200
EB 230 PRINT : INPUT "ENTER KEY
      FOR CODE: ";A$:KY = VAL (
      A$): IF KY = 0 THEN PRINT
       "RANGE FOR KEY IS 1E-38
      <--> 1E+38.": GOTO 230
A4 240 L = 0: HOME : PRINT "MAKE
       CERTAIN THAT THE DISKETT
      E WITH": PRINT : PRINT IN
      $;" IS IN SLOT #";IS;", D
      RIVE #";ID: PRINT : IF OT
      $ < > "SCR" THEN PRINT "A
      ND THE DISKETTE FOR": PRI
      NT : PRINT OT$;" IS IN SL
      OT #";OS;", DRIVE #";OD
87 250 RD = 1:XYZ = RND ( - ABS
      (KY)): PRINT : PRINT "HIT
       <RETURN> TO CODE, <ESC>
      TO RESTART ";: GET A$: ON
       A$ < > CHR$ (13) AND A$
      < > CHR$ (27) GOTO 250: O
      N A$ = CHR$ (27) GOTO 160
      : HOME : PRINT
4E 260 PRINT : PRINT : PRINT : H
      TAB (4): IF ED = 1 THEN P
      RINT "EN";
42 270 IF ED = - 1 THEN PRINT "D
      E";
17 280 PRINT "CODING.  PLEASE WA
      IT FOR 'BEEP'":X = FRE (
      PEEK ( - 16368)): REM CLE
      AR KEYBOARD STROBE.
E8 290 REM  ** ENCODE/DECODE **
37 300 S = IS:DR = ID: PRINT D$
      + "OPEN" + IN$ + ",S";IS;
      ",D";ID
76 310 IF OT$ = "SCR" THEN HOME
      : GOTO 330
10 320 S = OS:DR = OD: PRINT D$
      + "OPEN" + OT$ + ",S";OS;
      ",D";OD: PRINT D$ + "CLOS
      E" + OT$: PRINT D$ + "DEL
      ETE" + OT$: PRINT D$ + "O
      PEN" + OT$:HT = EI + EI *
       PF
E3 330 O$ = "": IF OT$ < > "SCR"
       THEN VTAB EI: HTAB (HT):
      L = L + WN: PRINT " LINE
      #";L
21 340 FOR R = ZR TO TFF: REM  S
      ET A MAXIMUM OF 256 CHARA
      CTERS PER INPUT LINE
F6 350 S = IS:DR = ID: PRINT D$
      + "READ" + IN$
41 360 GET A$: PRINT : PRINT D$:
       REM  USE 'GET' RATHER TH
      AN 'INPUT' SO -ALL- CHARA
      CTERS CAN BE CAPTURED
29 370 A = ASC (A$): IF A = RTN
      THEN 510: REM  END OF LIN
      E SIGNALLED BY 'RETURN' I
      NPUT
FD 380 IF (A < TT) OR (A > OTE -
       WN AND A < SX) THEN 490:
       REM  PASS ALL NON-ALPHA
      NUMERIC INPUT
1D 390 B = A + ED * INT ( RND (R
      D) * NF): IF RD = ZR THEN
       RD = WN: REM  CREATE A N
      EW ASCII VALUE USING THE
      OLD VALUE AND A RANDOM #
      FROM 0 TO NF
FA 400 IF A > = OTE THEN 440
B6 410 IF B > = OTE THEN B = B -
       OTE + TT
7C 420 IF B < TT THEN B = NF + W
      N + B
1B 430 GOTO 460
42 440 IF B > TFF THEN B = B - (
      TFF + WN) + SX
06 450 IF B < SX THEN B = NF + W
      N + B
01 460 IF B = RTN THEN RD = ZR:
      GOTO 490: REM  CAN'T USE
      A 'RETURN' IN OUTPUT STRI
      NG
CA 470 IF (B < TT) OR (B > = OTE
       AND B < SX) THEN RD = ZR
      : GOTO 490: REM  DON'T AL
      TER NON-ALPHANUMERIC OUTP
      UT
2B 480 A = B
43 490 O$ = O$ + CHR$ (A)
FC 500 NEXT
86 510 IF OT$ = "SCR" THEN 530
85 520 S = OS:DR = OD: PRINT D$
      + "WRITE" + OT$
04 530 PRINT O$
FA 540 PRINT D$
45 550 GOTO 330: REM KEEP GETTIN
      G UNTIL THERE'S AN END-OF
      -DATA ERROR, WHICH WILL B
      E CONSIDERED THE END OF T
      HE FILE
68 560 PRINT "CONVERSION COMPLET
      E.": PRINT "WOULD YOU LIK
      E TO DO ANOTHER ?": PRINT
       "<Y>ES  OR  <N>O ";: GET
       A$: PRINT A$: ON A$ < >
      "Y" AND A$ < > "N" GOTO 5
      60: IF A$ = "Y" THEN RUN
B6 570 TEXT : PRINT : PRINT "APP
      LECODER DONE.": END
62 580 REM ** ERROR HANDLING **
80 590 ECN = PEEK (222):ELN = PE
      EK (218) + 256 * PEEK (21
      9)
FE 600 PRINT : PRINT D$ + "CLOSE
      " + IN$: PRINT
F1 610 PRINT D$ + "CLOSE" + OT$:
       PRINT : PRINT BL$;
D0 620 ON ECN = 5 GOTO 560: REM
       'END OF FILE' HAS BEEN R
      EACHED.
11 630 PRINT "ERROR! HIT <RETURN
      > TO CONTINUE.";:X = PEEK
       ( - 16368): GET A$: PRIN
      T A$;: IF A$ < > CHR$ (13
      ) THEN HTAB (1): GOTO 630
ED 640 PRINT
33 650 IF ECN = 4 THEN PRINT "TH
      E DISKETTE IN SLOT #";S;"
      , DRIVE #";DR: PRINT "IS
      WRITE PROTECTED.  PLEASE
      REMOVE THE": PRINT "WRITE
       PROTECT TAB.": GOSUB 790
      : GOTO 240
E5 660 IF ECN < > 8 THEN 690
AB 670 PRINT "INPUT/OUTPUT ERROR
      . ": PRINT "CHECK DISK DR
      IVE #";DR;" IN SLOT #";S;
      "."
53 680 PRINT : PRINT "CODING MUS
      T BE RESTARTED.": GOSUB 7
      90: GOTO 240
D5 690 IF ECN = 9 THEN PRINT "TH
      E DISKETTE IN SLOT #";S;"
      , DRIVE #";DR: PRINT "IS
      FULL.  PLEASE INSERT A DI
      SKETTE": PRINT "WITH MORE
       SPACE AND RESTART.": GOS
      UB 790: GOTO 240
51 700 IF ECN < > 10 THEN 740
41 710 PRINT "THE FILE ";OT$;",
      IS LOCKED.": PRINT "UNLOC
      K IT NOW?": PRINT "<Y>ES
      OR <N>O ";: GET A$: PRINT
       A$: ON A$ < > "Y" AND A$
      < > "N" GOTO 710
3E 720 IF A$ = "Y" THEN PRINT D$
       + "UNLOCK" + OT$ + ",S";
      OS;",D";OD: PRINT "FILE H
      AS BEEN UNLOCKED."
A4 730 GOSUB 790: GOTO 240
9C 740 IF ECN = 11 THEN PRINT "E
      RROR IN FILE NAME.": PRIN
      T "FILE NAME MUST CONFORM
       TO YOUR DOS.": GOSUB 790
      : GOTO 180
40 750 IF ECN = 13 THEN PRINT "F
      ILE-TYPE MISMATCH.": PRIN
      T "ONLY TEXT FILES CAN BE
       CODED.": PRINT "PLEASE C
      HECK YOUR FILE-TYPE BY":
      PRINT "LOOKING AT THE 'CA
      TALOG'": GOSUB 790: GOTO
      180
4B 760 IF ECN = 255 THEN PRINT "
      YOU TYPED A <CTRL-C>.": P
      RINT "IF THIS WAS DONE DU
      RING CODING,": PRINT "THE
       <CTRL-C> MAY HAVE BEEN S
      ENT": PRINT "TO THE OUTPU
      T FILE.": PRINT "REDO IF
      THIS IS THE CASE.": GOSUB
       790: GOTO 240
DB 770 PRINT "ERROR NUMBER: ";EC
      N: PRINT "IN LINE NUMBER:
       ";ELN: PRINT "PLEASE REF
      ER TO YOUR PROGRAMMING":
      PRINT "MANUAL FOR A FULL
      DESCRIPTION.": PRINT "THI
      S SCREEN WILL REMAIN DISP
      LAYED": PRINT "UNTIL YOU
      HIT <RESET>.":R = 0
B8 780 ON R > 0 GOTO 780: TEXT :
       PRINT : PRINT "APPLECODE
      R DONE.":R = 1: GOTO 780
C1 790 PRINT : PRINT "HIT <RETUR
      N> TO RESTART, <ESC> TO E
      ND ";: GET A$: PRINT A$:
      ON A$ < > CHR$ (13) AND A
      $ < > CHR$ (27) GOTO 790:
       IF A$ = CHR$ (13) THEN R
      ETURN
69 800 PRINT : PRINT "VERIFY: EX
      IT APPLECODER": PRINT "<Y
      >ES OR <N>O ";: GET A$: P
      RINT A$;: ON A$ < > "Y" A
      ND A$ < > "N" GOTO 800: O
      N A$ = "N" GOTO 790: TEXT
       : PRINT : PRINT : PRINT
      "APPLECODER DONE.": END
```

Program 2: Filemaker

```
9B 80 D$ = CHR$ (4): REM  DISK C
      OMMAND PREFIX
57 90 N$ = "STRANGE": PRINT D$ +
       "OPEN" + N$: PRINT D$ + "
      WRITE" + N$: REM CREATE TH
      E TEXT FILE 'STRANGE' AND
      PREPARE TO WRITE TO IT.
79 100 PRINT "5L+>AYF&4S;": REM
      THIS IS THE PHRASE WHICH
      APPLECODER WILL DECODE. C
      AN YOU GUESS WHAT IT SAYS
       NOW?
E2 110 PRINT D$ + "CLOSE" + N$
0B 120 PRINT "'" + N$ + "'" + "
      HAS BEEN CREATED.": PRINT
       "CREATE.PHRASE DONE."
8F 130 END
```

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128 File Viewer

Jeffrey D. Partch

This Commodore 128 utility packs a double punch. It can print the contents of any disk file or disassemble any machine language program directly from disk. Neither operation disturbs the program currently in memory. A disk drive is required.

Have you ever wanted to know the contents of a mysterious file in the disk directory, or needed to look at another file during a programming session? All too often, getting that information requires a lot of saving, loading, and listing. "128 File Viewer" allows you to display the contents of any program (PRG) or sequential (SEQ) disk file on the screen without harming the program in memory. It can also disassemble any machine language program directly from disk—again, without disturbing the current program. Since it adds a new command to the Commodore 128's BASIC, this program is very easy to use.

Because File Viewer is written entirely in machine language, it must be typed in using the "MLX" machine language entry program found elsewhere in this issue. Be sure to read and understand the instructions for using MLX before you begin entering the data for File Viewer. When you run MLX, you'll be asked for a starting address and an ending address for the data you'll be entering. Here are the addresses for File Viewer:

Starting address: 1350
Ending address: 17E7

When you finish entering the data, be sure to save a copy to disk before you leave MLX. Once you have a completed copy of File Viewer on disk, you can activate it with a command of the form:

BOOT "FILE VIEWER",D*drive*,U*device*

Of course, you should replace FILE VIEWER in this statement with the filename you used when saving the data with MLX. If your disk drive is device 8, the normal device number for Commodore drives, you can omit everything after the closing quotation mark (just use BOOT "FILE VIEWER"). The first optional parameter is used to specify the drive number for dual-drive systems with drive 1 in addition to drive 0. (Commodore 1541 and 1571 drives are always drive 0.) The second parameter is used to specify a device number other than 8. For instance, BOOT "FILE VIEWER",D0,U9 boots the program from a disk in a drive addressed as device 9.

When the familiar READY prompt reappears, File Viewer has been installed and is ready to use. (Note that pressing the reset switch deactivates File Viewer.) This program works as an extension of the Commodore 128's BASIC, so it's as easy to use as any other BASIC statement. Here is the general syntax:

VIEW *"filename,type"*,D*drive*,U*device*

Again, the last two parameters are not needed if you are using a single 1541 or 1571 disk drive addressed as device 8.

The *type* parameter is also optional in most cases, since File Viewer ordinarily determines for itself whether the file is a sequential or program file. If necessary, however, you can specify the type by including an *S* for sequential files or a *P* for program files. For instance, the statement VIEW "SAMPLE,S" displays the contents of the sequential file SAMPLE, while VIEW "SAMPLE,P" displays the contents of a program file of the same name.

File Viewer ordinarily reads and displays the entire file. You can slow the display by pressing the Commodore key or pause it completely by pressing NO SCROLL. Press STOP if you wish to terminate the display before you reach the end of the file.

Disassembly

To aid machine language programmers, File Viewer also includes a disassembly option. Here's the syntax to use:

VIEW *"filename,M"*

The *M* stands for machine language. It's not a Commodore file type, but simply a signal to File Viewer that you wish to disassemble the file rather than print it to the screen. When you choose this option, File Viewer reads the file from disk and disassembles it to the screen in standard 6502 assembler

format. Just as with the display option, you can slow the disassembly with the Commodore key, pause it with NO SCROLL, or cut it off by pressing STOP.

Redirecting Output

In most cases you'll want to look at a file on the screen. However, File Viewer also lets you divert the normal screen output to a printer or other peripheral device. This option is most useful for machine language disassemblies, since it allows you to create a hardcopy printout of the program which can be studied at leisure. However, you can also use it as a quick way to print a text file without loading it into memory.

Diverting output requires that you open a logical file to the desired device. For instance, say that you want to send the contents of a file to the printer. The statement OPEN 1,4 opens logical file 1 to the printer (which is usually device 4). Once the logical file is open, you must tell File Viewer where to send its output. This is done by adding the logical file number to the VIEW statement:

VIEW# ***file number,"filename,type",***
D*drive*, U*device*

The logical file number must match the one you used when you opened the logical file, and must be in the range 1–127. As with normal format for the statement, the type, drive number, and device number parameters are optional. For example, if you open a file to the printer with OPEN 1,4, this statement makes a hardcopy printout of the file SAMPLE from a disk in the drive addressed as device 8:

```
VIEW#1, "SAMPLE"
```

In special cases, you may wish to divert output to a disk file, or even to a modem via the RS-232 interface. File Viewer isn't picky about where it sends output, as long as you have properly opened a logical file to the device. The *Commodore 128 System Guide* explains the syntax needed to open a file to disk or RS-232 interface.

Special Concerns

The VIEW statement works only in direct mode; you should not attempt to add it to a program. VIEW does not accept string or numeric variables in place of its parameters (you can't use a statement like F$ = "SAMPLE": VIEW F$).

The file display mode of File Viewer is intended primarily for looking at text files—that is, files that consist of printable character codes. It is possible to view other types of files such as tokenized BASIC programs, but the display may be difficult or impossible to read in such cases. For instance, if the file contains values equivalent to control-code characters, displaying the file may clear the screen, change the printing color, and so forth. If you try to print a hardcopy of such a file, some of the values may be interpreted as spurious printer control codes, causing strange behavior such as unwanted form feeds or a change in printing mode. Similarly, disassembling a file that doesn't contain a machine language program produces meaningless results, but does no real harm.

The machine language for File Viewer occupies memory locations 4944–6114 ($1350–$17E2). If you disturb the contents of this area while File Viewer is active, the computer will probably lock up. The program also uses locations 4864–4937 ($1300–$1349) and 250–254 ($FA–$FE) for temporary storage. You may use these locations for your own purposes; however, every VIEW statement will overwrite the contents of these areas.

File Viewer also maintains a six-byte bank-switching routine beginning at location 2048 ($0800) in both banks 0 and 1. This is necessary because some BASIC errors may occur while the system is operating in bank 1. In bank 0, this area is at the bottom of the BASIC runtime stack, where it isn't likely to be disturbed unless you run a program that uses a very large number of nested GOSUBs or FOR-NEXT loops. To accommodate this routine in bank 1, File Viewer bumps the start of variables up to address 2054 ($0806) when you first BOOT the program, thereby protecting the bank 1 copy of the switching routine from being destroyed by the system. This results in a slight reduction of the amount of space available for scalar variables, but should have no noticeable effect on the operation of BASIC.

128 File Viewer

Please refer to the "MLX" article in this issue before entering the following program.

```
1350:20 97 13 20 FA 51 78 A9 88
1358:6F 8D 14 03 A9 13 8D 15 16
1360:03 58 A9 56 8D 00 0A A9 E2
1368:13 8D 01 0A 4C 03 40 A0 CB
1370:06 88 30 1B B9 00 08 D9 2B
1378:C9 13 F0 F5 20 97 13 BA 06
1380:A9 00 9D 01 01 A9 13 9D B1
1388:07 01 A9 91 9D 06 01 4C 14
1390:65 FA A2 10 4C 29 14 A0 4D
1398:06 A9 08 8D 01 03 85 FB 21
13A0:85 30 A9 00 8D 00 03 85 C2
13A8:FA 84 2F A9 EF 8D 27 03 F4
13B0:A9 79 8D 26 03 88 A9 FA A6
13B8:8D B9 02 A2 01 B9 C9 13 14
13C0:91 FA 20 77 FF 88 10 F3 20
13C8:60 8D 03 FF 4C CF 13 20 CA
13D0:51 16 E0 0B D0 53 A0 FF 07
13D8:A2 04 A5 3E 85 FB A5 3D 8E
13E0:38 E9 04 85 FA B0 02 C6 DB
13E8:FB C8 CA 30 09 B9 36 14 4B
13F0:D1 FA F0 F5 D0 1C 24 7F FA
13F8:30 21 A0 00 C6 FA 30 3A 50
1400:B1 FA C9 20 F0 F4 C9 3A 24
1408:D0 08 F0 2E A2 0E 2C A2 E3
1410:17 2C A2 0B 2C A2 09 2C FD
1418:A2 04 2C A2 22 2C A2 08 51
1420:2C A2 05 2C A2 1E 2C A2 F2
1428:80 86 FC 20 A3 17 20 97 25
1430:13 A6 FC 4C 3F 4D 56 49 15
1438:45 57 20 51 16 20 86 03 33
1440:C9 23 D0 32 20 46 17 90 2C
1448:06 C9 2C F0 0E D0 C3 29 DE
1450:0F 20 27 17 20 80 03 D0 38
1458:EE F0 B7 E6 3D A5 FC F0 05
1460:AB 30 A9 20 59 FF 90 04 91
1468:A2 03 D0 C7 85 FE E0 04 27
1470:90 A3 A2 00 86 FC A6 98 2C
1478:E0 0A 90 04 A2 01 D0 B3 54
1480:20 CC FF 20 87 16 C9 2C 42
1488:F0 09 A2 3F 86 FB D0 1C 95
1490:4D 50 53 C8 A2 02 B1 3D 28
1498:DD 90 14 F0 06 CA 10 F6 D7
14A0:4C 12 14 E6 3D E6 3D 88 EC
14A8:85 FB B1 3D 20 B4 16 20 BC
14B0:90 03 F0 07 C9 22 D0 E8 D1
14B8:20 D4 16 A5 FC D0 04 A9 20
14C0:08 85 FC A0 02 98 20 59 04
14C8:FF B0 04 A8 C8 10 F6 85 22
14D0:FD 85 05 20 53 17 A5 FE 3D
14D8:F0 0A A9 17 8D 27 03 A9 5B
14E0:B0 8D 26 03 20 DB 17 A4 FC
14E8:FB C0 53 F0 0F C0 50 F0 C5
14F0:21 C0 4D D0 03 4C A8 15 40
14F8:C9 01 F0 16 20 D2 FF 8A 9C
1500:20 D2 FF 20 CF FF 24 90 48
1508:08 20 D2 FF 68 20 6E 16 4F
1510:D0 F1 A0 20 A9 6A 85 FA 32
1518:A9 51 85 FB B1 FA 99 00 88
1520:13 88 10 F8 A9 05 8D 1B 1F
1528:13 C8 B9 CF 17 99 21 13 B6
1530:C8 C0 06 90 F5 A9 0D 20 49
1538:D2 FF A0 03 20 CF FF 99 E9
1540:FA 00 88 10 F7 24 90 08 73
1548:68 20 6E 16 C8 B9 FA 00 01
1550:99 64 00 C0 01 90 F5 A2 45
1558:90 38 20 75 8C 20 44 8E 30
1560:20 E2 55 A9 20 20 D2 FF BF
1568:20 CF FF F0 C8 C9 CE F0 A1
1570:25 C9 FE F0 24 30 15 20 BA
1578:D2 FF C9 22 D0 EA 20 CF A9
1580:FF F0 B2 20 D2 FF C9 22 8B
1588:F0 DE D0 F2 AA A9 44 A0 51
1590:17 20 00 13 D0 D2 A0 C9 5C
1598:2C A0 09 20 CF FF 09 80 35
15A0:18 E9 01 AA A9 46 D0 E9 0E
15A8:48 A0 49 B9 0F B6 99 00 6A
15B0:13 88 10 F7 A9 FB 8D 3F 9F
15B8:13 A9 FA 8D 45 13 A9 13 EB
15C0:8D 34 13 A9 3E 8D 33 13 5D
15C8:68 85 FA 85 66 86 FB 86 0C
15D0:67 A9 0D 20 D2 FF 20 9B 2F
```

```
15D8:B8 A9 2D 20 D2 FF 20 CF 18
15E0:FF 24 90 08 48 20 A5 B8 6D
15E8:68 A0 00 84 67 84 68 99 6F
15F0:06 00 20 59 B6 48 AE AB 97
15F8:0A 86 FC C8 CA 30 0C 20 45
1600:CF FF 99 06 00 20 A5 B8 2C
1608:4C FB 15 A9 12 20 60 16 7E
1610:68 A2 03 20 A1 B6 A2 06 AE
1618:86 66 20 00 13 A9 20 20 C4
1620:60 16 A9 3B 20 D2 FF A0 D7
1628:00 E6 FC B9 06 00 48 29 33
1630:7F C9 20 68 B0 02 A9 20 1A
1638:20 D2 FF C8 C4 FC 90 EB DC
1640:68 20 6E 16 A6 FB A5 FA 43
1648:18 65 FC 90 01 E8 4C C9 90
1650:15 A9 00 A0 04 99 FA 00 F7
1658:88 10 FA 85 05 85 7A 60 18
1660:38 E5 EC A8 A9 20 20 D2 2B
1668:FF 88 D0 FA 18 60 48 28 7B
1670:70 12 20 E1 FF F0 01 60 A1
1678:A5 FE F0 05 A9 0D 20 D2 3A
1680:FF 4C 24 14 4C 27 14 20 CC
1688:86 03 C9 22 F0 02 D0 5B A0
1690:A9 30 8D 00 11 A9 3A 8D 80
1698:01 11 E6 3D B1 3D F0 13 B1
16A0:C9 22 F0 0F C9 2C F0 0B 35
16A8:99 02 11 C8 C0 11 D0 EC A9
16B0:4C 0F 14 60 48 C0 00 D0 65
16B8:03 4C 1E 14 98 48 A9 2C E3
16C0:99 02 11 C8 A5 FB 99 02 3B
16C8:11 C8 84 FA 18 68 65 3D 5A
16D0:85 3D 68 60 20 37 17 C9 F7
16D8:44 F0 06 C9 55 F0 1C D0 38
16E0:0A 20 46 17 90 0B 20 3A 7F
16E8:17 B0 10 4C 12 14 4C 0C 19
16F0:14 8D 00 11 C9 32 B0 F6 0B
16F8:20 37 17 C9 55 D0 EC 20 6A
1700:46 17 B0 E7 F0 E5 29 0F 2C
1708:85 FC 20 80 03 F0 0A B0 E4
1710:DA 29 0F 20 27 17 4C 0A 12
1718:17 A5 FC C9 08 B0 03 4C CC
1720:15 14 C9 1F B0 F9 60 48 7F
1728:A5 FC 0A 0A 65 FC 0A 85 03
1730:FC 68 65 FC 85 FC 60 20 74
1738:80 03 F0 14 C9 2C F0 03 AA
1740:4C 12 14 4C 80 03 20 80 31
1748:03 C9 30 F0 F9 4C 86 03 90
1750:68 68 60 A9 00 8D 00 FF A9
1758:AA 20 68 FF A5 FA A0 11 5C
1760:20 BD FF A5 05 A6 FC A4 C9
1768:FD 20 BA FF 20 0F F5 E6 05
1770:B7 E6 B7 20 C0 FF B0 28 BC
1778:A6 05 20 C6 FF 20 CF FF CB
1780:48 A9 02 24 90 D0 16 20 D3
1788:CF FF AA 68 20 D4 17 20 1D
1790:7D FF 0D 56 49 45 57 49 DB
1798:4E 47 0D 00 60 4C 18 14 D9
17A0:4C 21 14 20 CC FF A5 05 78
17A8:20 C3 FF A5 FE 4C C3 FF E2
17B0:20 D4 17 20 CC FF A6 FE BB
17B8:20 C9 FF 20 DB 17 20 79 60
17C0:EF 20 CC FF A6 05 20 C6 D8
17C8:FF 20 DB 17 4C 79 EF 29 3D
17D0:7F 4C D2 FF 85 41 86 42 AC
17D8:84 43 60 A5 41 A6 42 A4 4E
17E0:43 60 00 00 00 00 00 00 C8
```

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Filedump For IBM PC/PCjr

Harry Faulkner

A file-dump program is useful for anyone who needs to examine the contents of a disk file in detail. This utility was designed originally for use with accounting files, but it can display the contents of any sequential or random disk file. The program runs on any IBM PC with BASICA or MS-DOS computer with compatible BASIC.

Have you ever needed to examine the contents of a disk file? There are MS-DOS commands, DEBUG and TYPE, that provide limited access. The TYPE command displays a file by printing each byte as an ASCII character. DEBUG is somewhat more flexible, but it displays bytes only in ASCII and hexadecimal form.

"Filedump" provides more options than either of these commands. It lets you look at any random or sequential disk file and send the output to either a monitor or a printer. It displays each byte in ASCII form (if it is printable) and prints its integer, single-precision, and double-precision value. The program also allows you to start at any position within the file.

I wrote this program while developing home accounting programs that use both random and sequential files. I needed a way to see if the programs were writing data to the correct places in these files, without having to run the program to get output. The program was written on a Leading Edge IBM-compatible computer; it runs without modification on the IBM PC with BASICA or PCjr with Cartridge BASIC.

Filedump For IBM PC/PCjr

For instructions on entering this program, please refer to "COMPUTE!'s Guide to Typing In Programs" elsewhere in this issue.

```
GI 70 GOSUB 1000    'Initialize t
      he field and obtain file f
      or opening
KM 80 RETRY=0
ON 100 COUNT=1:EIGHT$=SPACE$(8):
       FOUR$=SPACE$(4):TWO$=SPAC
       E$(2):ONE$=SPACE$(1):EIGH
       TTEMP$=SPACE$(8):FOURTEMP
       $=SPACE$(4):TWOTEMP$=SPAC
       E$(2)  'initialize variab
       les
ME 110      WHILE NOT EOF(1)
KH 120      GET #1
KI 125      IF COUNT<IST GOTO 190
HH 130      LSET ONE$=INCHAR$
MH 140      EIGHTTEMP$=RIGHT$(EIG
       HT$,7):EIGHT$=EIGHTTEMP$+
       INCHAR$:  'Add new charac
       ter to right end of strin
       gs
HI 150      FOURTEMP$=RIGHT$(FOUR
       $,3):FOUR$=FOURTEMP$+INCH
       AR$
AE 160      TWOTEMP$=RIGHT$(TWO$,
       1):TWO$=TWOTEMP$+INCHAR$
```

```
KP 170      INTEGER=CVI(TWO$):SGL
            PRE!=CVS(FOUR$):DBLPRE#=C
            VD(EIGHT$)
LL 180      GOSUB 2000
PI 190      COUNT=COUNT+1
DN 200      WEND
HM 205 IF COUNT<=IST THEN PRINT
            "STARTING BYTE, ";IST;",
            PAST ENDING BYTE, ";COUNT
            -1;", OF FILE.":PRINT "PL
            EASE TRY AGAIN.":CLOSE #1
            :RETRY=1:GOSUB 1014
OP 206 IF RETRY>0 THEN GOTO 80
MH 210 IF POPT%<>1 THEN LPRINT:L
            PRINT:LPRINT,TAB(10),"End
             of file": ELSE PRINT:PRI
            NT:PRINT, TAB(10),"End of
             file"
IC 220 CLOSE #1:END
MM 1000 REM *** Initialize print
            out, get filename, and i
            nitialize field  ***
EK 1005 ON ERROR GOTO 1100
MC 1010 CLS
JN 1012 INPUT "Enter name of fil
            e to be dumped? ",FILE$
IA 1014 OPEN FILE$ FOR INPUT AS
            #1:CLOSE #1:OPEN FILE$ A
            S #1 LEN=1 : FIELD #1, 1
             AS INCHAR$
LH 1016 INPUT "Starting byte #:
            ",IST
LI 1021 PRINT "Output device: (M
            ) monitor"
EG 1023 PRINT "                (P
            ) printer"
HP 1025 INPUT "       Choice: ",
            POPT$:POPT%=CINT(INSTR("
            MmPp",POPT$)/2):IF POPT%
            <1 OR POPT%>2 THEN BEEP:
            PRINT"Invalid entry. Cho
            ose M or P": GOTO 1025
EH 1030 IF POPT%=1 THEN CLS:GOSU
            B 1500   'Initialize scr
            een or printer
FC 1035 IF POPT%=2 THEN GOSUB 15
            00   'Initialize screen
            or printer
IH 1040 RETURN
IC 1100 IF ERR=53 THEN PRINT "Fi
            le, ";FILE$;", not found
            . Please try again.":BEE
            P:RESUME 1012
KN 1110 PRINT "Error # ";ERR;" o
            ccurred at line ";ERL
HJ 1120 END
FJ 1500 REM *** Subroutine to pr
            int header line ***
NG 1510 INIT$="  BYTE #      Char
            .      Int.      Sgl. Prec
            is. val.      Dbl. Precis
            . val."
AC 1520 IF POPT%=1 THEN PRINT IN
            IT$:PRINT
GJ 1530 IF POPT%=2 THEN LPRINT I
            NIT$:LPRINT
JB 1540 RETURN
ED 2000 REM *** Subroutine to ou
            tput values.    ***
CB 2010 REM *** This sub outputs
             15 lines to the monitor
             and 50 lines to the
PL 2020 REM *** printer then ask
            s if the user wants to o
            utput more data.
JM 2030 IF POPT%=1 THEN PRINT TA
            B(5); COUNT; TAB(17); ON
            E$;
KL 2040 IF POPT%=2 THEN LPRINT T
            AB(5); COUNT; TAB(17); O
            NE$;
DP 2050 IF COUNT>1 AND POPT%=1 T
            HEN PRINT TAB(23); INTEG
            ER;
ED 2060 IF COUNT>1 AND POPT%=2 T
            HEN LPRINT TAB(23); INTE
            GER;
KM 2070 IF COUNT>3 AND POPT%=1 T
            HEN PRINT TAB(34); SGLPR
            E!;
JC 2080 IF COUNT>3 AND POPT%=2 T
            HEN LPRINT TAB(34); SGLP
            RE!;
QI 2090 IF COUNT>7 AND POPT%=1 T
            HEN PRINT TAB(55); DBLPR
            E#;
MD 2100 IF COUNT>7 AND POPT%=2 T
            HEN LPRINT TAB(55); DBLP
            RE#;
EK 2110 IF POPT%=1 THEN PRINT
GB 2120 IF POPT%=2 THEN LPRINT
PM 2130 IF POPT%=1 AND ((COUNT-I
            ST+1) MOD 15) =0 THEN GO
            SUB 2500
NB 2140 IF POPT%=2 AND ((COUNT-I
            ST+1) MOD 50) =0 THEN GO
            SUB 2500
JN 2150 RETURN
EL 2500 REM *** Subroutine to qu
            ery for more output    **
            *
HE 2510 LOCATE ,,1:PRINT:PRINT "
            Hit A to abort, any othe
            r key for more ";  'turn
             cursor on
MO 2520 EN$=INKEY$:IF EN$="" GOT
            O 2520
DC 2530 IF INSTR("Aa",EN$) > 0 T
            HEN RETURN 220
HN 2540 IF POPT%=1 THEN CLS
GE 2550 GOSUB 1500
KI 2560 RETURN                  ©
```


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DOS Calc

Steve Kelly

This convenient, menu-driven utility for the Commodore 64 includes all the disk functions of the familiar "DOS Wedge" program, plus a powerful scientific calculator. A disk drive is required to use the program's DOS functions.

"DOS Calc" is two programs in one. Not only is it a complete replacement for the "DOS Wedge" program supplied on the 1541 or 1571 *Test/Demo* disk, but it has a built-in scientific calculator. The program is entirely menu-driven and employs easy-to-use, pop-down windows.

DOS Calc is written in machine language, so you must enter it with "MLX," the machine language entry program found elsewhere in this issue. Here are the addresses you need to type and save the program with MLX:

Starting address: 0801
Ending address: 16E8

After you have saved a copy of DOS Calc, it can be loaded and run just like any BASIC program. When you run it, DOS Calc relocates itself to the safe memory area beginning at address 49152, a process that takes only an instant.

Once the READY prompt returns, DOS Calc is ready to use. Like the "DOS Wedge," DOS Calc works only in immediate mode (when you are not running a program). To enter DOS Calc, type @ and press RETURN. DOS Calc displays the main menu window with the following selections:

A. Exit
B. Directory
C. Load
D. Load relocated
E. Save
F. Resave
G. Bsave
H. Re-Bsave
I. Scratch
J. Rename
K. Copy
L. Validate
M. Initialize
N. Read error channel
O. New a disk
P. Calculator

To select a function from the main menu, simply press the letter shown next to the function you want. For instance, pressing A exits DOS Calc and returns you to BASIC. When you choose any other function, DOS Calc opens a new screen window in which the interaction for that function takes place.

Directory

The directory function (B) is perhaps the most frequently used DOS function. When you press B, DOS Calc opens a window and prompts you to enter a wildcard specification. As a convenience, it prints the asterisk (*) wildcard in the window. If you wish to view all the files on the disk, simply press RETURN. To view only selected files, change the wildcard accordingly.

For example, suppose that you want to see all the files beginning with GAME. Type GAME* and press RETURN. After you enter the wildcard, DOS Calc opens a third window which contains all the requested directory information. To exit this window and return to the main menu, press A. If the disk contains more files than will fit in the window, you can press B to view the next page of the directory. Press C to enter a new wildcard and begin a new directory search.

File Functions

The next eight DOS functions all concern existing files. They are Load, Load Relocated, Resave, Bsave, Re-Bsave, Scratch, Rename, and Copy. After you select any of these functions from the main menu, DOS Calc asks you to enter the name of the file you wish to manipulate. If you enter a null filename (no name), DOS Calc automatically displays the directory for the current disk. This directory differs from the normal directory display, however, in that each filename is prefaced by a letter. To select a file for the current function, simply press the letter key that appears in front of the filename. If you change your mind and decide not to complete the operation, press A to exit.

For instance, let's try the Resave command, which deletes an existing program from disk and replaces it with the BASIC program currently in memory. When you choose Resave from the main menu, DOS Calc opens a window asking for a filename. If you press RETURN without entering a name, DOS Calc opens a secondary directory window from which you can select the file by pressing a single key. Once this is done, the program completes the resave. You should avoid using any wildcards in the directory function when it appears as part of a Resave or Re-Bsave command.

The Copy and Rename commands require two filenames. The

first name you enter is used as the name of the new file for the Copy command or the new name of the existing file for the Rename command. This name must be typed in (it cannot be derived from the directory). The second name indicates the original file; this name can be taken from the directory.

DOS Calc provides two functions that are not included in the "DOS Wedge" program. The B in Bsave and Re-Bsave stands for binary, indicating a binary file containing machine language, graphics data, or something other than a BASIC program. Since these functions save a designated area of memory, you must supply two addresses: the beginning and ending addresses of the area to be saved.

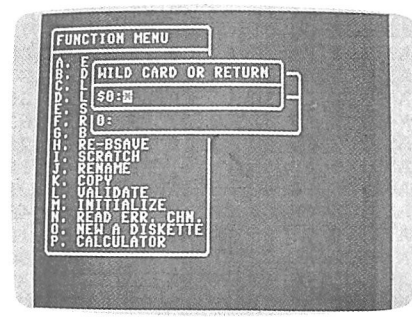
The Validate, Initialize, and Read Error Channel commands require little explanation. Since no information is required for these commands, DOS Calc simply performs them without any introductory prompts. The New command, which formats a disk, requires either one or two items of information. The first item—the disk name—is mandatory. To reformat an already formatted disk, you can supply a new disk name without anything else. To format a disk that has never been used, you must supply a two-character disk ID after the disk name, separating the two items with a comma.

For additional information on DOS operations, refer to the user's manual for your disk drive.

Scientific Calculator

DOS Calc also includes a built-in calculator which is very useful for math, engineering, and various scientific applications. This calculator is different from the familiar pocket calculators used by most people. It uses a notation called *Reverse Polish Notation* (RPN), which allows you to solve complex formulas without parentheses.

When you select the calculator from the main menu, two secondary windows appear on the screen. On the right is the function window, which lists all the calculator functions preceded, as usual, by the letter key which invokes them. To the left is the result window, which is subdivided into three sections.



"DOS Calc" is entirely menu-driven and employs easy-to-use, pop-down windows.

The result area contains either answers from calculations or keyboard input from you. In the middle is the stack display, which holds intermediate results. The bottom area is a message area where the calculator displays error messages such as *Divide by Zero.*

Notation

Before looking at the calculator functions, let's establish some rules for entering numbers. You can enter any number in either standard notation (2534.56 is an example) or in scientific notation (123E34 is an example). Negative numbers are entered somewhat differently than you might expect, since the minus (−) sign is already used to signify subtraction (see below). Use the shifted minus sign (hold down SHIFT and press the minus key) as a substitute. The second trick has to do with the *E* symbol used in scientific notation. This calculator also uses the letter *E* for another function (it causes the stack to wrap down; see below). As a substitute, use the ↑ symbol (the up-arrow key directly to the right of the asterisk). Whenever you enter ↑ as part of a number, DOS Calc puts an *E* in the number you are entering.

Examples

To start with an easy exercise, let's look at how to perform 2 + 5. In RPN there is no need for an equal sign (=). In this case, you enter both numbers followed by the plus sign (+), which is the operator you wish to use. Press the number 2. DOS Calc prints a 2 in the result window. Now press RETURN. The number 2 shifts to the right and also appears as the top entry in the stack area. Press the number 5. The top line of the result window now shows that number. Press the plus key. The 2 on the stack is replaced by a 0 and the result line displays a 7. Simple arithmetic operations use the same general procedure. To subtract 2 from 5, you would enter the numbers 5 and 2, followed by the minus key.

More complex equations demonstrate the power of an RPN calculator. Let's solve the equation 2048/(8*4). Begin by entering 2048 and pressing RETURN. Now type 8, followed by RETURN, and then a 4. At this point the stack contains all the numbers for the equation, in correct order. Now press the asterisk (*) key to perform multiplication. The result line should display 32. Press the slash (/) to perform division. The calculator displays the final result, which is 64.

Each time you pressed RETURN in this example, the calculator pushed the number from the result line onto the stack. All other numbers were pushed down one location, and the fourth entry on the stack was lost.

There are seven other functions which, like RETURN, have some effect on the calculator's stack. The first is Clear Entry: This function clears the result line and leaves all other entries untouched. The Clear Stack function clears the result line and the entire stack. The next four functions cause the entire stack, including the result line, to *wrap* or *roll* in either direction. A wrap allows either the top or bottom entry to move from top to bottom, or vice versa. A roll causes the top or bottom entry to be lost. The seventh stack function, Exchange, swaps the result line with the top stack entry. This operation is useful if numbers are entered in the wrong order and need to be corrected.

All the remaining functions are standard math operations which operate on the result line. Except for Power and Pi, these functions affect only the result line. The Power function raises the number on the top of the stack to the power specified in the result line; the answer is left on the result line and the stack shifts up one location. The Pi function enters the value of *pi* (3.1415926) in the result line just as if you had typed it from the keyboard.

Using an RPN calculator may seem strange at first, but once you become familiar with its powerful features, you may never want to go back to using a simple pocket calculator.

DOS Calc

Please refer to the "MLX" article in this issue before entering the following program.

```
0801:0B 08 0A 00 9E 32 30 36 2E
0809:31 00 00 00 A0 00 A2 10 0C
0811:A9 00 85 FB A9 C0 85 FC BE
0819:A9 01 85 FD A9 08 85 FE 46
0821:B1 FD 91 FB C8 D0 F9 E6 DF
0829:FE E6 FC CA D0 F2 4C 31 DA
0831:C0 AD 08 03 8D AA C0 AD 84
0839:09 03 8D AB C0 A9 4D 8D CF
0841:08 03 A9 C0 8D 09 03 A9 97
0849:FF 8D 6A C1 60 A5 3A C9 FD
0851:FF F0 03 6C AA C0 AD 00 78
0859:02 C9 40 D0 F6 A9 8E 20 8D
0861:D2 FF A9 13 A0 01 A2 01 90
0869:20 84 C1 A9 AD A0 C0 20 0F
0871:E9 C1 A9 BB A0 C0 38 20 70
0879:FB C1 20 66 C2 A9 00 8D AC
0881:AC C0 8D BD CE A9 20 8D 90
0889:8C CE A9 41 A0 52 20 12 7D
0891:C3 AA BD 4A C1 8D 9F C0 CE
0899:BD 4B C1 8D A0 C0 20 E2 97
08A1:FC 4C 7D C0 20 6C C2 6C A3
08A9:02 A0 00 00 00 46 55 4E F4
08B1:43 54 49 4F 4E 20 4D 45 69
08B9:4E 55 FF 45 58 49 54 00 2B
08C1:44 49 52 45 43 54 4F 52 41
08C9:59 00 4C 4F 41 44 00 4C 6C
08D1:4F 41 44 20 52 45 4C 4F F3
08D9:43 41 54 45 44 00 53 41 C4
08E1:56 45 00 52 45 53 41 56 E3
08E9:45 00 42 53 41 56 45 00 08
08F1:52 45 2D 42 53 41 56 45 D7
08F9:00 53 43 52 41 54 43 48 96
0901:00 52 45 4E 41 4D 45 00 FE
0909:43 4F 50 59 00 56 41 4C 58
0911:49 44 41 54 45 00 49 4E 51
0919:49 54 49 41 4C 49 5A 45 A3
0921:00 52 45 41 44 20 45 52 04
0929:52 2E 20 43 48 4E 2E 00 FF
0931:4E 45 57 20 41 20 44 49 05
0939:53 4B 45 54 54 45 00 43 B0
0941:41 4C 43 55 4C 41 54 4F 24
0949:52 FF A4 C0 3B C9 DD CA AC
0951:DA CA 6D CB 6A CB 64 CB 05
0959:67 CB 63 CC E0 CC DD CC 0E
0961:54 CD 58 CD 60 CD 5A CE B6
0969:2C C5 FF 00 41 00 00 00 0D
0971:00 00 00 00 00 00 00 00 83
0979:00 00 00 0A 0D 0E A0 A8 B6
0981:B0 A4 AC B4 48 8A EE 6A AA
0989:C1 AE 6A C1 9D 72 C1 8D 59
0991:6B C1 98 9D 75 C1 68 9D D7
0999:78 C1 E0 00 D0 26 AD A7 96
09A1:02 8D 70 C1 AD A7 02 8D DF
09A9:6F C1 AD A7 02 8D 71 C1 FE
09B1:38 20 F0 FF 8E 6D C1 8C 40
09B9:6E C1 A9 00 8D A7 02 A9 61
09C1:00 8D A7 02 A9 04 85 FC B1
09C9:AE 6A C1 BD 7E C1 85 FE E6
09D1:20 AC C2 AD 6A C1 D0 05 53
09D9:A9 93 20 D2 FF 20 F9 C2 0E
09E1:A9 00 20 CF C2 20 F6 C2 11
09E9:60 A2 41 8E 6C C1 18 20 A0
09F1:FB C1 A9 02 20 CF C2 20 AD
09F9:F6 C2 60 85 FB 84 FC A9 32
0A01:18 90 02 A9 38 8D 15 C2 05
0A09:A9 62 20 D2 FF AC 6A C1 05
0A11:BE 78 C1 CA CA 18 90 16 75
0A19:AD 6C C1 20 D2 FF A9 2E 71
0A21:20 D2 FF A9 20 20 D2 FF BB
0A29:EE 6C C1 CA CA CA A0 00 77
0A31:B1 FB F0 07 C9 FF F0 03 DE
0A39:C8 D0 02 A9 20 20 D2 FF E7
0A41:CA D0 ED B1 FB 85 FD 84 3E
0A49:FE A9 62 20 D2 FF 20 F6 63
0A51:C2 A5 FD D0 10 E6 FE 18 2F
0A59:A5 FB 65 FE 85 FB 90 02 1B
0A61:E6 FC 4C 08 C2 60 A9 04 21
0A69:20 CF C2 60 AE 6A C1 BD 40
0A71:7E C1 85 FC A9 04 85 FE 1D
0A79:20 AC C2 CE 6A C1 AE 6A 30
0A81:C1 E0 FF F0 0A BD 72 C1 AB
0A89:8D 6B C1 20 F9 C2 60 AD C2
0A91:6F C1 8D A7 02 AD 70 C1 63
0A99:8D A7 02 AD 71 C1 8D A7 CE
0AA1:02 AE 6D C1 AC 6E C1 18 E6
0AA9:20 F0 FF 60 A5 01 29 FE 92
0AB1:85 01 A0 00 84 FB 84 FD F7
0AB9:A2 04 B1 FB 91 FD C8 D0 FC
0AC1:F9 E6 FC E6 FE CA D0 F2 52
0AC9:A5 01 09 01 85 01 60 48 5B
0AD1:AA BD F0 C2 20 D2 FF AC ED
0AD9:6A C1 BE 78 C1 CA CA A9 6B
0AE1:60 20 D2 FF CA D0 F8 68 7C
0AE9:AA BD F1 C2 20 D2 FF 60 D9
0AF1:75 69 AB B3 6A 6B EE 6B 16
0AF9:C1 AE 6A C1 BD 7B C1 8D F0
0B01:A7 02 BC 75 C1 AE 6B C1 BB
0B09:18 20 F0 FF 60 A9 41 AC 2A
0B11:6C C1 85 FB 84 FC 20 E4 7B
0B19:FF C9 00 F0 F9 C5 FB 90 20
0B21:F5 C5 FC B0 F1 38 E5 FB 86
0B29:0A 60 48 A9 8F 85 FB A9 34
0B31:CE 85 FC 68 85 FD 18 20 AA
0B39:F0 FF A9 00 85 FE A5 C6 37
0B41:85 CC F0 FA 78 A5 CF F0 06
0B49:0C A5 CE AE 87 02 A0 00 19
0B51:84 CF 20 13 EA 58 20 E4 B0
0B59:FF C9 14 F0 21 C9 0D F0 AE
0B61:39 C9 20 90 D9 C9 60 B0 FA
0B69:D5 A6 FD E4 FE F0 CF AC 2A
0B71:BD CE 91 FB 20 D2 FF E6 3F
0B79:FE EE BD CE D0 C0 A4 FE 41
0B81:F0 BC C6 FE CE BD CE 88 9B
0B89:A9 9D 20 D2 FF A9 20 20 14
0B91:D2 FF A9 9D 20 D2 FF 4C B8
0B99:3E C3 A6 FE AC BD CE F0 6F
0BA1:0C A9 20 88 D1 FB D0 04 D8
0BA9:88 CA D0 F8 C8 8C BD CE 23
0BB1:8A 60 46 55 4E 43 54 49 B4
0BB9:4F 4E 53 3A FF 45 58 49 28
0BC1:54 00 43 4C 45 41 52 20 23
0BC9:45 4E 54 52 59 00 43 4C 63
0BD1:45 41 52 20 53 54 41 43 D8
0BD9:4B 00 57 52 41 50 20 55 86
0BE1:50 00 57 52 41 50 20 44 FF
0BE9:4F 57 4E 00 52 4F 4C 4C FB
0BF1:20 55 50 00 52 4F 4C 4C 2C
0BF9:20 44 4F 57 4E 00 45 58 E5
0C01:43 48 41 4E 47 45 00 43 6C
0C09:48 41 4E 47 45 20 53 49 6E
0C11:47 4E 00 49 4E 54 45 47 8A
0C19:45 52 00 53 51 55 41 52 52
0C21:45 20 52 4F 4F 54 00 50 3F
0C29:4F 57 45 52 00 50 49 00 60
0C31:53 49 4E 45 00 43 4F 53 62
0C39:49 4E 45 00 54 41 4E 47 BD
0C41:45 4E 54 00 41 52 43 54 48
0C49:41 4E 47 45 4E 54 00 44 DA
0C51:45 47 2D 3E 52 41 44 00 87
0C59:52 41 44 2D 3E 44 45 47 1B
0C61:00 4C 4F 47 2F 45 00 45 BE
0C69:58 50 2F 45 FF 53 54 41 33
0C71:43 4B 3A 00 00 00 00 00 45
0C79:00 00 00 00 FF 52 45 53 B8
0C81:55 4C 54 3A 00 00 00 FF 85
0C89:4D 45 53 53 41 47 45 53 3E
0C91:3A FF 49 4C 4C 45 47 41 FB
0C99:4C 20 51 55 41 4E 54 49 94
0CA1:54 59 FF 4F 56 45 52 46 E1
0CA9:4C 4F 57 FF 44 49 56 49 E3
0CB1:53 49 4F 4E 20 42 59 20 71
0CB9:5A 45 52 4F FF 55 4E 4B CC
0CC1:4E 4F 57 4E FF 00 00 00 A4
0CC9:00 00 00 00 00 00 00 00 E1
0CD1:00 00 00 00 00 00 00 00 E9
0CD9:00 00 00 00 00 00 41 42 B6
0CE1:43 44 45 46 47 48 49 4A F1
0CE9:4B 4C 4D 4E 4F 50 51 52 F9
0CF1:53 54 55 2B 2D 2A 2F 0D A3
0CF9:AE C6 BF C6 DB C6 EC C6 1A
0D01:F8 C6 04 C7 20 C7 3C C7 A6
0D09:53 C7 5B C7 60 C7 65 C7 5B
0D11:77 C7 88 C7 8D C7 92 C7 DE
0D19:97 C7 9C C7 B1 C7 BA C7 EA
0D21:BF C7 7E C6 8A C6 96 C6 AC
0D29:A2 C6 70 C6 A9 12 A0 15 AC
0D31:A2 00 20 84 C1 A9 B2 A0 A3
0D39:C3 20 E9 C1 A9 BD A0 C3 DF
0D41:38 20 FB C1 20 66 C2 A9 E4
0D49:13 A0 01 A2 00 20 84 C1 AA
0D51:A9 7D A0 C4 20 E9 C1 A9 D5
0D59:6D A0 C4 18 20 FB C1 A9 8A
0D61:02 20 CF C2 20 F6 C2 A9 B6
0D69:88 A0 C4 18 20 FB C1 A9 28
0D71:7A A0 C4 18 20 FB C1 20 9F
0D79:66 C2 AD 00 03 48 AD 01 C2
0D81:03 48 A9 78 8D 00 03 A9 08
0D89:C8 8D 01 03 20 DB C6 20 D9
0D91:F1 C7 A9 00 A0 DE 20 12 9E
0D99:C3 6A 48 A9 13 8D 6B C1 3B
0DA1:20 F9 C2 A9 87 A0 C4 18 9D
0DA9:20 FB C1 68 C9 30 90 07 C8
0DB1:C9 3A B0 03 4C 25 C6 C9 D3
0DB9:5E D0 04 A9 45 D0 F5 C9 75
0DC1:DD D0 04 A9 2D D0 ED C9 6C
0DC9:2E F0 E9 C9 14 D0 03 4C 47
0DD1:60 C6 A0 00 A2 1A D9 DE F1
0DD9:C4 F0 06 C8 CA D0 F7 F0 5A
0DE1:B1 C0 0C F0 05 A9 00 8D F1
0DE9:7D C6 98 48 20 D4 C7 68 58
0DF1:0A AA BD F8 C4 8D 08 C6 36
0DF9:BD F9 C4 8D 09 C6 20 C4 4B
0E01:C7 BA CA CA 8E 7A C8 20 C5
0E09:07 C6 B0 03 20 CC C7 4C B0
0E11:8F C5 20 20 20 20 20 20 4E
0E19:20 20 20 20 20 20 20 20 35
0E21:20 30 FF 00 00 48 AD 24 F9
0E29:C6 D0 0B AD 7D C6 D0 06 C7
0E31:20 20 C7 20 00 C8 68 8D E1
0E39:24 C6 AC 23 C6 C0 10 F0 2B
0E41:1C 99 12 C6 C8 8C 23 C6 06
0E49:A9 FF 99 12 C6 A9 03 8D FE
0E51:6B C1 20 F9 C2 A9 12 A0 B8
0E59:C6 18 20 FB C1 4C 92 C5 CC
0E61:AC 23 C6 F0 F8 88 A9 FF C1
0E69:99 12 C6 8C 23 C6 D0 DD 2C
0E71:20 20 C7 20 CC C7 A9 01 7A
0E79:8D 7D C6 38 60 00 20 04 5F
0E81:C7 A0 C4 A9 C5 20 67 B8 13
0E89:18 60 20 04 C7 A0 C4 A9 02
0E91:C5 20 50 B8 18 60 20 04 B4
0E99:C7 A0 C4 A9 C5 20 28 BA AE
0EA1:18 60 20 04 C7 A0 C4 A9 1A
0EA9:C5 20 0F BB 18 60 20 6C 3D
0EB1:C2 20 6C C2 68 68 8D 34
0EB9:01 03 68 8D 00 03 60 20 E9
0EC1:2E C7 A9 FF 8D 7D C6 A9 B5
0EC9:30 8D 12 C6 A9 FF 8D 13 8B
0ED1:C6 A9 00 8D 23 C6 8D 24 08
0ED9:C6 38 60 A2 19 A0 00 98 81
0EE1:99 C5 C4 C8 CA D0 F9 20 0F
0EE9:C7 C6 38 60 20 04 C7 A2 EB
0EF1:D9 A0 C4 20 D4 BB 38 60 24
0EF9:A9 D9 A0 C4 20 A2 BB 20 E4
0F01:20 C7 18 60 A2 14 A0 00 D0
0F09:B9 CA C4 99 C5 C4 C8 CA 86
0F11:D0 F6 A9 00 A8 A2 05 99 FD
0F19:D9 C4 C8 CA D0 F9 38 60 5A
0F21:A2 14 A0 13 B9 C5 C4 99 E2
0F29:CA C4 88 CA D0 F6 A9 00 51
0F31:A8 A2 05 99 C5 C4 C8 CA 24
0F39:D0 F9 38 60 A2 05 A0 00 B5
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0F41:B9 CA C4 99 C5 C4 C8 CA BE
0F49:D0 F6 A2 CA A0 C4 20 D4 BB
0F51:BB 38 60 A5 66 49 FF 85 9F
0F59:66 18 60 20 CC BC 18 60 A8
0F61:20 71 BF 18 60 A0 C4 A9 1E
0F69:CA 20 8C BA 20 C4 C7 20 F5
0F71:7B BF 20 04 C7 18 60 A0 81
0F79:AE A9 A8 20 A2 BB AD 7D 4D
0F81:C6 D0 03 20 20 C7 18 60 4A
0F89:20 6B E2 18 60 20 64 E2 9F
0F91:18 60 20 B4 E2 18 60 20 7B
0F99:0E E3 18 60 A0 C7 A9 AC E4
0FA1:20 A2 BB A0 C4 A9 C5 20 72
0FA9:0F BB 18 60 86 65 2E E0 4E
0FB1:D4 A0 C7 A9 AC 20 28 BA E6
0FB9:18 60 20 EA B9 18 60 20 BD
0FC1:ED BF 18 60 A0 C4 A9 C5 01
0FC9:20 A2 BB 60 A2 C5 A0 C4 50
0FD1:20 D4 BB 60 AD 24 C6 F0 2F
0FD9:17 A9 12 85 7A A9 C6 85 16
0FE1:7B 20 79 00 20 F3 BC 20 5F
0FE9:1B BC 20 CC C7 20 C7 C6 AA
0FF1:60 A9 03 8D 6B C1 20 F9 80
0FF9:C2 A0 C4 A9 C5 20 2E C8 A8
1001:A9 08 8D 6B C1 20 F9 C2 A5
1009:A0 C4 A9 CA 20 2E C8 20 F7
1011:F6 C2 A0 C4 A9 CF 20 2E B8
1019:C8 20 F6 C2 A0 C4 A9 D4 F0
1021:20 2E C8 20 F6 C2 A0 C4 C0
1029:A9 D9 20 2E C8 60 20 A2 26
1031:BB 20 DD BD 20 59 C8 A0 67
1039:00 B9 00 01 F0 03 C8 D0 CD
1041:F8 A2 0F 88 B9 00 01 9D 5E
1049:67 C8 CA 88 C0 FF D0 F4 CD
1051:A9 67 A0 C8 18 20 FB C1 BB
1059:60 A9 20 A0 00 A2 10 99 66
1061:67 C8 C8 CA D0 F9 60 20 7C
1069:20 20 20 20 20 20 20 20 89
1071:20 20 20 20 20 20 39 FF A3
1079:8A A2 00 9A 48 A9 13 8D CD
1081:6B C1 20 F9 C2 68 C9 0E C4
1089:D0 09 A9 92 A0 C4 18 20 1B
1091:FB C1 60 C9 0F D0 09 A9 40
1099:A3 A0 C4 18 20 FB C1 60 A2
10A1:C9 14 D0 09 A9 AC A0 C4 5C
10A9:18 20 FB C1 60 A9 BD A0 3F
10B1:C4 18 20 FB C1 60 57 49 85
10B9:4C 44 20 43 41 52 44 20 45
10C1:4F 52 20 52 45 54 55 52 BF
10C9:4E FF 20 20 20 20 20 20 F8
10D1:20 20 20 20 20 20 20 20 F1
10D9:20 20 20 20 20 20 20 20 F9
10E1:20 20 20 20 FF 20 20 20 01
10E9:20 20 20 20 20 20 20 20 0A
10F1:20 20 20 20 20 20 20 20 12
10F9:20 20 20 20 20 20 20 20 1A
1101:20 20 20 20 20 20 FF 45 08
1109:58 49 54 00 4E 45 58 54 C0
1111:20 50 41 47 45 00 4E 45 FF
1119:57 20 53 45 41 52 43 48 CF
1121:FF 24 30 3A 2A 20 20 20 28
1129:20 20 20 20 20 20 20 20 4B
1131:20 20 20 20 24 30 3A 2A F1
1139:FF 00 00 20 79 CD 90 01 82
1141:60 A9 16 A0 06 A2 04 20 AD
1149:84 C1 A9 B6 A0 C8 20 E9 11
1151:C1 A9 34 A0 C9 18 20 FB 3A
1159:C1 20 66 C2 A9 24 85 FB 42
1161:A9 C9 85 FC AD BD CE 48 95
1169:A9 00 8D BD CE A2 07 A0 9D
1171:0A A9 10 20 34 C3 D0 07 60
1179:A9 2A 8D 24 C9 A9 01 18 FD
1181:69 03 A2 21 A0 C9 20 BD A9
1189:FF 68 8D BD CE A9 01 A2 15
1191:08 A0 00 8C 3A C9 20 BA 9C
1199:FF 20 C0 FF 20 6F CD 90 C6
11A1:05 A9 00 4C 2C CA 20 6C AE
11A9:C2 A2 01 20 C6 FF 20 CF 3E
11B1:FF C9 22 D0 F9 A0 00 99 83
11B9:CA C8 20 CF FF C8 C9 00 2B
11C1:D0 F5 20 CC FF A9 23 A0 28
11C9:02 A2 01 20 84 C1 A9 CA 01
11D1:A0 C8 20 E9 C1 A9 07 A0 7C
11D9:C9 38 20 FB C1 A9 11 8D 17
11E1:39 C9 A2 01 20 C6 FF A2 36
11E9:04 A8 20 CF FF CA D0 F9 FF
11F1:20 B3 CA 20 CF FF C9 00 7E
11F9:F0 06 99 E5 C8 D0 F3 A6
1201:20 CC FF AD EA C8 C9 22 73
1209:D0 41 A9 E5 A0 C8 38 20 32
1211:FB C1 CE 39 C9 D0 CB 20 5A
1219:66 C2 20 0D C3 C9 02 D0 10
1221:0B AD 3A C9 D0 F4 20 6C 21
1229:C2 4C C5 C9 48 A9 01 20 22
1231:C3 FF 68 C9 04 D0 06 20 70
1239:6C C2 4C 41 C9 48 20 8A 1C
1241:CD 68 AE AC C0 D0 17 20 9E
1249:6C C2 60 EE 3A C9 A9 E5 81
1251:A0 C8 18 20 FB C1 A9 01 38
1259:20 C3 FF 4C 17 CA C9 00 BA
1261:D0 05 20 6C C2 38 60 4A FB
1269:18 69 04 AA A0 0C 20 F0 85
1271:FF A9 03 A2 03 A0 FF 20 45
1279:BA FF A9 00 20 BD FF 20 48
1281:C0 FF A2 03 20 C6 FF A2 49
1289:10 AC BD CE 20 CF FF 99 5F
1291:8F CE C9 22 F0 04 C8 CA 80
1299:D0 F2 8C BD CE A9 FF 99 07
12A1:8F CE 20 CC FF A9 03 20 DE
12A9:C3 FF 20 6C C2 A9 00 85 BC
12B1:D4 18 60 20 91 B3 20 DD CD
12B9:BD A0 00 B9 01 01 F0 06 74
12C1:99 E5 C8 C8 D0 F5 A9 20 A3
12C9:99 E5 C8 C8 60 4C 4F 41 ED
12D1:44 FF 4E 41 4D 45 00 30 A5
12D9:3A FF A9 01 2C A9 00 8D F5
12E1:0D CB A9 18 A0 06 A2 05 9D
12E9:20 84 C1 A9 CD A0 CA 20 B8
12F1:E9 C1 A9 D2 A0 CA 18 20 5E
12F9:FB C1 20 66 C2 A2 09 A0 4A
1301:09 A9 10 20 2A C3 F0 31 8D
1309:A9 01 A2 08 A0 00 20 BA 19
1311:FF AD BD CE A2 8F A0 CE AA
1319:20 BD FF A9 00 85 9D A6 51
1321:2B A4 2C 20 D5 FF 86 2D 76
1329:84 2E 20 60 CD 90 06 20 04
1331:6C C2 4C 44 A6 20 6C C2 5D
1339:60 20 9C CC 90 CA B0 F5 FE
1341:28 52 45 29 20 28 42 29 9A
1349:20 53 41 56 45 FF 4E 41 E9
1351:4D 45 00 30 3A FF 00 53 97
1359:54 41 52 54 3A 00 00 45 A0
1361:4E 44 3A FF A9 40 2C A9 57
1369:C0 2C A9 80 2C A9 00 85 C5
1371:02 A9 18 A0 06 A2 05 20 F4
1379:84 C1 A9 40 A0 CB 20 E9 E9
1381:C1 A9 4E A0 CB 18 20 FB C1
1389:C1 24 02 50 08 A9 56 A0 13
1391:CB 18 20 FB C1 20 66 C2 85
1399:A2 09 A0 09 A9 10 20 2A EF
13A1:C3 D0 06 24 02 30 66 10 8E
13A9:60 24 02 10 0B EE AC C0 78
13B1:A9 53 8D 8C CE 20 BE CE 3F
13B9:AD BD CE A2 8F A0 CE 20 E6
13C1:BD FF 24 02 50 1F A2 0B BA
13C9:A0 0E 20 14 CC B0 F7 48 6A
13D1:98 48 A2 0D A0 0C 20 14 05
13D9:CC B0 F7 84 FD 85 FE 68 46
13E1:85 FB 68 85 FC A9 01 A2 62
13E9:08 A0 00 84 9D 20 BA FF 67
13F1:24 02 50 09 A9 FB A6 FD CD
13F9:A4 FE 4C 03 CC A9 2B A6 F5
1401:2D A4 2E 20 D8 FF 20 60 18
1409:CD 20 6C C2 60 20 9C CC 63
1411:90 97 B0 F5 A9 12 85 FB 79
1419:A9 C6 85 FC A9 00 8D BD 6E
1421:CE A9 05 20 34 C3 A9 0D CE
1429:91 FB 98 AA A0 00 A9 2F 5E
1431:D1 FB B0 1D B1 FB C9 3A 74
1439:B0 17 C8 CA D0 F0 20 D9 A9
1441:C7 20 9B BC 18 A5 62 65 16
1449:63 38 D0 05 A5 64 A4 65 09
1451:18 60 53 43 52 41 54 43 BF
1459:48 FF 4E 41 4D 45 00 53 56
1461:30 3A FF A9 18 A0 06 A2 BC
1469:05 20 84 C1 A9 52 A0 CC 6D
1471:20 E9 C1 A9 5A A0 CC 18 FD
1479:20 FB C1 20 66 C2 A9 53 CF
1481:8D 8C CE A2 09 A0 0A A9 20
1489:10 20 2A C3 F0 07 20 BE E5
1491:CE 20 6C C2 60 20 9C CC 6C
1499:90 F4 B0 F5 EE AC C0 20 88
14A1:3B C9 08 A9 09 8D 6B C1 8C
14A9:20 F9 C2 A9 8C A0 CE 18 EF
14B1:20 FB C1 A9 00 8D AC C0 0C
14B9:28 60 43 4F 50 59 20 4F E2
14C1:52 20 52 45 4E 41 4D 45 11
14C9:FF 4E 45 57 20 4E 41 4D AD
14D1:45 00 00 4F 4C 44 20 4E 93
14D9:41 4D 45 00 FF A9 43 2C F7
14E1:A9 52 8D 8C CE A9 13 A0 D1
14E9:09 A2 05 20 84 C1 A9 BA 1B
14F1:A0 CC 20 E9 C1 A9 C9 A0 29
14F9:CC 18 20 FB C1 20 66 C2 70
1501:A2 09 A0 0A A9 10 20 2A 6B
1509:C3 F0 19 AC BD CE A9 3D F8
1511:99 8F CE EE BD CE A2 0B 2E
1519:A0 0A A9 10 20 2A C3 F0 6E
1521:07 20 BE CE 20 6C C2 60 34
1529:AD BD CE 8D 44 CD EE AC 30
1531:C0 20 3B C9 B0 EE A9 0B 67
1539:8D 6B C1 20 F9 C2 A9 8F FC
1541:A0 CE 18 69 00 90 01 C8 16
1549:18 20 FB C1 A9 00 8D AC 38
1551:C0 4C 21 CD A9 56 D0 02 3A
1559:A9 49 8D 8C CE 4C BE CE 19
1561:20 79 CD 20 90 CD 08 20 A1
1569:CE CD 20 8A CD 28 60 20 0B
1571:90 CD 90 04 20 CE CD 38 B9
1579:60 A9 0F A2 08 A8 20 BA 28
1581:FF A9 00 20 BD FF 20 C0 07
1589:FF 60 A9 0F 20 C3 FF 60 62
1591:A2 0F 20 C6 FF B0 27 A0 F2
1599:00 20 CF FF C9 0D F0 06 30
15A1:99 15 CE C8 D0 F3 A9 FF ED
15A9:99 15 CE 20 CC FF A9 30 AB
15B1:CD 15 CE D0 07 CD 16 CE 59
15B9:D0 02 18 60 38 60 A0 00 5A
15C1:A2 0D B9 32 CE 99 15 CE B0
15C9:C8 CA D0 F6 F0 EE A9 1E 49
15D1:A0 05 A2 0C 20 84 C1 A9 E2
15D9:F4 A0 CD 20 E9 C1 A9 15 21
15E1:A0 CE 18 20 FB C1 20 66 A2
15E9:C2 A9 00 A0 FE 20 12 C3 4A
15F1:20 6C C2 60 44 49 53 4B DE
15F9:20 45 52 52 4F 52 20 44 3D
1601:49 53 50 4C 41 59 00 50 35
1609:52 45 53 53 20 41 4E 59 4B
1611:20 4B 45 59 FF 20 20 20 3F
1619:20 20 20 20 20 20 20 20 45
1621:20 20 20 20 20 20 20 20 4D
1629:20 20 20 20 20 20 20 20 55
1631:20 FF 44 45 56 49 43 45 ED
1639:20 45 52 52 4F 52 FF 4E 48
1641:45 57 20 41 20 44 49 53 F5
1649:4B 45 54 54 45 FF 4E 41 44
1651:4D 45 2C 49 44 00 4E 30 7E
1659:3A FF A9 18 A0 06 A2 05 C0
1661:20 84 C1 A9 3F A0 CE 20 CB
1669:E9 C1 A9 4E A0 CE 18 20 A5
1671:FB C1 20 66 C2 A2 09 A0 C9
1679:0A A9 13 20 2A C3 F0 08 C3
1681:A9 4E 8D 8C CE 20 BE CE D3
1689:20 6C C2 60 49 30 3A 20 DE
1691:20 20 20 20 20 20 20 20 BD
1699:20 20 20 20 20 20 20 20 C5
16A1:20 20 20 20 20 20 20 20 CD
16A9:20 20 20 20 20 20 20 20 D5
16B1:20 20 20 20 20 20 20 20 DD
16B9:20 20 20 20 20 00 20 79 BE
16C1:CD A2 0F 20 C9 FF A0 00 F0
16C9:AE BD CE E8 E8 E8 B9 8C 10
16D1:CE 20 D2 FF C8 CA D0 F6 D1
16D9:20 CC FF AD AC C0 F0 03 71
16E1:4C 8A CD 4C 63 00 00 00 70
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Diskcheck: Apple Sector Editor For DOS 3.3

Steve Meyles

A disk editor is useful for learning about disk organization and many other tasks. This program, recommended for intermediate and advanced programmers, provides all the basic functions you need to examine and edit the contents of an Apple DOS 3.3 disk. A disk drive is required.

Have you ever needed to repair a garbled Apple II disk? Without a good disk-editor program, the task can become a nightmare. "Diskcheck" allows you to examine and modify the contents of any sector on an Apple II disk formatted with DOS 3.3. If you're just learning about how DOS 3.3 disks are organized, the program is an invaluable educational tool. Other important uses include repairing damaged disk data and concealing files from unauthorized users.

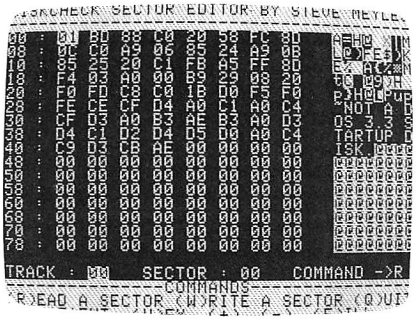
Since this program is written in machine language, you must type it in with "MLX," the machine language entry program published elsewhere in this issue. Here are the starting and ending addresses for MLX:

Starting address: 1000
Ending address: 197A

After you type in and save the program, run it with BRUN. The photograph illustrates the Diskcheck work screen. The central area of the screen displays the contents of one disk sector. The rest of the screen contains prompts and other information.

One-Key Operation

Diskcheck offers several different functions; each of them is invoked by pressing a single key. The simplest commands are Q, which exits the program, and C, which clears the screen and displays a catalog of the current disk. Press Return when you have finished looking at the catalog display.



"Diskcheck" provides several different functions for examining and editing the contents of Apple II disks.

Each byte in the current sector is displayed as a two-digit hexadecimal value. The inverse (reverse) cursor marks your position in the byte display. Use the I, J, K, and M keys to move the cursor up, left, right, and down, respectively. The current track and sector are displayed at the bottom of the byte display area.

The Read command (R) lets you read and display the contents of any sector on the disk. After you press R, the inverse cursor moves to the track and sector area below the byte field. To choose a new track, enter a two-digit hexadecimal value and press Return. The program then moves the cursor to the sector display and waits for you to enter a new sector value. After you press Return, the new sector is read from disk and shown on the screen.

For instance, sector $0F of track $11 contains directory information. To view this, enter 11 for the track and 0F for the sector. Diskcheck reads the first sector of the directory and displays it on the screen.

The plus (+) and minus (−) keys allow you to move forward and backward through the disk without having to enter new track and sector values for each sector. The plus key reads the next sector and the minus key backs up to read the previous sector.

The Write command (W) writes the current sector back to disk. This is normally done after you have made some changes to the sector's contents.

The Fill command (F) fills all or part of the sector with the specified byte value. This function operates from the current cursor position to the end of the sector, so you should position the cursor at the desired byte before selecting the function. After you press F, Diskcheck asks you to enter the byte value and press Return. The designated area is then filled with that value.

Editing

The Text (T) and Hex (H) functions are used to edit the current sector. In Hex mode, you can change a byte by entering a new two-digit hexadecimal value. Text mode is useful in cases where you need to enter a number of ASCII characters. When you press T, Diskcheck asks you to choose between flashing, inverse, and normal characters. After you respond to this prompt, you can enter new values simply by pressing one key for each byte. To exit editing mode, press Return.

If you're not familiar with Apple DOS 3.3, it's best to practice on an unimportant disk rather than one which contains important

information. A disk editor is a very powerful tool; in the worst case, you might scramble an entire disk by changing only a few bytes.

Note that this program is designed for use with normal DOS 3.3 disks. (Don't try to edit ProDOS disks with this program.) If a disk has been specially formatted with extra sectors, those sectors may not be accessible to Diskcheck. Similarly, you may get peculiar results if you try to edit a commercially copy-protected disk which contains deliberate errors or nonconventional file structures.

Diskcheck

Please refer to the "MLX" article in this issue before entering the following program.

```
START ADDRESS:  1000
END ADDRESS:    197A
```

```
1000: A9 00 8D 03 03 8D 04 03 30
1008: 8D 05 03 8D 06 03 8D 0A CA
1010: 03 8D 0B 03 20 2D 13 20 A2
1018: 3D 11 20 48 12 A9 1D 8D A2
1020: 08 03 A9 10 8D 09 03 A9 7B
1028: 13 20 5B FB A9 25 85 24 16
1030: 20 BE 18 20 38 15 C9 D2 91
1038: D0 09 20 72 16 20 2D 13 CC
1040: 4C 1A 10 C9 D7 D0 0C 20 E5
1048: DD 18 20 72 16 20 65 13 97
1050: 4C 1A 10 C9 C3 D0 06 20 49
1058: 88 13 4C 1A 10 C9 C9 D0 B8
1060: 06 20 8C 15 4C 1A 10 C9 23
1068: CD D0 06 20 AE 15 4C 1A E2
1070: 10 C9 CB D0 06 20 DE 15 15
1078: 4C 1A 10 C9 CA D0 06 20 A9
1080: FF 15 4C 1A 10 C9 AB D0 E0
1088: 11 20 41 19 20 22 16 A9 52
1090: 00 8D 05 03 8D 06 03 4C BB
1098: 1A 10 C9 AD D0 11 20 41 2A
10A0: 19 20 4C 16 A9 00 8D 05 AD
10A8: 03 8D 06 03 4C 1A 10 C9 53
10B0: C8 D0 06 20 B8 16 4C 1A FC
10B8: 10 C9 D4 D0 06 20 66 17 8F
10C0: 4C 1D 10 C9 C6 D0 06 20 92
10C8: 19 19 4C 1A 10 C9 D1 F0 23
10D0: 03 4C 1A 10 A9 00 85 22 44
10D8: A9 18 85 23 20 58 FC 20 33
10E0: 5C 15 C7 CF CF C4 C2 D9 5B
10E8: C5 A0 AD A0 D9 CF D5 A0 2E
10F0: C3 C1 CE A0 D2 C5 C5 CE 4F
10F8: D4 C5 D2 A0 D4 C8 D2 CF 98
1100: D5 C7 C8 A0 C1 8D B1 B0 7A
1108: B0 B0 C7 A0 C6 D2 CF CD A0
1110: A0 D4 C8 C5 A0 CD CF CE D7
1118: C9 D4 CF D2 A0 CF D2 A0 06
1120: C1 A0 C3 C1 CC CC A0 B4 6F
1128: B0 B9 B6 8D C6 D2 CF CD AF
1130: A0 C2 C1 D3 C9 C3 8D 8D CE
1138: 8D 00 4C D0 03 20 58 FC FD
1140: 20 5C 15 04 09 13 0B 03 1A
1148: 08 05 03 0B 20 13 05 03 1B
1150: 14 0F 12 20 05 04 09 14 E2
1158: 0F 12 20 02 19 20 13 14 2E
1160: 05 16 05 20 0D 05 19 0C E7
1168: 05 13 8D 2D 2D 2D 2D 2D FB
1170: 2D 2D 2D 2D 2D 2D 2D 2D 92
1178: 2D 2D 2D 2D 2D 2D 2D 2D 9A
1180: 2D 2D 2D 2D 2D 2D 2D 2D A2
1188: 2D 2D 2D 2D 2D 2D 2D 2D AA
1190: 2D 2D 8D 00 A9 14 20 5B 7F
1198: FB 20 5C 15 2D 2D 2D 2D 43
11A0: 2D 2D 2D 2D 2D 2D 2D 2D C2
11A8: 2D 2D 2D 03 0F 0D 0D 01 4A
11B0: 0E 04 13 2D 2D 2D 2D 2D B5
11B8: 2D 2D 2D 2D 2D 2D 2D 2D DA
11C0: 2D 2D 2D 8D 28 12 29 05 24
11C8: 01 04 20 01 20 13 05 03 DA
11D0: 14 0F 12 20 28 17 29 12 07
11D8: 09 14 05 20 01 20 13 05 DA
11E0: 03 14 0F 12 20 28 11 29 79
11E8: 15 09 14 8D 20 20 20 20 15
11F0: 28 14 29 05 18 14 20 20 13
11F8: 28 08 29 05 18 20 20 28 50
1200: 28 29 20 20 28 20 29 20 72
1208: 20 28 06 29 09 0C 0C 20 4A
1210: 20 20 20 8D 20 20 20 20 0B
1218: 20 28 03 29 01 14 01 0C AF
1220: 0F 07 20 20 20 28 09 2C 73
1228: 0A 2C 0B 2C 0D 29 0D 0F B6
1230: 16 05 0D 05 0E 14 20 20 B3
1238: 20 20 20 00 A9 02 85 22 FA
1240: A9 14 85 23 20 58 FC 60 DD
1248: AD 55 C0 20 58 FC A9 00 BC
1250: 8D 01 03 AD 06 03 8D 02 10
1258: 03 AE 02 03 20 44 F9 20 40
1260: 5C 15 A0 BA A0 00 A0 00 FD
1268: 98 18 6D 02 03 AA BD 00 EA
1270: 1F AA 20 44 F9 A9 A0 20 EE
1278: F0 FD C8 C0 08 D0 E9 20 31
1280: 5C 15 A0 A0 00 A0 00 98 51
1288: 18 6D 02 03 AA BD 00 1F EF
1290: C9 80 90 06 C9 A0 B0 02 60
1298: 29 7F 20 F0 FD C8 C0 08 E0
12A0: D0 E5 A9 8D 20 ED FD 98 02
12A8: 18 6D 02 03 8D 02 03 EE 0E
12B0: 01 03 AD 01 03 C9 10 D0 0C
12B8: A0 AD 02 03 8D 07 03 20 B7
12C0: 5C 15 8D D4 D2 C1 C3 CB 48
12C8: A0 BA A0 00 AE 03 03 20 A7
12D0: 44 F9 20 5C 15 A0 A0 A0 6C
12D8: D3 C5 C3 D4 CF D2 A0 BA E3
12E0: A0 00 AE 04 03 20 44 F9 86
12E8: 20 5C 15 A0 A0 A0 C3 CF BF
12F0: CD CD C1 CE C4 A0 AD BE 57
12F8: 00 20 03 13 20 4E 19 AD D0
1300: 54 C0 60 AD 05 03 38 ED F9
1308: 06 03 8D 02 03 4A 4A 4A E3
1310: 18 69 02 20 5B FB AD 02 07
1318: 03 29 07 8D 02 03 0A 6D 61
1320: 02 03 69 05 85 24 AC 05 A0
1328: 03 B9 00 1F 60 AD 03 03 F2
1330: 8D 54 13 AD 04 03 8D 55 0C
1338: 13 A9 01 8D 5C 13 A9 13 E0
1340: A0 50 20 D9 03 AD 5D 13 09
1348: 20 4E 14 A9 00 85 48 60 36
1350: 01 60 01 00 00 00 61 13 05
1358: 00 1F 00 00 01 00 00 60 AE
1360: 01 00 01 EF D8 AD 03 03 AC
1368: 8D 54 13 AD 04 03 8D 55 44
1370: 13 A9 02 8D 5C 13 A9 13 39
1378: A0 50 20 D9 03 AD 5D 13 41
1380: 20 4E 14 A9 00 85 48 60 6E
1388: 20 DC 03 85 FD 84 FC 20 CA
1390: 58 FC A0 00 B9 A8 13 91 5E
1398: FC C8 C0 12 D0 F6 20 D6 22
13A0: 03 20 15 14 20 38 15 60 A0
13A8: 06 00 00 00 00 01 06 00 E1
13B0: 00 00 00 00 00 93 00 00 25
13B8: 00 00 85 FE 20 4E 19 A9 95
13C0: 88 20 ED FD 20 ED FD 2C B1
13C8: 00 C0 10 FB AD 00 C0 2C FB
13D0: 10 C0 C9 8D D0 0F A6 FE 50
13D8: 20 44 F9 A9 A0 20 F0 FD 5F
13E0: A5 FE A2 00 60 C9 A0 D0 2A
13E8: 0F A6 FE 20 44 F9 A9 A0 20
13F0: 20 F0 FD A5 FE A2 01 60 62
13F8: 49 B0 C9 0A 90 08 69 88 C9
1400: C9 FA 90 C3 29 0F 48 A5 D5
1408: FE 0A 0A 0A 0A 85 FE 68 E0
1410: 05 FE 4C BA 13 A0 0A B1 90
1418: FC C9 00 D0 01 60 20 58 60
1420: FC 20 5C 15 87 49 6F 4F 3B
1428: 60 45 52 52 4F 52 8D 8D AD
1430: C8 C9 D4 A0 C1 CE D9 A0 71
1438: CB C5 D9 A0 D4 CF A0 C3 E7
1440: CF CE D4 C9 CE D5 C5 00 94
1448: 20 38 15 68 68 60 B0 01 DE
1450: 60 8D 00 03 AD 0A 03 8D 65
1458: 03 03 AD 0B 03 8D 04 03 82
1460: A9 87 20 ED FD 20 58 FC 40
1468: AD 00 03 C9 10 D0 39 20 BA
1470: 5C 15 44 49 53 4B 60 49 FA
1478: 53 60 57 52 49 54 45 60 F8
1480: 50 52 4F 54 45 43 54 45 B9
1488: 44 61 8D 8D C8 C9 D4 A0 6D
1490: C1 CE D9 A0 CB C5 D9 A0 5C
1498: D4 CF A0 C3 CF CE D4 C9 9C
14A0: CE D5 C5 00 20 38 15 60 CA
14A8: C9 40 D0 60 20 5C 15 44 C6
14B0: 52 49 56 45 60 45 52 52 82
14B8: 4F 52 6C 60 43 41 4E 67 D3
14C0: 54 60 52 45 41 44 6F 57 1B
14C8: 52 49 54 45 8D A0 A0 A0 1C
14D0: A0 A0 A0 A0 A0 A0 A0 A0 F8
14D8: A0 A0 A0 A0 A0 A0 A0 A0 01
14E0: A0 A0 54 52 41 43 4B 6F 4E
14E8: 53 45 43 54 4F 52 8D 8D 26
14F0: C8 C9 D4 A0 C1 CE D9 A0 32
14F8: CB C5 D9 A0 D4 CF A0 C3 A8
1500: CF CE D4 C9 CE D5 C5 00 56
1508: 20 38 15 60 20 5C 15 42 D7
1510: 41 44 60 53 45 43 54 4F 5C
1518: 52 61 8D 8D C8 C9 D4 A0 06
1520: C1 CE D9 A0 CB C5 D9 A0 ED
1528: D4 CF A0 C3 CF CE D4 C9 2E
1530: CE D5 C5 00 20 38 15 60 5C
1538: 20 5C 15 60 88 00 2C 00 CE
1540: C0 10 FB 20 5C 15 A0 88 51
1548: 00 AD 00 C0 2C 10 C0 C9 D6
1550: 80 90 05 C9 A0 B0 01 60 46
1558: 20 F0 FD 60 85 45 84 47 26
1560: 86 46 68 85 FA 68 85 FB 45
1568: E6 FA D0 02 E6 FB A0 00 67
1570: B1 FA F0 0B 20 ED FD E6 9C
1578: FA D0 F5 E6 FB D0 F1 A5 2E
1580: FB 48 A5 FA 48 A5 45 A6 29
1588: 46 A4 47 60 AD 05 03 38 AD
1590: E9 08 B0 05 68 68 6C 08 DD
1598: 03 CD 06 03 90 03 4C 9F 71
15A0: 16 8D 05 03 AD 06 03 38 CD
15A8: E9 08 8D 06 03 60 AD 05 D5
15B0: 03 18 69 08 90 05 68 68 E1
15B8: 6C 08 03 38 E9 01 CE 07 F6
15C0: 03 CD 07 03 08 EE 07 03 FD
15C8: 18 69 01 28 90 0D 8D 05 D4
15D0: 03 AD 06 03 18 69 08 8D DC
15D8: 06 03 60 4C 9F 16 AC 05 4B
15E0: 03 C8 D0 05 68 68 6C 08 EE
15E8: 03 CC 07 03 F0 04 98 4C ED
15F0: 9F 16 8C 05 03 AD 06 03 30
15F8: 18 69 08 8D 06 03 60 AC 0D
1600: 05 03 88 C0 FF D0 05 68 42
1608: 68 6C 08 03 CC 06 03 90 C9
1610: 04 98 4C 9F 16 8C 05 03 D7
1618: AD 06 03 38 E9 08 8D 06 11
1620: 03 60 AD 04 03 C9 0F F0 2A
1628: 07 EE 04 03 20 2D 13 60 80
1630: A9 00 8D 04 03 AD 03 03 FA
1638: C9 22 F0 07 EE 03 03 20 0A
1640: 2D 13 60 A9 00 8D 03 03 AD
1648: 20 2D 13 60 AD 04 03 F0 AC
1650: 07 CE 04 03 20 2D 13 60 A0
1658: A9 0F 8D 04 03 AD 03 03 E6
1660: F0 07 CE 03 03 20 2D 13 D6
1668: 60 A9 22 8D 03 03 20 2D DD
1670: 13 60 20 41 19 A9 13 20 0C
1678: 5B FB A9 08 85 24 AD 03 22
1680: 03 20 BA 13 C9 23 B0 EA E5
1688: 8D 03 03 A9 16 85 24 AD F3
1690: 04 03 20 BA 13 29 0F C9 54
1698: 10 B0 F0 8D 04 03 60 85 62
16A0: FA 20 03 13 AA 20 44 F9 3C
16A8: A4 FA 8C 05 03 20 03 13 79
16B0: 20 4E 19 68 68 6C 08 03 32
16B8: A9 01 20 5B FB A9 00 85 BF
16C0: 24 20 5C 15 6D 6D 48 45 DA
16C8: 58 6D 53 50 41 43 45 60 ED
16D0: 42 45 54 57 45 45 45 4E 87
16D8: 60 45 41 43 48 7B 60 43 17
16E0: 6F 52 60 54 4F 60 45 4E 7F
```

```
16E8: 44 6D 6D 00 20 03 13 20 93
16F0: BE 18 AC 05 03 B9 00 1F 86
16F8: 20 BA 13 AC 05 03 99 00 78
1700: 1F C9 80 90 06 C9 A0 B0 92
1708: 02 29 7F 48 AD 05 03 29 A6
1710: 07 18 69 1F 85 24 68 20 94
1718: F0 FD E0 00 F0 13 A9 EC 6E
1720: 8D 08 03 A9 16 8D 09 03 0E
1728: 20 DE 15 20 48 12 4C EC D2
1730: 16 A9 01 20 5B FB A9 00 14
1738: 85 24 20 5C 15 2D 2D 2D E0
1740: 2D 2D 2D 2D 2D 2D 2D 2D 6E
1748: 2D 2D 2D 2D 2D 2D 2D 2D 76
1750: 2D 2D 2D 2D 2D 2D 2D 2D 7E
1758: 2D 2D 2D 2D 2D 2D 2D 2D 86
1760: 2D 2D 2D 2D 00 60 A9 12 CF
1768: 20 5B FB A9 00 85 24 20 16
1770: 5C 15 68 46 69 4C 41 53 D5
1778: 48 49 4E 47 60 28 09 29 3A
1780: 0E 16 05 12 13 05 20 A8 92
1788: CE A9 CF D2 CD C1 CC A0 5F
1790: A8 C6 AF C9 AF CE A9 00 63
1798: 20 38 15 C9 C6 D0 08 A9 57
17A0: 7F 8D 0C 03 4C D2 17 C9 49
17A8: C9 D0 08 A9 3F 8D 0C 03 D6
17B0: 4C D2 17 C9 CE D0 08 A9 AC
17B8: FF 8D 0C 03 4C D2 17 C9 A1
17C0: 80 90 07 C9 A0 B0 03 4C EA
17C8: 98 17 A9 88 20 ED FD 4C C7
17D0: 98 17 A9 12 20 5B FB A9 77
17D8: 00 85 24 20 5C 15 A0 A0 08
17E0: A0 A0 A0 A0 A0 A0 A0 A0 0F
17E8: A0 A0 A0 A0 A0 A0 A0 A0 17
17F0: A0 A0 A0 A0 A0 A0 A0 A0 1F
17F8: A0 A0 A0 A0 A0 A0 A0 A0 27
1800: A0 A0 A0 A0 00 A9 01 20 8F
1808: 5B FB A9 00 85 24 20 5C 73
1810: 15 6D 6D 6D 54 45 58 54 67
1818: 6D 54 59 50 45 60 49 4E D0
1820: 60 44 41 54 41 60 57 49 82
1828: 54 48 60 43 6F 52 60 54 AE
1830: 4F 60 45 4E 44 6D 6D 6D CD
1838: 00 A9 13 20 5B FB A9 25 7A
1840: 85 24 20 BE 18 20 38 15 F2
1848: C9 8D F0 3D 2D 0C 03 AC FE
1850: 05 03 99 00 1F 48 20 03 54
1858: 13 20 4E 19 68 C9 80 90 71
1860: 06 C9 A0 B0 02 29 7F 48 21
1868: AD 05 03 29 07 18 69 1F 2E
1870: 85 24 68 20 F0 FD A9 39 87
1878: 8D 08 03 A9 18 8D 09 03 78
1880: 20 DE 15 20 48 12 4C 39 79
1888: 18 A9 01 20 5B FB A9 00 6F
1890: 85 24 20 5C 15 2D 2D 2D 3B
1898: 2D 2D 2D 2D 2D 2D 2D 2D C8
18A0: 2D 2D 2D 2D 2D 2D 2D 2D D0
18A8: 2D 2D 2D 2D 2D 2D 2D 2D D8
18B0: 2D 2D 2D 2D 2D 2D 2D 2D E0
18B8: 2D 2D 2D 2D 00 60 A2 04 0E
18C0: 8E CC 18 A9 08 8D CF 18 37
18C8: A0 00 B9 00 04 99 00 08 0F
18D0: C8 D0 F7 EE CC 18 EE CF FB
18D8: 18 CA D0 EE 60 A9 12 20 BE
18E0: 5B FB A9 00 85 24 20 5C 4C
18E8: 15 57 52 49 54 45 60 68 39
18F0: 59 6F 4E 69 00 20 38 15 10
18F8: C9 CE D0 05 68 68 4C 1A C3
1900: 10 C9 D9 F0 13 C9 80 90 48
1908: 07 C9 A0 B0 03 4C F5 18 9C
1910: A9 88 20 ED FD 4C F5 18 41
1918: 60 A9 12 20 5B FB A9 00 47
1920: 85 24 20 5C 15 C8 C5 D8 18
1928: A0 C2 D9 D4 C5 A0 AD AD 9D
1930: BE 00 A9 00 20 BA 13 AC B5
1938: 05 03 99 00 1F C8 D0 FA 99
1940: 60 AD 03 03 8D 0A 03 AD E6
1948: 04 03 8D 0B 03 60 85 FE 43
1950: 4A 4A 4A 4A C9 0A B0 08 08
1958: 69 30 20 F0 FD 4C 65 19 63
1960: E9 09 20 F0 FD A5 FE 29 8A
1968: 0F C9 0A B0 08 69 30 20 47
1970: F0 FD 4C 7A 19 E9 09 20 6E
1978: F0 FD 60 D8 D4 A0 A0 A0 47
                              (C)
```

128 Editing Functions For Commodore 64

Jim Allen

This powerful programming aid makes all of the important Commodore 128 screen-editing functions available on the Commodore 64.

If you own a Commodore 64, you may wish that you had the extra screen-editing functions available on the Commodore 128. With just two quick keystrokes, you can turn auto-insert mode on or off, clear selected portions of the screen, set and manipulate screen windows, move the cursor instantly to any location, and more. In the 128, these functions are called ESC (*escape*) functions because they are activated with the ESC key. "128 Screen Editor" adds 14 ESC functions to the 64, plus a NO SCROLL key to prevent screen scrolling, and three new functions that aren't even available on the 128. It also allows all keys to repeat.

Type in and save the program with the "MLX" machine language entry program found elsewhere in this issue. Be sure to read and understand the instructions for using MLX before you begin entering the data for 128 Screen Editor. When you run MLX, you'll be asked for a starting address and an ending address for the data you'll be entering. Use the following values:

Starting address: **C000**
Ending address: **C3D7**

After you've finished entering all the data for 128 Screen Editor, be sure to save a copy to disk or tape before you leave MLX.

This program loads with the command LOAD *"filename"*,8,1 (replace *filename* with the name you used when entering the program with MLX, and replace the ,8,1 with ,1,1 if you are using tape instead of disk). After the program has loaded into memory, type these commands in direct mode (without line numbers):

```
NEW
SYS 49152
```

Don't forget to press RETURN at the end of each line. After you've entered the second command, the program sets the screen border to the same color as the background as a signal that it is active.

New ESCape Functions

Since the 64 lacks an ESC key, this program uses the back-arrow key (←) in its place. In the remainder of this article, the term ESC refers to the back-arrow key at the upper left corner of the keyboard. ESC functions require two keypresses: First you press and release the ESC key; then you press a second key. For instance, to delete a line, you press ESC and then D.

If you change your mind after pressing ESC and decide *not* to perform an ESC function, simply press a key that has no special ESC function (a CRSR key, for instance). If you need to type the back-arrow character itself, press ESC twice in succession. A description of the ESC functions follows.

Erase/Delete Functions

ESC @ Clears the screen from the current cursor position to the bottom.

ESC D Deletes the line the cursor is on, scrolls the screen up to fill that line, and places the cursor on the left screen margin.

ESC P Erases from the start of the current line up to and including the current cursor position.

ESC Q Erases from the current cursor position to the end of the current line.

f1 Erases from the line the cursor is on, including the current line, to the top of the screen or window.

f3 Deletes the character under the cursor and moves the remainder of the line one space to the left.

Insert Functions

ESC A Turns on autoinsert mode, which allows you to insert printable characters without using the INST key. The cursor and other editing keys work as usual. RETURN cancels autoinsert mode (this is not true on the 128).

ESC C Cancels autoinsert mode. This works the same as ESC C on the 128. (Note, however, that some of Commodore's documentation for the 128 confuses ESC C with the ESC O function.)

ESC O Cancels insert and quote modes, allowing you to use cursor keys and other editing keys after pressing INST or typing a quotation mark.

ESC I Inserts a blank line at the current cursor position, scrolling the remainder of the screen down and placing the cursor on the left edge of the display.

Cursor Movement Functions

ESC J Moves the cursor to the beginning of the line.

ESC K Moves the cursor to the end of the text on the line.

f7 Moves the cursor to the lower left corner of the screen.

Miscellaneous Functions

ESC T Sets the top of the window. Blocks the top portion of the screen from being erased or scrolled. The cursor position determines the top row of the new window. To reset the window to the full screen size, press the HOME key twice.

ESC V Scrolls the contents of the screen or window up one line. A new blank line will be scrolled in at the bottom, and the previous contents of the top line will be lost.

ESC W Scrolls the contents of the screen or window down one line. A new blank line will be scrolled in at the top, and the previous contents of the bottom line will be lost.

SHIFT Enables the NO SCROLL feature. The NO SCROLL key on the 128 lets you pause printing to the screen display (for instance, when you are listing a program). To pause a scrolling display, press SHIFT or SHIFT LOCK. When you release the key, printing resumes.

ESC Z Disables all 128 Screen Editor functions. You can reenable the ESC functions at any time with SYS 49152. (On the 128, ESC Z clears all TAB stops, a function not available in this program.)

You should be aware that these functions affect logical lines, not physical screen lines. On the Commodore 64, a physical line is always 40 characters long, but a logical line can overlap two physical screen lines. Thus, for example, the ESC V function may scroll the screen upward two lines if the topmost logical line in the current window is more than 40 characters long.

The window function (ESC T) does not prevent you from moving the cursor above the window boundary with the cursor keys. If you venture above the boundary, strange results will occur. (If this happens accidentally, perform a warm start by pressing RUN/STOP–RESTORE; then restart the program with SYS 49152.)

The delete-line function (ESC D) is intended for deleting a line which lies between two other lines. If you simply want to erase a line (particularly a line on the bottom screen line), use the ESC Q function.

This program works by copying BASIC and the Kernal ROM into underlying RAM and modifying them. It also modifies two important vectors: IQPLOP at $306 and IBASIN at $324. Locations $02, $B6, and $334–$338 are also used for various purposes.

Quick Reference

Function	Keys
Erase from cursor to end of screen	ESC @
Delete current line	ESC D
Erase from start of line to cursor	ESC P
Erase from cursor to end of line	ESC Q
Erase from cursor to top of window	† f1
Delete to right of cursor	† f3
Enable auto-insert mode	ESC A
Cancel auto-insert mode	ESC C
Cancel insert and quote modes	ESC O
Insert a line	ESC I
Move cursor to start of line	ESC J
Move cursor to end of line	ESC K
Move cursor to lower left corner	† f7
Set top of window	ESC T
Scroll screen/window up	ESC V
Scroll screen/window down	ESC W
Pause scrolling	† SHIFT
Disable Editor	† ESC Z
Enable Editor	† SYS 49152

† different from Commodore 128

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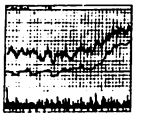
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128 Screen Editor For Commodore 64

Please refer to the "MLX" article in this issue before entering the following program.

```
C000:20 90 C3 78 AD 24 03 8D 47
C008:34 03 A9 7B 8D 24 03 AD 02
C010:25 03 8D 35 03 A9 C0 8D B7
C018:25 03 AD 06 03 C9 49 D0 A5
C020:0A A9 C3 CD 07 03 F0 16 A2
C028:AD 06 03 8D 37 03 A9 49 9D
C030:8D 06 03 AD 07 03 8D 38 CC
C038:03 A9 C3 8D 07 03 A2 A0 21
C040:A0 00 20 AD C3 A2 E0 20 7B
C048:AD C3 A2 FF 86 B6 84 02 FF
C050:A9 A6 8D F6 E8 8D 16 E9 05
C058:A9 B6 8D F7 E8 A9 02 8D 0D
C060:17 E9 A9 FD 25 01 85 01 36
C068:58 AD 8A 02 8D 36 03 A9 E7
C070:80 8D 8A 02 4C 80 A4 00 B4
C078:00 00 00 A5 99 D0 13 A5 30
C080:D3 85 CA A5 D6 85 C9 98 F9
C088:48 8A 48 A5 D0 F0 09 4C DC
C090:3A E6 4C 57 F1 20 16 E7 0C
C098:20 1A C3 C9 5F D0 0C EE 0B
C0A0:78 C0 20 A3 C1 C9 0D F0 0D
C0A8:4B D0 ED C9 13 D0 18 AE 19
C0B0:78 C0 10 05 A2 00 20 5B A1
C0B8:C1 A2 FF 8E 78 C0 A6 02 C2
C0C0:F0 D3 20 14 C3 10 D1 EE E5
C0C8:78 C0 C9 93 D0 0B A6 02 2B
C0D0:F0 C3 86 19 A2 18 4C FB 28
C0D8:C0 C9 88 D0 03 4C 37 C3 C6
C0E0:C9 85 D0 03 4C F7 C0 C9 80
C0E8:86 D0 05 20 3F C3 10 A8 56
C0F0:C9 0D D0 A1 4C EA E5 A6 4F
C0F8:D6 86 19 20 FF E9 CA 30 1A
C100:04 E4 02 B0 F6 A6 19 20 AE
C108:14 C3 4C 98 C0 20 76 C3 D0
C110:A6 02 20 F0 E9 A0 27 B5 50
C118:DA 30 02 A0 4F 8C 7A C0 C1
C120:B1 D1 99 00 01 88 10 F8 67
C128:86 D6 20 65 E9 A6 02 20 0D
C130:FF E9 E8 20 F0 E9 AC 7A 50
C138:C0 B9 00 01 91 D1 88 10 8F
C140:F8 A6 02 B5 DA 09 80 95 17
C148:DA AC 7A C0 C0 27 F0 04 48
C150:A9 7F 35 DB 95 DB 4C 88 2A
C158:C3 A6 D6 86 02 CA 86 B6 A9
C160:60 A4 D3 84 19 A0 00 84 CF
C168:D3 88 C8 A9 20 20 D2 FF D2
C170:C4 19 90 F6 C6 D3 60 20 84
C178:76 C3 20 EA E8 4C 88 C3 28
C180:F0 8B A0 00 84 D3 60 20 C7
C188:C0 C3 B1 D1 C9 20 D0 05 26
C190:88 10 F7 F0 01 C8 84 D3 72
C198:60 20 C0 C3 20 3F C3 88 B6
C1A0:D0 FA 60 20 1A C3 C9 54 21
C1A8:F0 AF C9 50 F0 B3 C9 40 F8
C1B0:F0 32 C9 57 F0 CA C9 56 84
C1B8:F0 BD C9 44 F0 32 C9 41 C6
C1C0:F0 76 C9 4F F0 6E C9 49 A6
C1C8:F0 6C C9 4A F0 B4 C9 4B F6
C1D0:F0 B5 C9 51 F0 C3 C9 5A 0D
C1D8:D0 03 4C B6 C2 A8 68 68 6C
C1E0:98 4C 95 C0 20 99 C1 20 8D
C1E8:76 C3 20 E7 C2 4C 88 C3 37
C1F0:A5 B6 85 19 A5 02 85 1A 91
C1F8:A6 D6 8E 77 C0 B5 DA 10 71
C200:0D B5 D9 30 15 09 80 95 1B
C208:D9 CA 8E 77 C0 CA 09 80 3A
C210:95 DA 86 B6 E8 86 02 20 D8
C218:EA E8 AE 77 C0 CA 86 B6 8F
C220:E8 86 02 20 EA E8 A6 19 5F
C228:86 B6 A6 1A 86 02 AE 77 26
C230:C0 4C 14 C3 F0 27 F0 3E 2C
C238:20 1A C3 C9 14 F0 73 C9 7E
C240:86 D0 05 20 3F C3 10 F0 F9
C248:C9 11 F0 0C C9 91 F0 08 54
C250:C9 1D F0 04 C9 9D D0 0E D4
C258:20 D2 FF D0 DB A2 00 86 9F
C260:D8 86 D4 86 C7 60 C9 5F A9
C268:D0 27 20 1A C3 C9 43 F0 82
C270:EC 20 CA C1 10 C2 20 82 38
C278:C1 A9 9D 20 D2 FF A9 94 7D
C280:20 D2 FF A9 20 20 D2 FF 8C
C288:A6 D6 B5 D9 09 80 95 D9 BA
C290:60 C9 0D D0 03 4C 5D C2 2E
C298:48 A5 D4 8D 77 C0 A9 00 31
C2A0:85 D4 A9 94 20 D2 FF AD 96
C2A8:77 C0 85 D4 68 20 D2 FF 81
C2B0:D0 86 A9 14 D0 F7 78 AD BB
C2B8:34 03 8D 24 03 AD 35 03 49
C2C0:8D 25 03 AD 37 03 8D 06 78
C2C8:03 AD 38 03 8D 07 03 A9 AA
C2D0:02 05 01 85 01 58 AD 36 0C
C2D8:03 8D 8A 02 AD 79 C0 30 B9
C2E0:03 8D 20 D0 4C 80 A4 AE B8
C2E8:77 C0 B5 DA 8D 7A C0 30 C6
C2F0:03 EE 77 C0 EE 77 C0 A2 28
C2F8:18 20 FF E9 B5 D9 09 80 D8
C300:95 D9 CA EC 77 C0 B0 F1 03
C308:CE 77 C0 2C 7A C0 30 03 E9
C310:CE 77 C0 60 A0 00 18 4C 7C
C318:F0 FF A5 C6 85 CC 8D 92 46
C320:02 F0 F7 78 A5 CF F0 0C C5
C328:A5 CE AE 87 02 A0 00 84 9B
C330:CF 20 13 EA 4C B4 E5 A2 5C
C338:18 20 14 C3 4C 98 C0 A9 82
C340:20 20 D2 FF A9 14 4C D2 43
C348:FF 48 98 48 20 87 EA 20 8E
C350:E4 FF C9 83 D0 0F 20 F3 B2
C358:F6 68 A8 68 20 77 C1 20 93
C360:82 C1 4C 80 A4 AD 8D 02 24
C368:C9 01 F0 E0 A9 00 85 C6 60
C370:68 A8 68 6C 37 03 38 20 80
C378:F0 FF 8E 77 C0 8C 78 C0 AB
C380:B5 D9 30 03 CE 77 C0 60 C5
C388:AE 77 C0 AC 78 C0 10 86 95
C390:AD 20 D0 29 0F 8D 79 C0 06
C398:AD 21 D0 29 0F CD 79 C0 4F
C3A0:F0 04 8D 20 D0 60 AD 86 3F
C3A8:02 8D 20 D0 60 86 1A 84 7B
C3B0:19 A2 20 B1 19 91 19 C8 96
C3B8:D0 F9 E6 1A CA D0 F4 60 89
C3C0:A0 27 A6 D6 B5 DA 10 07 E4
C3C8:C4 D3 F0 05 90 01 60 A0 FF
C3D0:4F 60 00 00 00 00 00 00 18
```

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All the programs in this issue are available on the ready-to-load *COMPUTE! Disk*. To order a one-year (four-disk) subscription, call toll free **800-247-5470** (in IA 800-532-1272). Please specify which computer you are using.

Amiga Banner Printer

Walter Bulawa

Here's a banner-printing program with an unusual twist. In addition to the usual Amiga characters, you can use any of the Amiga's disk-based custom character fonts. A dot-matrix or laser printer is required.

This Amiga BASIC program allows you to construct and print a banner of enlarged letters using any of the 13 fonts present on the Workbench disk. You can use any combination of fonts on the same banner. Program 1, the banner printing program, requires that two special files called *graphics.bmap* and *diskfont.bmap* be present on the same disk as the program itself. The *graphics.bmap* file is included in the BasicDemos folder on the Amiga Extras disk supplied with the computer (the disk which contains BASIC). The *diskfont.bmap* file is not included on disk; however, you can create a copy by running Program 2. (This program is taken from *Advanced Amiga BASIC* by Tom Halfhill and Charles Brannon, available from COMPUTE! Books.) Once you have both *graphics.bmap* and *diskfont.bmap*, you can copy them either to the same folder as Program 1 or to the LIBS folder of the same disk. (Once you've used Program 2 to create *diskfont.bmap*, you won't need Program 2 again except to create additional copies of that file.)

Banner Construction

When you run Program 1, it opens a window where you can construct a banner. The white area near the bottom of the window represents the printer paper, with the left edge of the display corresponding to the top edge of the printer paper. The small vertical line is the cursor.

Letters that you type on the keyboard appear in the work area with the current character font. You can move the cursor to any position in the white work area by dragging it with the mouse pointer. The Mouse menu allows you to use the mouse for two other purposes as well—drawing and erasing pixels in the work area. This facility lets you add graphics to text or erase text that you wish to eliminate.

The upper portion of the window indicates which font is currently in use. To change fonts, simply choose the desired font from the Font Selection menu. Except for the Topaz fonts, which are contained in ROM, new fonts will be loaded from the Workbench disk. Once the program has found the font, it identifies and displays the font on the screen. You may then type in the work area with that font.

It is important to remember that the white area represents the banner as it will be produced on the printer. So, should you wish larger letters for the banner, use the Box Height menu to select a narrower height for the white area. The more you shrink the work area, the larger the characters appear on the paper. Changing the work area's height always erases the work area completely.

This program ordinarily uses the *X* character to form the banner characters. However, you can select a different printing character with the Change Printer Char option of the Action menu. Simply type the new character when prompted.

Printing

Once you have finished writing on the work area, choose the Print Banner option from the Action menu to print the banner. Make sure that the printer is connected and turned on before you take this action. It's also important that you use the correct printer driver for your printer. To check or change the printer driver, click on the Preferences tool from the Workbench and choose the Change Printer option.

You can abort the printing at any time by pressing the ESC key. Printing always begins at the left margin of the work area; to avoid wasting paper, it's usually best to locate the first character close to the left margin. If your banner message doesn't completely fill the text window, the printer will print blank lines representing the unused portion. To avoid wasting paper, you may want to press ESC to halt printing as soon as all of your message has been printed.

When the banner is printed, the characters tend to look somewhat stretched compared to their appearance on the screen. The Printer lines/display column option allows you to correct for the stretching effect, depending on what height is selected under the Box Height menu. Good results can often be obtained by using a value about half as large as the default value.

For instructions on entering these programs, please refer to "COMPUTE!'s Guide to Typing In Programs" elsewhere in this issue.

Program 1: Amiga Banner Printer

```
'↵
DEFINT a-z↵
LIBRARY "graphics.library"↵
LIBRARY "diskfont.library"↵
DECLARE FUNCTION OpenDiskFont&()
```

```
LIBRARY
DECLARE FUNCTION OpenFont&() LIB
RARY
DIM TextAttr&(1),FontName$(13),F
ontSize(13)
DIM choice(4)
xmin=0:xmax=615:ymin=107:ymax=18
4:LpC%=1:CpL%=1
false=0:true=-1:kwit=false
pen=1:choice(2)=1:choice(3)=4
xe=70:ye=20
PChar$="X"

MENU 1,0,1,"Action"
MENU 1,1,1,"  Print Banner"
MENU 1,2,1,"  Erase Box"
MENU 1,3,1,"  Change Printer Cha
r"
MENU 1,4,1,"  Change Ptr lines/c
ol"
MENU 1,5,1,"  Quit"

MENU 2,0,1,"Mouse"
MENU 2,1,2,"  Draw"
MENU 2,2,1,"  Erase"
MENU 2,3,1,"  Position cursor"

MENU 3,0,1,"Box Height"
MENU 3,1,1,"  10 pixels"
MENU 3,2,1,"  20 pixels"
MENU 3,3,1,"  40 pixels"
MENU 3,4,2,"  80 pixels"

MENU 4,0,1,"Font Selection"
FOR i%=1 TO 13
READ FontName$(i%),FontSize(i%)
MENU 4,i%,1,"  "+FontName$(i%)+S
TR$(FontSize(i%))
NEXT i%

'Set-up the Screen Display
COLOR 3,0
LOCATE 3,1:PRINT "Font:"
LOCATE 7,1:PRINT "Printer charac
ter:"
PRINT "Printer lines/display col
umn:"
COLOR 1,0
LOCATE 7,20:PRINT PChar$
LOCATE 8,30:PRINT LpC%
'Get Info on current font
Rp&=WINDOW(8)
CALL AskFont&(Rp&,VARPTR(TextAtt
r&(0)))
FontSize=TextAttr&(1)\65536&
FontName$="topaz"
Font.Default&=OpenFont&(VARPTR(T
extAttr&(0)))
Font.Active&=Font.Default&
BaseLine=PEEKW(Rp&+62)
GOSUB Show.Example
GOSUB Erase.Box 'Display Banner
Box

'Main Loop
ON MOUSE GOSUB Mouse.Action:MOUS
E ON
ON MENU GOSUB Menu.Request:MENU
ON

WHILE NOT kwit
c$=INKEY$
IF c$<>"" THEN
IF ASC(c$)=13 THEN
GOSUB Erase.Cursor
xc=xmin:yc=yc+FontSize+3
GOSUB Yc.Check
GOSUB Move.Cursor
ELSE
GOSUB Erase.Cursor
COLOR 2,1
PRINT RIGHT$(c$,1);
xc=PEEKW(Rp&+36):yc=PEEKW(Rp&+38
)
GOSUB Show.Cursor 'display new c
ursor
END IF
END IF
WEND

Done:
COLOR 1,0
MENU RESET
CALL CloseFont&(Rp&,Font.Active&
)
CALL SetFont&(Rp&,Font.Default&)

LIBRARY CLOSE
END

Mouse.Action:
WHILE MOUSE(0)<>0
mx=MOUSE(1):my=MOUSE(2)
IF mx<xmin THEN mx=xmin
IF mx>xmax THEN mx=xmax
IF cursor.mode THEN          'Move
cursor w/mouse
GOSUB Erase.Cursor
yc=my:xc=mx
GOSUB Yc.Check
GOSUB Move.Cursor
ELSE                         'Draw
w/mouse
IF my<ymin THEN my=ymin
IF my>ymax THEN my=ymax
PSET (mx,my),pen
END IF
WEND
RETURN

Menu.Request:
mnu=MENU(0):item=MENU(1)
IF choice(mnu)<>0 THEN MENU mnu,
choice(mnu),1
choice(mnu)=item
MENU mnu,choice(mnu),2
ON mnu GOSUB Menu.1,Menu.2,Menu.
3,Menu.4
c$=""
RETURN

Menu.1:
ON item GOSUB Print.it,Erase.Box
,Choose.PChar,Choose.LpC,Quit
RETURN

Menu.2:
IF item=1 THEN pen=2
IF item=2 THEN pen=1
cursor.mode=false
IF item=3 THEN cursor.mode=true
RETURN

Menu.3:
LINE (xmin,ymin)-(xmax,ymax),0,b
f 'erase old box
BoxHeight%=10*2^(item-1)
ymax=ymin+BoxHeight%-1
GOSUB Erase.Box  'display new bo
x
LpC%=80/BoxHeight%:CpL%=LpC%
CALL SetFont&(Rp&,Font.Default&)

COLOR 1,0:LOCATE 8,30:PRINT LpC%

CALL SetFont&(Rp&,Font.Active&)
GOSUB Move.Cursor
RETURN

Menu.4:
F=0
TextAttr&(0)=SADD(FontName$(item
)+".font"+CHR$(0))
TextAttr&(1)=FontSize(item)*6553
6&
IF item<3 THEN
F&=OpenFont&(VARPTR(TextAttr&(0)
)) 'ROM fonts
ELSE
F&=OpenDiskFont&(VARPTR(TextAttr
&(0))) 'Disk fonts
END IF
IF F&=0 THEN RETURN
GOSUB Erase.Example:GOSUB Erase.
Cursor
IF Font.Active&<>0 AND Font.Acti
ve&<>Font.Default& THEN CALL Clo
seFont&(Rp&,Font.Active&)
Font.Active&=F&
FontSize=FontSize(item)
FontName$=FontName$(item)
CALL SetFont&(Rp&,Font.Active&)
BaseLine=PEEKW(Rp&+62)
GOSUB Show.Example
GOSUB Yc.Check
GOSUB Move.Cursor
RETURN

Choose.PChar:
CALL SetFont&(Rp&,Font.Default&)

COLOR 1,0:LOCATE 10,1:PRINT "Ent
er new printer character:  "
c$="":WHILE c$="":c$=INKEY$:WEND

IF ASC(c$)>32 THEN
PChar$=c$
LOCATE 7,20:PRINT PChar$
END IF
LOCATE 10,1:PRINT STRING$(30,32)

CALL SetFont&(Rp&,Font.Active&)
GOSUB Move.Cursor
GOSUB Delay
RETURN

Choose.LpC:
CALL SetFont&(Rp&,Font.Default&)

COLOR 1,0:LOCATE 10,1:PRINT "Ent
er lines/col:  "
c$="":WHILE c$="":c$=INKEY$:WEND

IF VAL(c$)<LpC% AND VAL(c$)>0 TH
EN
LpC%=VAL(c$)
LOCATE 8,30:PRINT LpC%
END IF
LOCATE 10,1:PRINT STRING$(30,32)

CALL SetFont&(Rp&,Font.Active&)
GOSUB Move.Cursor
GOSUB Delay
RETURN

Choose.LpC:
CALL SetFont&(Rp&,Font.Default&)

COLOR 1,0:LOCATE 10,1:PRINT "Ent
er lines/col:  "
c$="":WHILE c$="":c$=INKEY$:WEND

IF VAL(c$)<LpC% AND VAL(c$)>0 TH
EN
LpC%=VAL(c$)
LOCATE 8,30:PRINT LpC%
END IF
LOCATE 10,1:PRINT STRING$(30,32)

CALL SetFont&(Rp&,Font.Active&)
GOSUB Move.Cursor
GOSUB Delay
RETURN

Print.it:
Prt.Stop=false
OPEN "PRT:" FOR OUTPUT AS #1
PRINT #1,CHR$(27);"[0z";CHR$(27)
;"#3";
CALL SetFont&(Rp&,Font.Default&)

COLOR 1,0:LOCATE 10,1:PRINT"Pres
s ESC to Abort Print"
FOR x=xmin TO xmax
p$=""
```

```
IF INKEY$=CHR$(27) THEN GOTO Pri
nt.Done
FOR y=ymax TO ymin STEP -1
IF POINT(x,y)<>1 THEN
c$=PChar$
ELSE
c$=" "
END IF
FOR i=1 TO CpL%:p$=p$+c$:NEXT
NEXT y
FOR i=1 TO LpC%
PRINT #1,p$
NEXT i
NEXT x
Print.Done:
CLOSE #1
LOCATE 10,1:PRINT STRING$(30," "
)
CALL SetFont&(Rp&,Font.Active&)
GOSUB Move.Cursor
RETURN

Erase.Box:
LINE (xmin,ymin)-(xmax,ymax),1,b
f
xc=xmin:yc=ymin+BaseLine
GOSUB Move.Cursor
RETURN

Quit:
kwit=true
RETURN

Move.Cursor:
CALL move&(Rp&,xc,yc)
Show.Cursor:
ytemp=yc-BaseLine
LINE (xc,ytemp)-(xc,ytemp+FontSi
ze-1),3
RETURN

Yc.Check:
ymn=ymin+BaseLine
IF yc<ymn THEN yc=ymn
ymx=ymax-FontSize+BaseLine+1
IF yc>ymx THEN yc=ymx
RETURN

Erase.Example:
COLOR 0,0
CALL move&(Rp&,xe,ye)
CALL ClearEOL&(Rp&)
RETURN

Show.Example:
COLOR 2,1
CALL move&(Rp&,xe,ye)
c$=FontName$+STR$(FontSize)
CALL Text&(Rp&,SADD(c$),LEN(c$))

RETURN

Erase.Cursor:
ytemp=yc-BaseLine
LINE (xc,ytemp)-(xc,ytemp+FontSi
ze-1),1
RETURN

Delay:
FOR j%=1 TO 1000:NEXT
RETURN

FontTypes:
DATA topaz,8,topaz,9
DATA diamond,12
DATA garnet,9,garnet,16
DATA ruby,8,ruby,12
DATA emerald,20
DATA opal,11
DATA sapphire,14,sapphire,15,sap
phire,18,sapphire,19

```

Program 2: *Diskfont.bmap* Filemaker

```
'DiskfontMaker
file$=":BMAPS/Diskfont.bmap"
READ filesize,checksum
PRINT "Checking DATA statements.
..":PRINT
FOR i=1 TO filesize
READ a$:a=VAL("&h"+a$)
check=check+a
NEXT i
RESTORE DiskFontData
IF check<>checksum THEN PRINT "C
hecksum mismatch -- error in typ
ing.":END
PRINT "DATA ok, creating the fil
e."
ON ERROR GOTO CreationError
OPEN file$ FOR OUTPUT AS #1
FOR i=1 TO filesize
READ a$:a=VAL("&h"+a$)
PRINT#1,CHR$(a);
NEXT i
CLOSE#1
PRINT "Finished."
END
CreationError:
PRINT "ERROR #";ERR:END

DATA 34,3196
DiskFontData:
DATA 4F,70,65,6E,44,69,73,6B,46,
6F,6E,74,00,FF,E2,09
DATA 00,41,76,61,69,6C,46,6F,6E,
74,73,00,FF,DC,09,01
DATA 02,00
```

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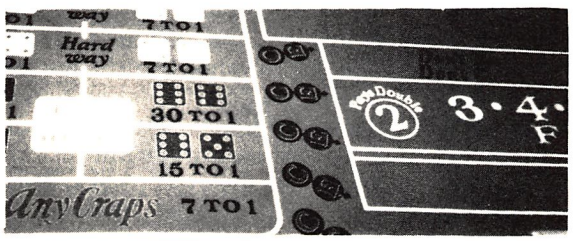
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Using PUT And GET On The IBM PC/PCjr

Rafael Gonzalez

This tutorial for beginning BASIC programmers explains how to use PUT and GET for graphics on the IBM PC/PCjr and compatibles. The program requires a color/graphics card, color monitor, and BASIC on the PC and a color monitor and cartridge BASIC on the PCjr.

IBM BASIC has two commands—PUT and GET—that make it easy for you to animate figures. These powerful commands appear frequently in games, but they have many other uses, as well. (PUT and GET are also used for random file operations, but with a different syntax.)

Bit Pumping

You might think of PUT and GET as "bit pump" operations which move bits from memory onto the screen (PUT) and from the screen into memory (GET). GET reads the colors of the points within a rectangular screen area and stores that information in an array. Here is the basic syntax for the command:

GET (*x1,y1*)–(*x2,y2*), *array*

Each GET command includes two pairs of screen coordinates and an array name. The coordinates define the area to be captured and the array name tells BASIC where to store the image. The first pair of coordinates (*x1* and *y1* in this example) defines the upper left corner of the rectangle. The second pair (*x2* and *y2* in this instance) defines the rectangle's lower right corner. (This is identical to the method used to define a rectangle in a LINE command with the B option.)

The array used with GET must be of the numeric type. It can be any precision, although integer arrays are commonly used. Except for very small shapes, you must DIMension the array before using it. This task, in turn, requires that you calculate how big the array should be. Here is the BASIC formula for calculating the array size:

4 + INT((*x* * *bits per pixel* + 7) / 8) * *y*

In this case, *x* and *y* are the lengths of the horizontal and vertical sides of the rectangle, respectively. The *bits per pixel* value is equal to 4 in low resolution, 2 or 4 in medium resolution, and 1 or 2 in high resolution, depending upon the current screen mode.

For example, suppose you want to capture a 10 × 12–pixel image in medium resolution with GET. The number of bytes required is 4 + INT((10 * 2 + 7) / 8) * 12, or 40 bytes. Next, you must consider how many bytes each element of the array contains. This factor depends on the array's precision. The following table shows how many bytes are contained in each element of an integer, single-precision, or double-precision array.

Number Of Bytes In Each Array Element

Bytes	Array type
2	integer
4	single precision
8	double precision

Since the example shape requires 40 bytes, it can be stored in an integer array containing 20 elements, a single precision array containing 8 elements, or a double precision array containing 5 elements. It's important to dimension an array of the proper size, since BASIC stops with the error message *Illegal function call* if the array is too small. Using an overly large array doesn't do any harm. However, grossly overlarge arrays waste memory.

The PUT command is the opposite of GET: Once you have stored a shape with GET, PUT can place the shape anywhere on the screen. Here is the basic syntax:

PUT (*x,y*), *array, action*

In this example, *x* and *y* set the coordinates where the upper left corner of the image will be placed and the variable *array* identifies the array which contains the shape.

The optional parameter *action* lets you select different modes for a PUT operation. This part of the statement may consist of the word PSET, PRESET, XOR, OR, or AND. If you omit the action parameter, PUT defaults to XOR mode (see below).

Modes For PUT

The PUT mode determines how the placed shape interacts with graphics data that's already present in the same screen area. Type in and save the example program, then run it to see how the mode affects PUT. The program draws a multicolored background and PUTs the same shape on the screen in five different places, using all of the different modes. Here is an explanation of what each mode does.

PSET. In this mode, PUT simply stores the captured data on the screen, overwriting any graphics data that previously existed in the same area. In the example program, the transferred image completely replaces the contents of that screen area.

PRESET. This mode replaces all existing data, just as in PSET mode, but the image is reversed. That is, a value of 0 in the array causes the corresponding point on the screen to have attribute number 3, and vice versa. A value of 1 in the array causes the corresponding point on the screen to have attribute 2, and forth. In the program,

this mode causes the image to have a different color.

AND. The AND mode sets pixels only at points that already contain data matching corresponding data in the transferred image. In the example program, only pixels that are originally cyan remain in the final image.

OR. This mode superimposes an image onto existing data.

XOR. The XOR mode is most often used for animation. When a pixel in the PUT image overlays a point on the screen that contains data, the point is inverted. This feature allows you to move a shape nondestructively over a complex background: When an image is PUT against a background twice, it restores the original data unchanged.

The following table shows how AND, XOR, and OR modes affect screen attributes in medium-resolution mode (SCREEN 1 or SCREEN 4).

Screen Attributes In AND, XOR, And OR Modes

AND

screen	array value 0	1	2	3
0	0	0	0	0
1	0	1	0	1
2	0	0	2	2
3	0	1	2	3

OR

screen	array value 0	1	2	3
0	0	1	2	3
1	1	1	3	3
2	2	3	2	3
3	3	3	3	3

XOR

screen	array value 0	1	2	3
0	0	1	2	3
1	1	0	3	2
2	2	3	0	1
3	3	2	1	0

Animation With PUT

The example program also demonstrates simple animation with PUT in XOR mode. After the five large shapes are drawn, it sends a small shape bouncing around the screen. The process of animation involves four basic steps:

1. Calculate a new position for the shape.
2. PUT the shape on the screen at its previous location (to erase the old image).
3. PUT the shape in its new position.
4. Return to step 1.

Before you enter the loop, you must have PUT the shape on the screen once, so that the PUT in step 2 will erase it. This preliminary step is performed in line 440 of the program. Line 450 saves the old position of the shape in OLDX and OLDY before a new position is calculated in lines 460–490.

BASIC animation with PUT always involves a certain amount of flickering, which results from the delay between the time the old shape is erased and the new one is drawn. To minimize flicker, you should perform the two PUTs as close together as possible. This reduces the amount of time that the shape is invisible. The example program accomplishes this by putting both PUT statements on the same line. The first statement in line 510 erases the old image, and the second statement draws the new one. The do-nothing loop in line 520 holds the new image on the screen for a short interval to alleviate flicker even further. Most programs won't need an explicit delay, since the program will be doing other time-consuming tasks between each redraw.

Once you understand the basics of GET and PUT, you may find many uses for these commands. A drawing program, for instance, may include a feature allowing you to copy one screen area to another. If you capture the indicated area with GET, it is effectively saved in an offscreen buffer, and can be replaced at any time with a simple PUT command. In fact, if sufficient memory is available, you can even GET an entire screen.

To see the effect of a full-screen GET, press any key while the small box is moving on the screen. The program saves the current screen in the array SCRN2%, then PUTs on the screen an image previously stored in the array SCRN1%. Immediately thereafter, it restores the current image by PUTting the SCRN2% image back on the screen. As you can see, significant delays result from manipulating images of this size.

PUT And GET Demo

For instructions on entering this program, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
GI 100 SCREEN 1:KEY OFF:RANDOMIZ
       E TIMER
CE 110 LINE (60,60)-(120,120),1,
       BF
PF 120 X=61:Y=61
DE 130 BITSPERPIXEL=2
CA 140 NUM=4+INT((X*BITSPERPIXEL
       +7)/8)*Y
FB 150 DIM LARGE%(NUM/2), SMALL%
       (NUM/4)
GF 160 X=320:Y=200
CG 170 NUM=4+INT((X*BITSPERPIXEL
       +7)/8)*Y
MD 180 DIM SCRN1%(NUM/2),SCRN2%(
       NUM/2)
MJ 190 GET (60,60)-(120,120), LA
       RGE%
BC 200 GET (60,60)-(90,90),   SM
       ALL%
AA 210 CLS
DG 220 FOR COL=1 TO 3:FOR J=1 TO
        50
JI 230 X=INT(RND*319):Y=INT(RND*
       199)
BI 240 PSET (X,Y),COL:NEXT:NEXT
DP 250 GET (0,0)-(319,199),SCRN1
       %
FC 260 FOR J=40 TO 140 STEP 10
OF 270 LINE (0,J)  -(320,J+1),1,
       BF
PP 280 LINE (0,J+2)-(320,J+3),2,
       BF
GN 290 LINE (0,J+4)-(320,J+5),3,
       BF
NP 300 NEXT
CO 310 PUT (30,20),   LARGE%, PS
       ET
GN 320 PUT (120,20),  LARGE%, PR
       ESET
KH 330 PUT (210,20),  LARGE%, AN
       D
NH 340 PUT (70,110),  LARGE%, OR
FJ 350 PUT (180,110), LARGE%, XO
       R
NB 360 LOCATE 2,6  :PRINT "PSET"
KN 370 LOCATE 2,17 :PRINT "PRESE
       T"
LO 380 LOCATE 2,29 :PRINT "AND"
OH 390 LOCATE 23,13:PRINT "OR"
HA 400 LOCATE 23,26:PRINT "XOR"
JC 410 X=10:Y=50:DX=2:DY=2
JP 420 RLIM=320-32:LLIM=0
KD 430 ULIM=0:DLIM=200-32
EH 440 PUT (X,Y), SMALL%
PI 450 OLDX=X:OLDY=Y
KE 460 IF INKEY$<>"" THEN GET (0
       ,0)-(319,199),SCRN2%:PUT
       (0,0),SCRN1%,AND:PUT (0,0
       ),SCRN2%,PSET
HM 470 X=X+DX
KN 480 IF X=>RLIM OR X<=LLIM THE
       N DX=-DX
IG 490 Y=Y+DY
HF 500 IF Y<=ULIM OR Y>=DLIM THE
       N DY=-DY
FJ 510 PUT (OLDX,OLDY),SMALL%:PU
       T (X,Y),SMALL%
ID 520 FOR J=0 TO 80:NEXT
GL 530 GOTO 450                  C
```

Superplotter

Greg Perkins and Derry Bryson

This 3-D plotting program for the Commodore 64 can handle the difficult problem of removing hidden lines from two-dimensional representations of solid objects. A disk drive is required.

As shown by the popularity of games using 3-D, people are interested in and entertained by three-dimensional displays. "Superplotter" is a program that plots 3-D equations with hidden-line removal and real perspective. Despite the complexity of those tasks—which require a lot of calculations—the program runs relatively quickly.

Type in and save Programs 1–3. Program 1 is the main program, Program 2 is a machine language routine used by the main program, and Program 3 is a BASIC program that displays picture files created by Program 1. Since Program 2 is written in machine language, it must be typed in using the "MLX" machine language entry program listed elsewhere in this issue. Read the MLX instructions carefully before you begin to enter the program. When you run MLX, you'll be asked for a starting address and an ending address for the data you'll be entering. Here are the addresses you need for Program 2:

Starting address: C500
Ending address: C83F

Using Superplotter

To draw a picture with Superplotter, Programs 1 and 2 must both be in memory. First, load Program 2 with a command like this:

```
LOAD"ML",8,1
```

Replace ML with the filename you used when you saved the Program 2 data with MLX. Type NEW and press RETURN; then load and run Program 1. Superplotter then asks you to enter the information it needs to draw the display. If the prompt following the request for information includes a blinking cursor, you'll need to press RETURN after your answer. If no blinking cursor appears, just press the appropriate key. After you've entered all the necessary information, the program waits for you to press any key to start the drawing process. When you've finished viewing the picture, press any key. You then have the option to run the program again, save the picture to disk, redraw the picture (perhaps in a different format), or quit.

Program 3 allows you to display pictures saved on disk without having to wait for them to be redrawn. When you run this program, it asks for the name of the picture file you wish to display. If you enter a dollar sign ($) at the filename prompt, the program prints a directory of the current disk. Once the picture is on the screen, the program waits for you to press any key.

Plotting New Shapes

The shape drawn by Superplotter is controlled by a function definition in the first line of the program (line 0 of Program 1). To change the picture, use a different function definition. Here's a simple example:

```
DEF FN F(X)=(X*X+Y*Y)
```

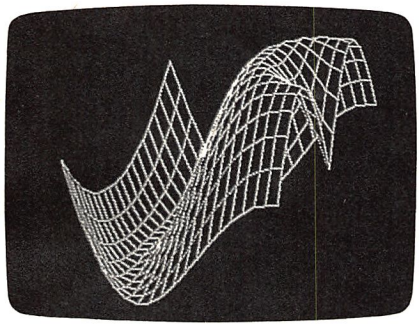
The DEF FN statement creates a user-defined function which is used later in the program. The expression to the right of the equal sign (=) is the part which you can change to modify the resulting shape. The equation must contain several items: a vantage point, *x* and *y* domains, a sampling resolution, the method of screen scaling, and whether or not to draw with hidden-line removal. Here's an explanation of those terms.

The *vantage point* is the point in space from which you wish to view the picture. Superplotter uses THETA, PHI, and RHO to define a point in a spherical coordinate system. In fact, they describe a line connecting that point and the origin (0,0,0). THETA is the angle of rotation about the *z*-axis using the *x*-axis as a starting point. PHI is the angle between the *z*-axis and the line. RHO is the distance from the origin to the point. RHO also determines the amount of perspective. The closer the object seems to be, the more pronounced the perspective effect. If your vantage point is inside the object, the picture usually becomes distorted beyond recognition.

The *x and y domains* are the limits for *x* and *y* in this drawing. These values determine how much of the equation is actually plotted on the screen.

The *sampling resolution* controls the number of segments or slices in each domain (x and y). This value tells Superplotter how many times it must sample the equation in order to draw the picture.

Superplotter can scale (proportion) the picture on the screen in two different ways. Full-screen scaling stretches or squeezes the picture horizontally and vertically to fit exactly on the screen. One-to-one scaling plots the picture exactly in one dimension and adjusts the other dimension to be in an exact one-to-one ratio with the first dimension. This results in truly representational plots for those concerned about mathematical accuracy.



"Superplotter" for the Commodore 64 can draw thousands of different 3-D shapes such as the one shown here.

Hidden-Line Removal

Superplotter also allows two methods for drawing the picture: with or without *hidden-line removal*. This factor determines whether the picture includes lines from surfaces on the opposite side of the object from your vantage point. If the hidden lines are removed, the object looks solid. If they are not, the representation of the object lacks solidity, as if the object were constructed of wire. In most cases, you will want hidden-line removal so that objects look solid. If you wish to see hidden features, however, this feature can be defeated.

For those who are interested, here is a description of how this program accomplishes hidden-line removal. The machine language line-draw routines constantly update a moving border to show the outside edges of the picture being drawn. Before plotting a point, the line-draw routine checks each point against this boundary. If the point is inside the boundary, the point is not plotted. If the point is outside the border, it is plotted and the moving border is updated to accommodate the new point. By drawing the picture from front to back, the program insures that only visible lines are drawn. Rather than remove lines that have been drawn, the program actually prevents hidden points from being plotted in the first place.

Sample Equations

Listed above are a few equations with parameters that produce interesting pictures. In each case you should substitute the first formula for the statement inside parentheses in the first line of the program. In the Bowl example, for instance, replace the original function definition with this statement:

```
DEF FN F(X)=(X*X+Y*Y)
```

The remainder of the information for each shape tells you how to respond to the program's prompts.

Bowl

Function: X*X+Y*Y
Eye: 30,50,200
Domains: −4,4,−4,−4
Segments: 10,10
Scaling: Full screen

SIN of distance

Function: SIN(SQR(X*X+Y*Y))
Eye: 30,75,200
Domains: −11,11,−11,11
Segments: 25,25
Scaling: Full screen

Thumbtack

Function: COS(SQR(X*X+Y*Y))/(SQR(X*X+Y*Y)+1)
Eye: 25,89.5,200
Domains: −8,8,−8,8
Segments: 26,26
Scaling: Full screen

Spike

Function: COS(SQR(X*X+Y*Y)/(10*SQR(X*X+Y*Y)+1)
Eye: 30,89,200
Domains: −2,2,−2,2
Segments: 16,16
Scaling: Full screen

Modulation

Function: 10/SQR(X*X+Y*Y)*SIN(SQR(X*X+Y*Y))*COS(X/2)
Eye: 60,70,200
Domains: −15,15,−15,15
Segments: 35,35
Scaling: Full screen

Cross section of SIN of distance

Function: SIN(SQR(X*X+Y*Y))
Eye: 15,80,200
Domains: −3,3,−3,0
Segments: 20,10
Scaling: Full screen

Program 1: Superplotter

For instructions on entering this program, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
DF Ø DEF FN F(X)=X*X+Y*Y
AH 1Ø POKE53280,Ø:POKE53281,Ø:
      PRINTCHR$(14)"{CLR}{WHT}
      {1Ø SPACES}<<< SUPERPLOT
      TER >>>"
JD 2Ø PRINT"{WHT}{DOWN}
      {1Ø SPACES}3-D FUNCTION
      {SPACE}PLOTTER{4Ø}"
AX 3Ø MM=2304:PRINT:POKE631,14
      4
KC 4Ø POKE632,71:POKE633,111:P
      OKE634,53:POKE635,48:POK
      E636,13:POKE198,6:LIST-1
JF 5Ø PRINT"{5Ø}{2 UP}
      {6 SPACES}{DOWN}"
CH 6Ø PRINT"{UP}ENTER EYE COOR
      DINATES (THETA DEGREES,"
HS 7Ø PRINT"{2 SPACES}PHI DEGR
      EES, RHO UNITS)";:INPUTT
      H,PH,RH
QH 8Ø IF TH>=36ØTHENTH=TH-36Ø:
      GOTO8Ø
BM 9Ø IF TH<ØTHENTH=TH+36Ø:GOT
      O9Ø
EE 1ØØ IF PH>=36ØTHENPH=PH-36Ø
      :GOTO1ØØ
XX 11Ø IF PH<ØTHENPH=PH+36Ø:GO
      TO11Ø
PX 12Ø SH=SIN(TH*.Ø174532778):
      CT=COS(TH*.Ø174532778):
      SP=SIN(PH*.Ø174532778)
```

```
SC 130 CP=COS(PH*.0174532778):
       DI=RH
XP 140 PRINT"{DOWN}ENTER DOMAI
       NS OF X AND Y (XMIN, XM
       AX,"
FR 150 PRINT"{2 SPACES}YMIN, Y
       MAX)";:INPUTXS,XE,YS,YE
MD 160 IF XS>=XE OR YS>=YE THE
       N PRINT"{3 UP}";:GOTO14
       0
MP 170 PRINT"{DOWN}ENTER THE N
       UMBER OF SEGMENTS FOR E
       ACH"
EK 180 PRINT"{2 SPACES}DOMAIN
       {SPACE}(XSEGS, YSEGS)";
       :INPUTSX,SY:SX=INT(SX):
       SY=INT(SY)
CQ 190 IF SX<=0 OR SY<=0ORSX*S
       Y>MM THENPRINT"{3 UP}";
       :GOTO170
FC 200 DIM PT(SY,SX,2)
CM 210 PRINT"{DOWN}SCALE <O>NE
       -TO-ONE, OR <F>ULL SCRE
       EN? ";
GE 220 GETSC$:IFSC$<>"O"ANDSC$
       <>"F"THEN220
HG 230 PRINTSC$
FH 240 PRINT"{DOWN}DRAW WITH
       {RVS}HIDDEN-LINE{OFF} R
       EMOVAL? (Y/N) ";
QF 250 GETHL$:IFHL$<>"Y"ANDHL$
       <>"N"THEN250
CJ 260 PRINTHL$
FF 270 PRINT"{2 DOWN}{8}SAMPLI
       NG FUNCTION... "
EB 280 IFPH<180THEN310
JP 290 PH=360-PH:IFTH>180THENT
       H=TH-180:GOTO310
FA 300 TH=TH+180
QR 310 X1=XS:X2=XE:Y1=YS:Y2=YE
       :DX=1:DY=1
CP 320 IFTH>0ANDTH<180 THENY1=
       YE:Y2=YS:DY=-1
DK 330 IFTH<90ORTH>270 THENX1=
       XE:X2=XS:DX=-1
GE 340 AY=-1:FORLX=X1TOX2STEPD
       X*((XE-XS)/SX):AY=AY+1:
       AX=-1
RE 350 PRINT"{UP}{20 RIGHT}"SX
       -AY"{LEFT}{2 SPACES}"
SM 360 FORLY=Y1TOY2STEPDY*((YE
       -YS)/SY):AX=AX+1:X=LX:Y
       =LY:Z=FNF(X):EX=-X*SH+Y
       *CT
FP 370 EY=-X*CT*CP-Y*SH*CP+Z*S
       P:EZ=-X*CT*SP-Y*SH*SP-Z
       *CP+RH:X=DI*(EX/EZ)
AG 380 Y=-DI*(EY/EZ):PT(AX,AY,
       1)=X:PT(AX,AY,2)=Y
JX 390 IF AX=0ANDAY=0THENM1=X:
       M2=X:M3=Y:M4=Y
DE 400 IFX>M1THENM1=X
FF 410 IFX<M2THENM2=X
QS 420 IFY>M3THENM3=Y
GX 430 IFY<M4THENM4=Y
PB 440 NEXTLY:NEXTLX
KC 450 GOSUB940:PRINT"{UP}SCAL
       ING{SHIFT-SPACE}RESULTS
       ..."
AD 460 IFSC$="F"THEN510
CR 470 IFM1>M3THENM3=M1
SR 480 IFM3>M1THENM1=M3
XC 490 IFM2<M4THENM4=M2
GC 500 IFM4<M2THENM2=M4
MB 510 S1=319/(M1-M2):S2=-S1*M
       2:S3=199/(M3-M4):S4=-S3
       *M4
MP 520 FORLY=0TOAY:PRINT"{UP}
       {18 RIGHT}"AY-LY"{LEFT}
       {2 SPACES}":FORLX=0TOAX
EJ 530 PT(LX,LY,1)=INT((S1*PT(
       LX,LY,1)+S2)+.5)
CK 540 PT(LX,LY,2)=INT((S3*PT(
       LX,LY,2)+S4)+.5):NEXTLX
       :NEXTLY
BA 550 GOSUB940:PRINT"{UP}
       {RVS} PRESS ANY KEY TO
       {SPACE}DRAW "
HK 560 GETK$:IFK$=""THEN560
JB 570 GOSUB940:IFHL$="Y"THENS
       YS50905:GOTO590
MX 580 SYS50977
FG 590 IFTH>180THENTH=TH-180:G
       OTO590
EC 600 IFTH>90THEN630
PR 610 IFTH>45THEN700
RQ 620 GOTO640
KQ 630 IFTH<135THEN700
ER 640 FORLY=0TOAY-1:FORLX=0TO
       AX-1
EH 650 SYS50630,PT(LX,LY,1),PT
       (LX,LY,2),PT(LX+1,LY,1)
       ,PT(LX+1,LY,2)
RS 660 SYS50630,PT(LX,LY,1),PT
       (LX,LY,2),PT(LX,LY+1,1)
       ,PT(LX,LY+1,2):NEXTLX
XP 670 SYS50630,PT(LX,LY,1),PT
       (LX,LY,2),PT(LX,LY+1,1)
       ,PT(LX,LY+1,2):NEXTLY
GK 680 FORLX=0TOAX-1:SYS50630,
       PT(LX,LY,1),PT(LX,LY,2)
       ,PT(LX+1,LY,1),PT(LX+1,
       LY,2)
JK 690 NEXTLX:GOTO760
FJ 700 FORLX=0TOAX-1:FORLY=0TO
       AY-1
CH 710 SYS50630,PT(LX,LY,1),PT
       (LX,LY,2),PT(LX,LY+1,1)
       ,PT(LX,LY+1,2)
JH 720 SYS50630,PT(LX,LY,1),PT
       (LX,LY,2),PT(LX+1,LY,1)
       ,PT(LX+1,LY,2):NEXTLY
DP 730 SYS50630,PT(LX,LY,1),PT
       (LX,LY,2),PT(LX+1,LY,1)
       ,PT(LX+1,LY,2):NEXTLX
ER 740 FORLY=0TOAY-1:SYS50630,
       PT(AX,LY,1),PT(AX,LY,2)
       ,PT(AX,LY+1,1),PT(AX,LY
       +1,2)
RK 750 NEXTLY
MJ 760 GETK$:IFK$=""THEN760
SR 770 SYS50448:PRINTCHR$(14);
KA 780 PRINT"{UP}<R>UN, <S>AVE
       , RE<D>RAW, OR <Q>UIT?
       {SPACE}"
MC 790 GETCH$:IFCH$<>"R"ANDCH$
       <>"S"ANDCH$<>"D"ANDCH$<
       >"Q"THEN790
KH 800 IFCH$="S"THEN860
MF 810 IFCH$="R"THENRUN
SM 820 IFCH$="Q"THENPRINT"{7}
       {CLR}";CHR$(142);:POKE5
       3280,14:POKE53281,6:LIS
       T-1
MR 830 GOSUB940:PRINT"{UP}DRAW
        WITH HIDDEN-LINE REMOV
       AL? (Y/N) "
GE 840 GETHL$:IFHL$<>"Y"ANDHL$
       <>"N"THEN840
SD 850 GOSUB940:GOTO570
FA 860 GOSUB940:FI$="":PRINT"
       {UP}PICTURE FILENAME";:
       INPUTFI$
QM 870 IF FI$=""THENGOSUB940:P
       RINT"{UP}":GOTO780
GG 880 GOSUB940:PRINT"{UP}SAVI
       NG "FI$
ES 890 OPEN2,8,2,"0:"+FI$+",P,
       W":SYS51197:CLOSE2:OPEN
       15,8,15:INPUT#15,A,B$:C
       LOSE15
XS 900 GOSUB940:PRINT"{UP}"B$:
       IFB$="OK"THENPRINT"{UP}
       ":GOTO780
DK 910 PRINT"{UP}{23 RIGHT} (P
       RESS ANY KEY)
BH 920 GETK$:IFK$=""THEN920
BK 930 GOSUB940:PRINT"{UP}":GO
       TO780
CQ 940 PRINT"{UP}";:FORC=1TO38
       :PRINT"{RIGHT}{DEL}";:N
       EXTC:PRINT:RETURN
```

Program 2: Machine Language Routine

Please refer to the "MLX" article in this issue before entering the following listing.

```
C500:A9 3B 8D 11 D0 A9 08 8D BC
C508:18 D0 A9 00 8D 00 DD 60 91
C510:A9 1B 8D 11 D0 A9 15 8D DE
C518:18 D0 A9 03 8D 00 DD 60 D1
C520:A9 00 85 FA A9 E0 85 FB B8
C528:A9 00 A2 00 A0 00 91 FA FF
C530:C8 D0 FB E6 FB E8 E0 20 A7
C538:D0 F2 A9 10 A0 00 99 00 57
C540:C0 99 00 C1 99 00 C2 99 9A
C548:00 C3 C8 D0 F1 60 A4 02 47
C550:98 29 F8 85 FE 85 FC A9 9B
C558:00 85 FD 06 FC 26 FD 06 E7
C560:FC 26 FD 18 A5 FC 65 FE 20
C568:85 FC A5 FD 69 00 85 FD DE
C570:06 FC 26 FD 06 FC 26 FD 51
C578:06 FC 26 FD 98 29 07 18 7A
C580:65 FC 85 FC A5 FD 69 00 76
C588:85 FD 18 A5 FA 29 F8 65 87
C590:FC 85 FC A5 FB 65 FD 85 EC
C598:FD 18 A9 00 65 FC 85 FC 85
C5A0:A9 E0 65 FD 85 FD A5 FA 30
C5A8:29 07 49 07 AA A9 01 CA EC
C5B0:30 03 0A D0 FA A0 00 A2 60
C5B8:34 78 86 01 11 FC 91 FC F9
C5C0:A2 37 86 01 58 60 20 FD CE
C5C8:AE 20 EB B7 8E 02 00 AD D6
C5D0:14 00 8D FA 00 AD 15 00 A8
C5D8:8D FB 00 20 FD AE 20 EB 03
C5E0:B7 8E A9 02 AD 14 00 8D 8C
C5E8:A7 02 AD 15 00 8D A8 02 59
C5F0:A9 00 8D AD 02 8D AE 02 83
C5F8:A9 EE 8D 8A C6 8D B7 C6 12
C600:AD A7 02 38 ED FA 00 8D FA
C608:AA 02 AD A8 02 ED FB 00 6B
C610:8D AB 02 10 19 A9 00 8D 8D
C618:B7 C6 38 A9 00 ED AA 02 E3
C620:8D AA 02 A9 00 ED AB 02 0B
C628:8D AB 02 4C 40 C6 AD AA 8F
C630:02 D0 0D AD AB 02 D0 08 7E
C638:A9 FF 8D AD 02 8D AE 02 CC
C640:AD A9 02 38 ED 02 00 8D D7
C648:AC 02 A9 00 E9 00 8D AF FB
C650:02 10 16 A9 CE 8D 8A C6 C8
C658:A9 00 38 ED AC 02 8D AC D5
C660:02 A9 00 ED AF 02 8D AF 88
C668:02 20 32 C7 AD A9 02 CD A7
C670:02 00 D0 11 AD A7 02 CD 08
C678:FA 00 D0 09 AD A8 02 CD 10
C680:FB 00 D0 01 60 AD AE 02 4F
C688:10 19 EE 02 00 AD AA 02 70
C690:18 6D AD 02 8D AD 02 AD 30
C698:AB 02 6D AE 02 8D AE 02 BA
C6A0:4C 69 C6 38 AD AD 02 ED 21
C6A8:AC 02 8D AD 02 AD AE 02 BF
C6B0:ED AF 02 8D AE 02 A9 EE F9
C6B8:F0 0B EE FA 00 D0 03 EE 47
C6C0:FB 00 4C 69 C6 38 AD FA D9
C6C8:00 E9 01 8D FA 00 AD FB F8
C6D0:00 E9 00 8D FB 00 4C 69 93
C6D8:C6 A9 C7 A0 00 99 00 CA 68
C6E0:99 00 CB C8 D0 F7 A9 00 FA
C6E8:99 41 CB 99 00 CC C8 D0 3C
C6F0:F7 A9 3F 99 81 CC 99 81 5A
C6F8:CD C8 A9 01 99 81 CC 99 EA
C700:81 CD C8 D0 EC A9 00 99 91
C708:11 CE 99 A1 CE C8 D0 F7 54
C710:20 20 C5 20 00 C5 A9 32 0F
C718:8D 6A C6 A9 C7 8D 6B C6 8E
```

```
C720:60 20 20 C5 20 00 C5 A9 7E
C728:4E 8D 6A C6 A9 C5 8D 6B E6
C730:C6 60 A9 00 8D FD CF A5 1A
C738:17 8D FE CF A5 18 8D FF 3C
C740:CF A5 FA 85 17 A5 FB 85 A5
C748:18 A9 CA 18 65 18 85 18 D7
C750:A0 00 A5 02 D1 17 B0 09 5A
C758:A9 01 8D FD CF A5 02 91 39
C760:17 A5 17 18 69 41 85 17 BB
C768:A5 18 69 01 85 18 B1 17 15
C770:C5 02 B0 09 A9 01 8D FD 74
C778:CF A5 02 91 17 A5 02 0A 10
C780:85 17 A9 CC 69 00 85 18 09
C788:A9 81 18 65 17 85 17 90 34
C790:02 E6 18 A0 01 38 A5 FA 17
C798:A0 00 F1 17 8D FC CF C8 F0
C7A0:A5 FB F1 17 0D FC CF B0 5E
C7A8:10 F0 0E A9 01 8D FD CF E2
C7B0:A5 FB 91 17 88 A5 FA 91 18
C7B8:17 A9 90 18 65 17 85 17 7B
C7C0:A9 01 65 18 85 18 A0 00 61
C7C8:38 A5 FA F1 17 8D FC CF 15
C7D0:A5 FB C8 F1 17 0D FC CF 21
C7D8:90 10 F0 0E A9 01 8D FD 1E
C7E0:CF A5 FB 91 17 88 A5 FA 7B
C7E8:91 17 AD FD CF F0 03 20 05
C7F0:4E C5 AD FF CF 85 18 AD 41
C7F8:FE CF 85 17 60 A2 02 20 CF
C800:C9 FF A9 00 20 D2 FF A9 A1
C808:20 20 D2 FF A9 00 85 FB 60
C810:A9 E0 85 FC A0 00 A2 34 AD
C818:78 86 01 B1 FB A2 37 86 22
C820:01 58 20 D2 FF E6 FB D0 DD
C828:02 E6 FC A5 FB C9 41 D0 C8
C830:E5 A5 FC C9 FF D0 DF 20 7D
C838:CC FF 60 00 FF 00 00 00 3C
```

Program 3: Picture Display

For instructions on entering this program, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
HB 10 IFX=0THEN20
KK 14 GETK$:IFK$=""THEN14
EA 15 POKE53272,21:POKE53265,2
      7:POKE53280,14
GC 20 INPUT"{CLR}{DOWN} PICTUR
      E FILENAME";FI$:IF FI$="
      $" THEN GOTO 50
GM 25 OPEN2,8,2,FI$:CLOSE2:OPE
      N15,8,15:INPUT#15,A,B$:C
      LOSE15:IFB$="OK"THEN30
AD 26 PRINTB$:END
BK 30 PRINT"{CLR}":POKE53280,0
      :POKE53265,59:POKE53272,
      29
SS 31 FORO=1TO24:PRINT"PPPPPPP
      PPPPPPPPPPPPPPPPPPPPPPP
      PPPPPPPPP";:NEXTO
SS 35 PRINT"PPPPPPPPPPPPPPPPPP
      PPPPPPPPPPPPPPPPPPPPP";:
      POKE2023,16:GOTO160
MM 40 REM *DIRECTORY ROUTINE*
DF 50 OPEN1,8,0,"$0"
XE 60 GET#1,A$,A$
MH 70 GET#1,A$,A$
XP 80 S=ST:IFS<>0THENCLOSE1:GO
      TO 140
CD 90 GET#1,LO$,HI$
BG 100 LO=ASC(LO$+CHR$(0)):HI=
       ASC(HI$+CHR$(0)):LN=LO+
       HI*256:LN$=MID$(STR$(LN
       ),2)
SE 110 PRINTLN$+" ";
CM 120 GET#1,B$:IF B$="" THEN
       {SPACE}PRINT CHR$(13);:
       GOTO 70
EC 130 PRINT B$;:GOTO 120
KP 140 OPEN15,8,15:INPUT#15,EN
       ,EM$,ET,ES:CLOSE15:IFEN
       <>0THENPRINTEN;ES
BG 150 X=1:GOTO10
KD 160 X=1:LOADFI$,8,1
```

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COMPUTE!'s Author's Guide

Most of the following suggestions serve to improve the speed and accuracy of publication. COMPUTE! is primarily interested in new and timely articles on the Commodore 64/128, Atari, Apple, IBM PC/PCjr, Amiga, and Atari ST. We are much more concerned with the content of an article than with its style, but articles should be clear and well-explained.

The guidelines below will permit your good ideas and programs to be more easily edited and published:

1. The upper left corner of the first page should contain your name, address, telephone number, and the date of submission.

2. The following information should appear in the upper right corner of the first page. If your article is specifically directed to one make of computer, please state the brand name and, if applicable, the BASIC or ROM or DOS version(s) involved. In addition, *please indicate the memory requirements of programs.*

3. The underlined title of the article should start about 2/3 of the way down the first page.

4. Following pages should be typed normally, except that in the upper right corner there should be an abbreviation of the title, your last name, and the page number. For example: Memory Map/Smith/2.

5. All lines within the text of the article must be double- or triple-spaced. A one-inch margin should be left at the right, left, top, and bottom of each page. No words should be divided at the ends of lines. And please do not justify. Leave the lines ragged.

6. Standard typing paper should be used (no erasable, onionskin, or other thin paper) and typing should be on one side of the paper only (upper- and lowercase).

7. Sheets should be attached together with a paper clip. Staples should not be used.

8. If you are submitting more than one article, send each one in a separate mailer with its own tape or disk.

9. Short programs (under 20 lines) can easily be included within the text. Longer programs should be separate listings. *It is essential that we have a copy of the program, recorded twice, on a tape or disk.* If your article was written with a word processor, we also appreciate a copy of the text file on the tape or disk. Please use high-quality 10 or 30 minute tapes with the program recorded on both sides. The tape or disk should be labeled with the author's name, the title of the article, and, if applicable, the BASIC/ROM/DOS version(s). Atari tapes should specify whether they are to be LOADed or ENTERed. We prefer to receive Apple programs on disk rather than tape. Tapes are fairly sturdy, but disks need to be enclosed within plastic or cardboard mailers (available at photography, stationery, or computer supply stores).

10. A good general rule is to spell out the numbers zero through ten in your article and write higher numbers as numerals (1024). The exceptions to this are: Figure 5, Table 3, TAB(4), etc. Within ordinary text, however, the zero through ten should appear as words, not numbers. Also, symbols and abbreviations should not be used within text: use "and" (not &), "reference" (not ref.), "through" (not thru).

11. For greater clarity, use all capitals when referring to keys (RETURN, TAB, ESC, SHIFT), BASIC words (LIST, RND, GOTO), and three languages (BASIC, APL, PILOT). Headlines and subheads should, however, be initial caps only, and emphasized words are not capitalized. If you wish to emphasize, underline the word and it will be italicized during typesetting.

12. Articles can be of any length—from a single-line routine to a multi-issue series. The average article is about four to eight double-spaced, typed pages.

13. If you want to include photographs, they should be either 5×7 black and white glossies or color slides.

14. We do not consider articles which are submitted simultaneously to other publishers. If you wish to send an article to another magazine for consideration, please do not submit it to us.

15. COMPUTE! pays between $70 and $800 for published articles. In general, the rate reflects the length and quality of the article. Payment is made upon acceptance. Following submission (Editorial Department, COMPUTE! Magazine, P.O. Box 5406, Greensboro, NC 27403) it will take from four to eight weeks for us to reply. If your work is accepted, you will be notified by a letter which will include a contract for you to sign and return. *Rejected manuscripts are returned to authors who enclose a self-addressed, stamped envelope.*

16. If your article is accepted and you have since made improvements to the program, please submit an entirely new tape or disk and a new copy of the article reflecting the update. We cannot easily make revisions to programs and articles. It is necessary that you send the revised version as if it were a new submission entirely, but be sure to indicate that your submission is a revised version by writing, "Revision" on the envelope and the article.

17. COMPUTE! does not accept unsolicited product reviews. If you are interested in serving on our panel of reviewers, contact the Review Coordinator for details.

COMPUTE!'s Guide To Typing In Programs

Computers are precise—type the program *exactly* as listed, including necessary punctuation and symbols, except for special characters noted below. We have provided a special listing convention as well as a program to check your typing—"The Automatic Proofreader."

Programs for the IBM, TI-99/4A, and Atari ST models should be typed exactly as listed; no special characters are used. Programs for Commodore, Apple, and Atari 400/800/XL/XE computers may contain some hard-to-read special characters, so we have a listing system that indicates these control characters. You will find these Commodore and Atari characters in curly braces; *do not type the braces.* For example, {CLEAR} or {CLR} instructs you to insert the symbol which clears the screen on the Atari or Commodore machines. A complete list of these symbols is shown in the tables below. For Commodore, Apple, and Atari, a single 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. This will produce a reverse video character on the Commodore (in quote mode), a graphics character on the Atari, and an invisible control character on the Apple.

Graphics characters entered with the Commodore logo key are enclosed in a special bracket: [<A>]. In this case, you would 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. One exception is {SHIFT-SPACE}. When you see this, hold down SHIFT and press the space bar. 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 (white on black) should be entered with the inverse video

Atari 400/800/XL/XE

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/64/128/16/+4

When You Read:	Press:	See:
{CLR}	SHIFT + CLR/HOME	
{HOME}	CLR/HOME	
{UP}	SHIFT + ↑ CRSR ↓	
{DOWN}	↑ CRSR ↓	
{LEFT}	SHIFT + ← CRSR →	
{RIGHT}	← CRSR →	
{RVS}	CTRL 9	
{OFF}	CTRL 0	
{BLK}	CTRL 1	
{WHT}	CTRL 2	
{RED}	CTRL 3	
{CYN}	CTRL 4	
{PUR}	CTRL 5	
{GRN}	CTRL 6	
{BLU}	CTRL 7	
{YEL}	CTRL 8	

When You Read:	Press:	See:
[<1>]	COMMODORE 1	
[<2>]	COMMODORE 2	
[<3>]	COMMODORE 3	
[<4>]	COMMODORE 4	
[<5>]	COMMODORE 5	
[<6>]	COMMODORE 6	
[<7>]	COMMODORE 7	
[<8>]	COMMODORE 8	
{F1}	f1	
{F2}	SHIFT + f1	
{F3}	f3	
{F4}	SHIFT + f3	
{F5}	f5	
{F6}	SHIFT + f5	
{F7}	f7	
{F8}	SHIFT + f7	
[<4>]	←	

key (Atari logo key on 400/800 models).

Whenever more than two spaces appear in a row, they are listed in a special format. For example, {6 SPACES} means press the space bar six times. Our Commodore listings never leave a single space at the end of a line, instead moving it to the next printed line as {SPACE}.

Amiga program listings contain only one special character, the left arrow (←) symbol. This character marks the end of each program line. Wherever you see a left arrow, press RETURN or move the cursor off the line to enter that line into memory. Don't try to type in the left arrow symbol; it's there only as a marker to indicate where each program line ends.

The Automatic Proofreader

Type in the appropriate program listed below, then save it for future use. The Commodore Proofreader works on the Commodore 128, 64, Plus/4, 16, and VIC-20. Don't omit any lines, even if they contain unfamiliar commands or you think they don't apply to your computer. When you run the program, it installs a machine language program in memory and erases its BASIC portion automatically (so be sure to save several copies before running the program for the first time). If you're using a Commodore 128, Plus/4 or 16, do *not* use any GRAPHIC commands while the Proofreader is active. You should disable the Commodore Proofreader before running any other program. To do this, either turn the computer off and on or enter SYS 64738 (for the 64), SYS 65341 (128), SYS 64802 (VIC-20), or SYS 65526 (Plus/4 or 16). To reenable the Proofreader, reload the program and run it as usual. Unlike the original VIC/64 Proofreader, this version works the same with disk or tape.

On the Atari, run the Proofreader to activate it (the Proofreader remains active in memory as a machine language program); you must then enter NEW to erase the BASIC loader. Pressing SYSTEM RESET deactivates the Atari Proofreader; enter PRINT USR(1536) to reenable it.

The Apple Proofreader erases the BASIC portion of itself after you run it, leaving only the machine language portion in memory. It works with either DOS 3.3 or ProDOS. Disable the Apple Proofreader by pressing CTRL-RESET before running another BASIC program.

The IBM Proofreader is a BASIC program that simulates the IBM BASIC line editor, letting you enter, edit, list, save, and load programs that you type. Type RUN to activate. Be sure to leave Caps Lock on, except when typing lowercase characters.

Once the Proofreader is active, try typing in a line. As soon as you press RETURN, either a hexadecimal number (on the Apple) or a pair of letters (on the Commodore, Atari, or IBM) appears. The number or pair of letters is called a *checksum*.

Compare the value displayed on the screen by the Proofreader with the checksum printed in the program listing in the magazine. 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), press RETURN or Enter, and compare the checksums. If they match, go on to the next line. If not, check your typing; you've made a mistake. Because of the checksum method used, do not type abbreviations, such as ? for PRINT. On the Atari and Apple Proofreaders, spaces are not counted as part of the checksum, so be sure you type the right number of spaces between quote marks. The Atari Proofreader does not check to see that you've typed the characters in the right order, so if characters are transposed, the checksum still matches the listing. The Commodore Proofreader catches transposition errors and ignores spaces unless they're enclosed in quotation marks. The IBM Proofreader detects errors in spacing and transposition.

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 prompts 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 as usual (this replaces 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 an existing BASIC program to Proofreader format, save it to disk with SAVE *"filename"*,A.

Program 1: Atari Proofreader

By Charles Brannon, Program Editor

```
100 GRAPHICS 0
110 FOR I=1536 TO 1700:REA
    D A:POKE I,A:CK=CK+A:N
    EXT I
120 IF CK<>19072 THEN ? "E
    rror in DATA Statement
    s.  Check Typing.":END

130 A=USR(1536)
140 ? :? "Automatic Proofr
    eader Now Activated."
150 END
160 DATA 104,160,0,185,26,
    3,201,69,240,7
170 DATA 200,200,192,34,20
    8,243,96,200,169,74
180 DATA 153,26,3,200,169,
    6,153,26,3,162
190 DATA 0,189,0,228,157,7
    4,6,232,224,16
200 DATA 208,245,169,93,14
    1,78,6,169,6,141
210 DATA 79,6,24,173,4,228
    ,105,1,141,95
220 DATA 6,173,5,228,105,0
    ,141,96,6,169
230 DATA 0,133,203,96,247,
    238,125,241,93,6
240 DATA 244,241,115,241,1
    24,241,76,205,238
250 DATA 0,0,0,0,0,32,62,2
    46,8,201
260 DATA 155,240,13,201,32
    ,240,7,72,24,101
270 DATA 203,133,203,104,4
    0,96,72,152,72,138
280 DATA 72,160,0,169,128,
    145,88,200,192,40
290 DATA 208,249,165,203,7
    4,74,74,74,24,105
300 DATA 161,160,3,145,88,
    165,203,41,15,24
310 DATA 105,161,200,145,8
    8,169,0,133,203,104
320 DATA 170,104,168,104,4
    0,96
```

Program 2: IBM Proofreader

By Charles Brannon, Program Editor

```
10 'Automatic Proofreader Vers
   ion 3.0 (Lines 205,206 adde
   d/190 deleted/470,490 chang
   ed from V2.0)
100 DIM L$(500),LNUM(500):COLO
    R 0,7,7:KEY OFF:CLS:MAX=0:
    LNUM(0)=65536!
110 ON ERROR GOTO 120:KEY 15,C
    HR$(4)+CHR$(70):ON KEY(15)
     GOSUB 640:KEY (15) ON:GOT
    O 130
120 RESUME 130
130 DEF SEG=&H40:W=PEEK(&H4A)
140 ON ERROR GOTO 650:PRINT:PR
    INT"Proofreader Ready."
150 LINE INPUT L$:Y=CSRLIN-INT
    (LEN(L$)/W)-1:LOCATE Y,1
160 DEF SEG=0:POKE 1050,30:POK
    E 1052,34:POKE 1054,0:POKE
     1055,79:POKE 1056,13:POKE
     1057,28:LINE INPUT L$: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$=M
    ID$(L$,4)
200 IF ASC(L$)>57 THEN 260 'no
     line number, therefore co
    mmand
205 BL=INSTR(L$," "):IF BL=0 T
    HEN BL$=L$:GOTO 206 ELSE B
    L$=LEFT$(L$,BL-1)
206 LNUM=VAL(BL$):TEXT$=MID$(L
    $,LEN(STR$(LNUM))+1)
210 IF TEXT$="" THEN GOSUB 540
    :IF LNUM=LNUM(P) THEN GOSU
    B 560:GOTO 150 ELSE 150
220 CKSUM=0:FOR I=1 TO LEN(L$)
    :CKSUM=(CKSUM+ASC(MID$(L$,
    I))*I) AND 255:NEXT:LOCATE
     Y,1:PRINT CHR$(65+CKSUM/1
    6)+CHR$(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
260 TEXT$="":FOR I=1 TO LEN(L$
    ):A=ASC(MID$(L$,I)):TEXT$=
    TEXT$+CHR$(A+32*(A>96 AND
    A<123)):NEXT
270 DELIMITER=INSTR(TEXT$," ")
    :COMMAND$=TEXT$:ARG$="":IF
     DELIMITER THEN COMMAND$=L
    EFT$(TEXT$,DELIMITER-1):AR
    G$=MID$(TEXT$,DELIMITER+1)
     ELSE DELIMITER=INSTR(TEXT
    $,CHR$(34)):IF DELIMITER T
    HEN COMMAND$=LEFT$(TEXT$,D
    ELIMITER-1):ARG$=MID$(TEXT
    $,DELIMITER)
280 IF COMMAND$<>"LIST" THEN 4
    10
290 OPEN "scrn:" FOR OUTPUT AS
     #1
300 IF ARG$="" THEN FIRST=0:P=
    MAX-1:GOTO 340
310 DELIMITER=INSTR(ARG$,"-"):
    IF DELIMITER=0 THEN LNUM=V
    AL(ARG$):GOSUB 540:FIRST=P
    :GOTO 340
320 FIRST=VAL(LEFT$(ARG$,DELIM
    ITER)):LAST=VAL(MID$(ARG$,
    DELIMITER+1))
330 LNUM=FIRST:GOSUB 540:FIRST
    =P:LNUM=LAST:GOSUB 540:IF
    P=0 THEN P=MAX-1
340 FOR X=FIRST TO P:N$=MID$(S
    TR$(LNUM(X)),2)+" "
350 IF CKFLAG=0 THEN A$="":GOT
    O 370
360 CKSUM=0:A$=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$="LLIST" THEN O
    PEN "lpt1:" FOR OUTPUT AS
    #1:GOTO 300
420 IF COMMAND$="CHECK" THEN C
    KFLAG=1:GOTO 290
430 IF COMMAND$<>"SAVE" THEN 4
    50
440 GOSUB 600:OPEN ARG$ FOR OU
    TPUT AS #1:ARG$="":GOTO 30
    0
450 IF COMMAND$<>"LOAD" THEN 4
    90
460 GOSUB 600:OPEN ARG$ FOR IN
    PUT AS #1:MAX=0:P=0
470 WHILE NOT EOF(1):LINE INPU
    T #1,L$:BL=INSTR(L$," "):B
    L$=LEFT$(L$,BL-1):LNUM(P)=
    VAL(BL$):L$(P)=MID$(L$,LEN
    (STR$(VAL(BL$)))+1):P=P+1:
    WEND
480 MAX=P:CLOSE #1:GOTO 130
490 IF COMMAND$="NEW" THEN INP
    UT "Erase program - Are yo
    u sure";L$:IF LEFT$(L$,1)=
    "y" OR LEFT$(L$,1)="Y" THE
    N MAX=0:LNUM(0)=65536!:GOT
    O 130:ELSE 130
500 IF COMMAND$="BASIC" THEN C
    OLOR 7,0,0:ON ERROR GOTO 0
    :CLS:END
510 IF COMMAND$<>"FILES" THEN
    520
515 IF ARG$="" THEN ARG$="A:"
    ELSE SEL=1:GOSUB 600
517 FILES ARG$:GOTO 130
520 PRINT"Syntax error":GOTO 1
    30
540 P=0:WHILE LNUM>LNUM(P) AND
     P<MAX:P=P+1:WEND:RETURN
560 MAX=MAX-1:FOR X=P TO MAX:L
    NUM(X)=LNUM(X+1):L$(X)=L$(
    X+1):NEXT:RETURN
580 MAX=MAX+1:FOR X=MAX TO P+1
     STEP -1:LNUM(X)=LNUM(X-1)
    :L$(X)=L$(X-1):NEXT:L$(P)=
    TEXT$:LNUM(P)=LNUM:RETURN
600 IF LEFT$(ARG$,1)<>CHR$(34)
     THEN 520 ELSE ARG$=MID$(A
    RG$,2)
610 IF RIGHT$(ARG$,1)=CHR$(34)
     THEN ARG$=LEFT$(ARG$,LEN(
    ARG$)-1)
620 IF SEL=0 AND INSTR(ARG$,".
    ")=0 THEN ARG$=ARG$+".BAS"
630 SEL=0:RETURN
640 CLOSE #1:CKFLAG=0:PRINT"St
    opped.":RETURN 150
650 PRINT "Error #";ERR:RESUME
     150
```

Program 3: Commodore Proofreader

By Philip Nelson, Assistant Editor

```
10 VEC=PEEK(772)+256*PEEK(773)
   :LO=43:HI=44
20 PRINT "AUTOMATIC PROOFREADE
   R FOR ";:IF VEC=42364 THEN
   {SPACE}PRINT "C-64"
30 IF VEC=50556 THEN PRINT "VI
   C-20"
40 IF VEC=35158 THEN GRAPHIC C
   LR:PRINT "PLUS/4 & 16"
50 IF VEC=17165 THEN LO=45:HI=
   46:GRAPHIC CLR:PRINT"128"
60 SA=(PEEK(LO)+256*PEEK(HI))+
   6:ADR=SA
70 FOR J=0 TO 166:READ BYT:POK
   E ADR,BYT:ADR=ADR+1:CHK=CHK
   +BYT:NEXT
80 IF CHK<>20570 THEN PRINT "*
    ERROR* CHECK TYPING IN DATA
    STATEMENTS":END
90 FOR J=1 TO 5:READ RF,LF,HF:
   RS=SA+RF:HB=INT(RS/256):LB=
   RS-(256*HB)
100 CHK=CHK+RF+LF+HF:POKE SA+L
   F,LB:POKE SA+HF,HB:NEXT
110 IF CHK<>22054 THEN PRINT "
   *ERROR* RELOAD PROGRAM AND
   {SPACE}CHECK FINAL LINE":EN
   D
120 POKE SA+149,PEEK(772):POKE
    SA+150,PEEK(773)
130 IF VEC=17165 THEN POKE SA+
   14,22:POKE SA+18,23:POKESA+
   29,224:POKESA+139,224
140 PRINT CHR$(147);CHR$(17);"
   PROOFREADER ACTIVE":SYS SA
150 POKE HI,PEEK(HI)+1:POKE (P
   EEK(LO)+256*PEEK(HI))-1,0:N
   EW
160 DATA 120,169,73,141,4,3,16
   9,3,141,5,3
170 DATA 88,96,165,20,133,167,
   165,21,133,168,169
180 DATA 0,141,0,255,162,31,18
   1,199,157,227,3
190 DATA 202,16,248,169,19,32,
   210,255,169,18,32
200 DATA 210,255,160,0,132,180
   ,132,176,136,230,180
210 DATA 200,185,0,2,240,46,20
   1,34,208,8,72
220 DATA 165,176,73,255,133,17
   6,104,72,201,32,208
230 DATA 7,165,176,208,3,104,2
   08,226,104,166,180
240 DATA 24,165,167,121,0,2,13
   3,167,165,168,105
250 DATA 0,133,168,202,208,239
   ,240,202,165,167,69
260 DATA 168,72,41,15,168,185,
   211,3,32,210,255
270 DATA 104,74,74,74,74,168,1
   85,211,3,32,210
280 DATA 255,162,31,189,227,3,
   149,199,202,16,248
290 DATA 169,146,32,210,255,76
   ,86,137,65,66,67
300 DATA 68,69,70,71,72,74,75,
   77,80,81,82,83,88
310 DATA 13,2,7,167,31,32,151,
   116,117,151,128,129,167,136
   ,137
```

Program 4: Apple Proofreader

By Tim Victor, Editorial Programmer

```
10 C = 0: FOR I = 768 TO 768 +
   68: READ A:C = C + A: POKE I
   ,A: NEXT
20 IF C < > 7258 THEN PRINT "ER
   ROR IN PROOFREADER DATA STAT
   EMENTS": END
30 IF PEEK (190 * 256) < > 76 T
   HEN POKE 56,0: POKE 57,3: CA
   LL 1002: GOTO 50
40 PRINT CHR$ (4);"IN#A$300"
50 POKE 34,0: HOME : POKE 34,1:
    VTAB 2: PRINT "PROOFREADER
   INSTALLED"
60 NEW
100 DATA 216,32,27,253,201,141
110 DATA 208,60,138,72,169,0
120 DATA 72,189,255,1,201,160
130 DATA 240,8,104,10,125,255
140 DATA 1,105,0,72,202,208
150 DATA 238,104,170,41,15,9
160 DATA 48,201,58,144,2,233
170 DATA 57,141,1,4,138,74
180 DATA 74,74,74,41,15,9
190 DATA 48,201,58,144,2,233
200 DATA 57,141,0,4,104,170
210 DATA 169,141,96
```

©

MLX Machine Language Entry Program For Commodore 64 And 128

Ottis Cowper, Technical Editor

"MLX" is a labor-saving utility that allows almost fail-safe entry of machine language programs. Included are versions for the Commodore 64 and 128.

Type in and save some copies of whichever version of MLX is appropriate for your computer (you'll want to use it to enter future ML programs from COMPUTE!). Program 1 is for the Commodore 64, and Program 2 is for the 128 (128 MLX can also be used to enter Commodore 64 ML programs for use in 64 mode). When you're ready to enter an ML program, load and run MLX. It asks you for a starting address and an ending address. These addresses appear in the article accompanying the MLX-format program listing you're typing.

If you're unfamiliar with machine language, the addresses (and all other values you enter in MLX) may appear strange. Instead of the usual decimal numbers you're accustomed to, these numbers are in *hexadecimal*—a base 16 numbering system commonly used by ML programmers. Hexadecimal—hex for short—includes the numerals 0–9 and the letters A–F. But don't worry—even if you know nothing about ML or hex, you should have no trouble using MLX.

After you enter the starting and ending addresses, you'll be offered the option of clearing the workspace. Choose this option if you're starting to enter a new listing. If you're continuing a listing that's partially typed from a previous session, don't choose this option.

A functions menu will appear. The first option in the menu is ENTER DATA. If you're just starting to type in a program, pick this. Press the E key, and type the first number in the first line of the program listing. If you've already typed in part of a program, type the line number where you left off typing at the end of the previous session (be sure to load the partially completed program before you resume entry). In any case, make sure the address you enter corresponds to the address of a line in the listing you are entering. Otherwise, you'll be unable to enter the data correctly. If you pressed E by mistake, you can return to the command menu by pressing RETURN alone when asked for the address. (You can get back to the menu from most options by pressing RETURN with no other input.)

Entering A Listing

Once you're in Enter mode, MLX prints the address for each program line for you. You then type in all nine numbers on that line, beginning with the first two-digit number after the colon (:). Each line represents eight data bytes and a checksum. Although an MLX-format listing appears similar to the "hex dump" listings from a machine language monitor program, the extra checksum number on the end allows MLX to check your typing. (Commodore 128 users *can* enter the data from an MLX listing using the built-in monitor if the rightmost column of data is omitted, but we recommend against it. It's much easier to let MLX do the proofreading and error checking for you.)

Figure 1: 64 MLX Keypad

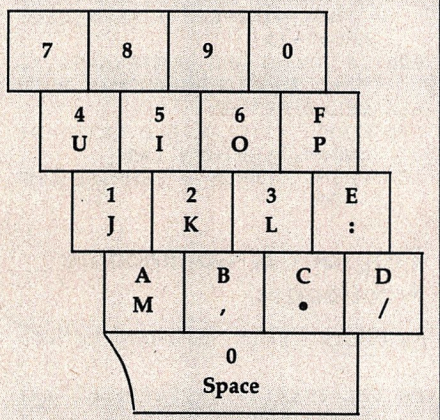
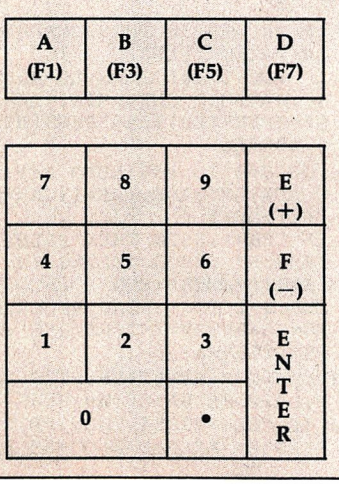


Figure 2: 128 MLX Keypad



When you enter a line, MLX recalculates the checksum from the eight bytes and the address and compares this value to the number from the ninth column. If the values match, you'll hear a bell tone, the data will be added to the workspace area, and the prompt for the next line of data will appear. But if MLX detects a typing error, you'll hear a low buzz and see an error message. The line will then be redisplayed for editing.

Invalid Characters Banned

Only a few keys are active while you're entering data, so you may have to unlearn some habits. You *do not* type spaces between the columns; MLX automatically inserts these for you. You *do not* press RETURN after typing the last number in a line; MLX automatically enters and checks the line after you type the last digit.

Only the numerals 0–9 and the letters A–F can be typed in. If you press any other key (with some exceptions noted below), you'll hear a warning buzz. To simplify typing, 128 MLX redefines the function keys and + and − keys on the numeric keypad so that you can enter data one-handed. In either case, the keypad is active only while entering data. Addresses must be entered with the normal letter and number keys. The figures below show the keypad configurations for each version.

MLX checks for transposed characters. If you're supposed to type in A0 and instead enter 0A, MLX will catch your mistake. There is one error that can slip past MLX: Because of the checksum formula used, MLX won't notice if you accidentally type FF in place of 00, and vice versa. And there's a very slim chance that you could garble a line and still end up with a combination of characters that adds up to the proper checksum. However, these mistakes should not occur if you take reasonable care while entering data.

Editing Features

To correct typing mistakes before finishing a line, use the INST/DEL key to delete the character to the left of the cursor. (The cursor-left key also deletes.) If you mess up a line really badly, press CLR/HOME to start the line over. The RETURN key is also active, but only before any data is typed on a line. Pressing RETURN at this point returns you to the command menu. After you

type a character of data, MLX disables RETURN until the cursor returns to the start of a line. Remember, you can press CLR/HOME to quickly get to a line number prompt.

More editing features are available when correcting lines in which MLX has detected an error. To make corrections in a line that MLX has redisplayed for editing, compare the line on the screen with the one printed in the listing, then move the cursor to the mistake and type the correct key. The cursor left and right keys provide the normal cursor controls. (The INST/DEL key now works as an alternative cursor-left key.) You cannot move left beyond the first character in the line. If you try to move beyond the rightmost character, you'll reenter the line. During editing, RETURN is active; pressing it tells MLX to recheck the line. You can press the CLR/HOME key to clear the entire line if you want to start from scratch, or if you want to get to a line number prompt to use RETURN to get back to the menu.

Display Data

The second menu choice, DISPLAY DATA, examines memory and shows the contents in the same format as the program listing (including the checksum). When you press D, MLX asks you for a starting address. Be sure that the starting address you give corresponds to a line number in the listing. Otherwise, the checksum display will be meaningless. MLX displays program lines until it reaches the end of the program, at which point the menu is redisplayed. You can pause the display by pressing the space bar. (MLX finishes printing the current line before halting.) Press space again to restart the display. To break out of the display and get back to the menu before the ending address is reached, press RETURN.

Other Menu Options

Two more menu selections let you save programs and load them back into the computer. These are SAVE FILE and LOAD FILE; their operation is quite straightforward. When you press S or L, MLX asks you for the filename. You'll then be asked to press either D or T to select disk or tape.

You'll notice the disk drive starting and stopping several times during a load or save (save only for the 128 version). Don't panic; this is normal behavior. MLX opens and reads from or writes to the file instead of using the usual LOAD and SAVE commands (128 MLX makes use of BLOAD). Disk users should also note that the drive prefix 0: is automatically added to the filename (line 750 in 64 MLX), so this should *not* be included when entering the name. This also precludes the use of @ for Save-with-Replace, so remember to give each version you save a different name. The 128 version makes up for this by giving you the option of scratching the existing file if you want to reuse a filename.

Remember that MLX saves the entire workspace area from the starting address to the ending address, so the save or load may take longer than you might expect if you've entered only a small amount of data from a long listing. When saving a partially completed listing, make sure to note the address where you stopped typing so you'll know where to resume entry when you reload.

MLX reports the standard disk or tape error messages if any problems are detected during the save or load. (Tape users should bear in mind that Commodore computers are never able to detect errors during a save to tape.) MLX also has three special load error messages: INCORRECT STARTING ADDRESS, which means the file you're trying to load does not have the starting address you specified when you ran MLX; LOAD ENDED AT *address*, which means the file you're trying to load ends before the ending address you specified when you started MLX; and TRUNCATED AT ENDING ADDRESS, which means the file you're trying to load extends beyond the ending address you specified when you started MLX. If you see one of these messages and feel certain that you've loaded the right file, exit and rerun MLX, being careful to enter the correct starting and ending addresses.

The 128 version also has a CATALOG DISK option so you can view the contents of the disk directory before saving or loading.

The QUIT menu option has the obvious effect—it stops MLX and enters BASIC. The RUN/STOP key is disabled, so the Q option lets you exit the program without turning off the computer. (Of course, RUN/STOP–RESTORE also gets you out.) You'll be asked for verification; press Y to exit to BASIC, or any other key to return to the menu. After quitting, you can type RUN again and reenter MLX without losing your data, as long as you don't use the clear workspace option.

The Finished Product

When you've finished typing all the data for an ML program and saved your work, you're ready to see the results. The instructions for loading and using the finished product vary from program to program. Some ML programs are designed to be loaded and run like BASIC programs, so all you need to type is LOAD *"filename"*,8 for disk (DLOAD *"filename"* on the 128) or LOAD *"filename"* for tape, and then RUN. Such programs will usually have a starting address of 0801 for the 64 or 1C01 for the 128. Other programs must be reloaded to specific addresses with a command such as LOAD *"filename"*,8,1 for disk (BLOAD *"filename"* on the 128) or LOAD *"filename"*,1,1 for tape, then started with a SYS to a particular memory address. On the Commodore 64, the most common starting address for such programs is 49152, which corresponds to MLX address C000. In either case, you should always refer to the article which accompanies the ML listing for information on loading and running the program.

An Ounce Of Prevention

By the time you finish typing in the data for a long ML program, you may have several hours invested in the project. Don't take chances—use our "Automatic Proofreader" to type the new MLX, and then test your copy *thoroughly* before first using it to enter any significant amount of data. Make sure all the menu options work as they should. Enter fragments of the program starting at several different addresses, then use the Display option to verify that the data has been entered correctly. And be sure to test the Save and Load options several times to insure that you can recall your work from disk or tape. Don't let a simple typing error in the new MLX cost you several nights of hard work.

Program 1: MLX For Commodore 64

```
SS 10 REM VERSION 1.1: LINES 8
      30,950 MODIFIED, LINES 4
      85-487 ADDED
EK 100 POKE 56,50:CLR:DIM IN$,
       I,J,A,B,A$,B$,A(7),N$
DM 110 C4=48:C6=16:C7=7:Z2=2:Z
       4=254:Z5=255:Z6=256:Z7=
       127
CJ 120 FA=PEEK(45)+Z6*PEEK(46)
       :BS=PEEK(55)+Z6*PEEK(56
       ):H$="0123456789ABCDEF"
SB 130 R$=CHR$(13):L$="{LEFT}"
       :S$=" ":D$=CHR$(20):Z$=
       CHR$(0):T$="{13 RIGHT}"
CQ 140 SD=54272:FOR I=SD TO SD
       +23:POKE I,0:NEXT:POKE
       {SPACE}SD+24,15:POKE 78
       8,52
FC 150 PRINT"{CLR}"CHR$(142)CH
       R$(8):POKE 53280,15:POK
       E 53281,15
EJ 160 PRINT T$" {RED}{RVS}
       {2 SPACES}[8 @]
       {2 SPACES}"SPC(28)"
       {2 SPACES}{OFF}{BLU} ML
       X II {RED}{RVS}
       {2 SPACES}"SPC(28)"
       {12 SPACES}{BLU}"
FR 170 PRINT"{3 DOWN}
       {3 SPACES}COMPUTE!'S MA
```

```
      CHINE LANGUAGE EDITOR
      {3 DOWN}"
JB 180 PRINT"{BLK}STARTING ADD
      RESS[43]";:GOSUB300:SA=A
      D:GOSUB1040:IF F THEN18
      0
GF 190 PRINT"{BLK}{2 SPACES}EN
      DING ADDRESS[43]";:GOSUB
      300:EA=AD:GOSUB1030:IF
      {SPACE}F THEN190
KR 200 INPUT"{3 DOWN}{BLK}CLEA
      R WORKSPACE [Y/N][43]";A
      $:IF LEFT$(A$,1)<>"Y"TH
      EN220
PG 210 PRINT"{2 DOWN}{BLU}WORK
      ING...";:FORI=BS TO BS+
      EA-SA+7:POKE I,0:NEXT:P
      RINT"DONE"
DR 220 PRINTTAB(10)"{2 DOWN}
      {BLK}{RVS} MLX COMMAND
      {SPACE}MENU {DOWN}[43]":
      PRINT T$"{RVS}E{OFF}NTE
      R DATA"
BD 230 PRINT T$"{RVS}D{OFF}ISP
      LAY DATA":PRINT T$"
      {RVS}L{OFF}OAD FILE"
JS 240 PRINT T$"{RVS}S{OFF}AVE
       FILE":PRINT T$"{RVS}Q
      {OFF}UIT{2 DOWN}{BLK}"
JH 250 GET A$:IF A$=N$ THEN250
HK 260 A=0:FOR I=1 TO 5:IF A$=
      MID$("EDLSQ",I,1)THEN A
      =I:I=5
FD 270 NEXT:ON A GOTO420,610,6
      90,700,280:GOSUB1060:GO
      TO250
EJ 280 PRINT"{RVS} QUIT ":INPU
      T"{DOWN}[43]ARE YOU SURE
       [Y/N]";A$:IF LEFT$(A$,
      1)<>"Y"THEN220
EM 290 POKE SD+24,0:END
JX 300 IN$=N$:AD=0:INPUTIN$:IF
      LEN(IN$)<>4THENRETURN
KF 310 B$=IN$:GOSUB320:AD=A:B$
      =MID$(IN$,3):GOSUB320:A
      D=AD*256+A:RETURN
PP 320 A=0:FOR J=1 TO 2:A$=MID
      $(B$,J,1):B=ASC(A$)-C4+
      (A$>"@")*C7:A=A*C6+B
JA 330 IF B<0 OR B>15 THEN AD=
      0:A=-1:J=2
GX 340 NEXT:RETURN
CH 350 B=INT(A/C6):PRINT MID$(
      H$,B+1,1);:B=A-B*C6:PRI
      NT MID$(H$,B+1,1);:RETU
      RN
RR 360 A=INT(AD/Z6):GOSUB350:A
      =AD-A*Z6:GOSUB350:PRINT
      ":";
BE 370 CK=INT(AD/Z6):CK=AD-Z4*
      CK+Z5*(CK>Z7):GOTO390
PX 380 CK=CK*Z2+Z5*(CK>Z7)+A
JC 390 CK=CK+Z5*(CK>Z5):RETURN
QS 400 PRINT"{DOWN}STARTING AT
      [43]";:GOSUB300:IF IN$<>
      N$ THEN GOSUB1030:IF F
      {SPACE}THEN400
EX 410 RETURN
HD 420 PRINT"{RVS} ENTER DATA
      {SPACE}":GOSUB400:IF IN
      $=N$ THEN220
JK 430 OPEN3,3:PRINT
SK 440 POKE198,0:GOSUB360:IF F
       THEN PRINT IN$:PRINT"
      {UP}{5 RIGHT}";
GC 450 FOR I=0 TO 24 STEP 3:B$
      =S$:FOR J=1 TO 2:IF F T
      HEN B$=MID$(IN$,I+J,1)
HA 460 PRINT"{RVS}"B$L$;:IF I<
      24THEN PRINT"{OFF}";
HD 470 GET A$:IF A$=N$ THEN470
FK 480 IF(A$>"/"ANDA$<":")OR(A
      $>"@"ANDA$<"G")THEN540
GS 485 A=-(A$="M")-2*(A$=",")-
      3*(A$=".")-4*(A$="/")-5
      *(A$="J")-6*(A$="K")
FX 486 A=A-7*(A$="L")-8*(A$=":
      ")-9*(A$="U")-10*(A$="I
      ")-11*(A$="O")-12*(A$="
      P")
CM 487 A=A-13*(A$=S$):IF A THE
      N A$=MID$("ABCD123E456F
      0",A,1):GOTO 540
MP 490 IF A$=R$ AND((I=0)AND(J
      =1)OR F)THEN PRINT B$;:
      J=2:NEXT:I=24:GOTO550
KC 500 IF A$="{HOME}" THEN PRI
      NT B$:J=2:NEXT:I=24:NEX
      T:F=0:GOTO440
MX 510 IF(A$="{RIGHT}")ANDF TH
      ENPRINT B$L$;:GOTO540
GK 520 IF A$<>L$ AND A$<>D$ OR
      ((I=0)AND(J=1))THEN GOS
      UB1060:GOTO470
HG 530 A$=L$+S$+L$:PRINT B$L$;
      :J=2-J:IF J THEN PRINT
      {SPACE}L$;:I=I-3
QS 540 PRINT A$;:NEXT J:PRINT
      {SPACE}S$;
PM 550 NEXT I:PRINT:PRINT"{UP}
      {5 RIGHT}";:INPUT#3,IN$
      :IF IN$=N$ THEN CLOSE3:
      GOTO220
QC 560 FOR I=1 TO 25 STEP3:B$=
      MID$(IN$,I):GOSUB320:IF
       I<25 THEN GOSUB380:A(I
      /3)=A
PK 570 NEXT:IF A<>CK THEN GOSU
      B1060:PRINT"{BLK}{RVS}
      {SPACE}ERROR: REENTER L
      INE [43]":F=1:GOTO440
HJ 580 GOSUB1080:B=BS+AD-SA:FO
      R I=0 TO 7:POKE B+I,A(I
      ):NEXT
QQ 590 AD=AD+8:IF AD>EA THEN C
      LOSE3:PRINT"{DOWN}{BLU}
      ** END OF ENTRY **{BLK}
      {2 DOWN}":GOTO700
GQ 600 F=0:GOTO440
QA 610 PRINT"{CLR}{DOWN}{RVS}
      {SPACE}DISPLAY DATA ":G
      OSUB400:IF IN$=N$ THEN2
      20
RJ 620 PRINT"{DOWN}{BLU}PRESS:
       {RVS}SPACE{OFF} TO PAU
      SE, {RVS}RETURN{OFF} TO
       BREAK[43]{DOWN}"
KS 630 GOSUB360:B=BS+AD-SA:FOR
      I=BTO B+7:A=PEEK(I):GOS
      UB350:GOSUB380:PRINT S$
      ;
CC 640 NEXT:PRINT"{RVS}";:A=CK
      :GOSUB350:PRINT
KH 650 F=1:AD=AD+8:IF AD>EA TH
      ENPRINT"{DOWN}{BLU}** E
      ND OF DATA **":GOTO220
KC 660 GET A$:IF A$=R$ THEN GO
      SUB1080:GOTO220
EQ 670 IF A$=S$ THEN F=F+1:GOS
      UB1080
AD 680 ONFGOTO630,660,630
CM 690 PRINT"{DOWN}{RVS} LOAD
      {SPACE}DATA ":OP=1:GOTO
      710
PC 700 PRINT"{DOWN}{RVS} SAVE
      {SPACE}FILE ":OP=0
RX 710 IN$=N$:INPUT"{DOWN}FILE
      NAME[43]";IN$:IF IN$=N$
      {SPACE}THEN220
PR 720 F=0:PRINT"{DOWN}{BLK}
      {RVS}T{OFF}APE OR {RVS}
      D{OFF}ISK: [43]";
FP 730 GET A$:IF A$="T"THEN PR
      INT"T{DOWN}":GOTO880
HQ 740 IF A$<>"D"THEN730
HH 750 PRINT"D{DOWN}":OPEN15,8
      ,15,"I0:":B=EA-SA:IN$="
      0:"+IN$:IF OP THEN810
SQ 760 OPEN 1,8,8,IN$+",P,W":G
      OSUB860:IF A THEN220
FJ 770 AH=INT(SA/256):AL=SA-(A
      H*256):PRINT#1,CHR$(AL)
      ;CHR$(AH);
PE 780 FOR I=0 TO B:PRINT#1,CH
      R$(PEEK(BS+I));:IF ST T
      HEN800
FC 790 NEXT:CLOSE1:CLOSE15:GOT
      O940
GS 800 GOSUB1060:PRINT"{DOWN}
      {BLK}ERROR DURING SAVE:
      [43]":GOSUB860:GOTO220
MA 810 OPEN 1,8,8,IN$+",P,R":G
      OSUB860:IF A THEN220
GE 820 GET#1,A$,B$:AD=ASC(A$+Z
      $)+256*ASC(B$+Z$):IF AD
      <>SA THEN F=1:GOTO850
RX 830 FOR I=0 TO B:GET#1,A$:P
      OKE BS+I,ASC(A$+Z$):IF(
      I<>B)AND ST THEN F=2:AD
      =I:I=B
FA 840 NEXT:IF ST<>64 THEN F=3
FQ 850 CLOSE1:CLOSE15:ON ABS(F
      >0)+1 GOTO960,970
SA 860 INPUT#15,A,A$:IF A THEN
       CLOSE1:CLOSE15:GOSUB10
      60:PRINT"{RVS}ERROR: "A
      $
GQ 870 RETURN
EJ 880 POKE183,PEEK(FA+2):POKE
      187,PEEK(FA+3):POKE188,
      PEEK(FA+4):IFOP=0THEN92
      0
HJ 890 SYS 63466:IF(PEEK(783)A
      ND1)THEN GOSUB1060:PRIN
      T"{DOWN}{RVS} FILE NOT
      {SPACE}FOUND ":GOTO690
CS 900 AD=PEEK(829)+256*PEEK(8
      30):IF AD<>SA THEN F=1:
      GOTO970
SC 910 A=PEEK(831)+256*PEEK(83
      2)-1:F=F-2*(A<EA)-3*(A>
      EA):AD=A-AD:GOTO930
KM 920 A=SA:B=EA+1:GOSUB1010:P
      OKE780,3:SYS 63338
JF 930 A=BS:B=BS+(EA-SA)+1:GOS
      UB1010:ON OP GOTO950:SY
      S 63591
AE 940 GOSUB1080:PRINT"{BLU}**
       SAVE COMPLETED **":GOT
      O220
XP 950 POKE147,0:SYS 63562:IF
      {SPACE}ST>0 THEN970
FR 960 GOSUB1080:PRINT"{BLU}**
       LOAD COMPLETED **":GOT
      O220
DP 970 GOSUB1060:PRINT"{BLK}
      {RVS}ERROR DURING LOAD:
      {DOWN}[43]":ON F GOSUB98
      0,990,1000:GOTO220
PP 980 PRINT"INCORRECT STARTIN
      G ADDRESS (";:GOSUB360:
      PRINT")":RETURN
GR 990 PRINT"LOAD ENDED AT ";:
      AD=SA+AD:GOSUB360:PRINT
      D$:RETURN
FD 1000 PRINT"TRUNCATED AT END
      ING ADDRESS":RETURN
RX 1010 AH=INT(A/256):AL=A-(AH
      *256):POKE193,AL:POKE1
      94,AH
FF 1020 AH=INT(B/256):AL=B-(AH
      *256):POKE174,AL:POKE1
      75,AH:RETURN
```

```
FX 1030 IF AD<SA OR AD>EA THEN
        1050
HA 1040 IF(AD>511 AND AD<40960
        )OR(AD>49151 AND AD<53
        248)THEN GOSUB1080:F=0
        :RETURN
HC 1050 GOSUB1060:PRINT"{RVS}
        {SPACE}INVALID ADDRESS
         {DOWN}{BLK}":F=1:RETU
        RN
AR 1060 POKE SD+5,31:POKE SD+6
        ,208:POKE SD,240:POKE
        {SPACE}SD+1,4:POKE SD+
        4,33
DX 1070 FOR S=1 TO 100:NEXT:GO
        TO1090
PF 1080 POKE SD+5,8:POKE SD+6,
        240:POKE SD,0:POKE SD+
        1,90:POKE SD+4,17
AC 1090 FOR S=1 TO 100:NEXT:PO
        KE SD+4,0:POKE SD,0:PO
        KE SD+1,0:RETURN
```

Program 2: MLX For Commodore 128

```
AE 100 TRAP 960:POKE 4627,128:
       DIM NL$,A(7)
XP 110 Z2=2:Z4=254:Z5=255:Z6=2
       56:Z7=127:BS=256*PEEK(4
       627):EA=65280
FB 120 BE$=CHR$(7):RT$=CHR$(13
       ):DL$=CHR$(20):SP$=CHR$
       (32):LF$=CHR$(157)
KE 130 DEF FNHB(A)=INT(A/256):
       DEF FNLB(A)=A-FNHB(A)*2
       56:DEF FNAD(A)=PEEK(A)+
       256*PEEK(A+1)
JB 140 KEY 1,"A":KEY 3,"B":KEY
        5,"C":KEY 7,"D":VOL 15
       :IF RGR(0)=5 THEN FAST
FJ 150 PRINT"{CLR}"CHR$(142);C
       HR$(8):COLOR 0,15:COLOR
        4,15:COLOR 6,15
GQ 160 PRINT TAB(12)"{RED}
       {RVS}{2 SPACES}[9 @3
       {2 SPACES}"RT$;TAB(12)"
       {RVS}{2 SPACES}{OFF}
       {BLU} 128 MLX {RED}
       {RVS}{2 SPACES}"RT$;TAB
       (12)"{RVS}{13 SPACES}
       {BLU}"
FE 170 PRINT"{2 DOWN}
       {3 SPACES}COMPUTE!'S MA
       CHINE LANGUAGE EDITOR
       {2 DOWN}"
DK 180 PRINT"{BLK}STARTING ADD
       RESS[43";:GOSUB 260:IF
       {SPACE}AD THEN SA=AD:EL
       SE 180
FH 190 PRINT"{BLK}{2 SPACES}EN
       DING ADDRESS[43";:GOSUB
        260:IF AD THEN EA=AD:E
       LSE 190
MF 200 PRINT"{DOWN}{BLK}CLEAR
       {SPACE}WORKSPACE [Y/N]?
       [43":GETKEY A$:IF A$<>"
       Y" THEN 220
QH 210 PRINT"{DOWN}{BLU}WORKIN
       G...";:BANK 0:FOR A=BS
       {SPACE}TO BS+(EA-SA)+7:
       POKE A,0:NEXT A:PRINT"D
       ONE"
DC 220 PRINT TAB(10)"{DOWN}
       {BLK}{RVS} MLX COMMAND
       {SPACE}MENU [43{DOWN}":
       PRINT TAB(13)"{RVS}E
       {OFF}NTER DATA"RT$;TAB(
       13)"{RVS}D{OFF}ISPLAY D
       ATA"RT$;TAB(13)"{RVS}L
       {OFF}OAD FILE"
HB 230 PRINT TAB(13)"{RVS}S
       {OFF}AVE FILE"RT$;TAB(1
       3)"{RVS}C{OFF}ATALOG DI
       SK"RT$;TAB(13)"{RVS}Q
       {OFF}UIT{DOWN}{BLK}"
AP 240 GETKEY A$:A=INSTR("EDLS
       CQ",A$):ON A GOTO 340,5
       50,640,650,930,940:GOSU
       B 950:GOTO 240
SX 250 PRINT"STARTING AT";:GOS
       UB 260:IF(AD<>0)OR(A$=N
       L$)THEN RETURN:ELSE 250
BG 260 A$=NL$:INPUT A$:IF LEN(
       A$)=4 THEN AD=DEC(A$)
PP 270 IF AD=0 THEN BEGIN:IF A
       $<>NL$ THEN 300:ELSE RE
       TURN:BEND
MA 280 IF AD<SA OR AD>EA THEN
       {SPACE}300
PM 290 IF AD>511 AND AD<65280
       {SPACE}THEN PRINT BE$;:
       RETURN
SQ 300 GOSUB 950:PRINT"{RVS} I
       NVALID ADDRESS {DOWN}
       {BLK}":AD=0:RETURN
RD 310 CK=FNHB(AD):CK=AD-Z4*CK
       +Z5*(CK>Z7):GOTO 330
DD 320 CK=CK*Z2+Z5*(CK>Z7)+A
AH 330 CK=CK+Z5*(CK>Z5):RETURN
QD 340 PRINT BE$;"{RVS} ENTER
       {SPACE}DATA ":GOSUB 250
       :IF A$=NL$ THEN 220
JA 350 BANK 0:PRINT:F=0:OPEN 3
       ,3
BR 360 GOSUB 310:PRINT HEX$(AD
       )+":";:IF F THEN PRINT
       {SPACE}L$:PRINT"{UP}
       {5 RIGHT}";
QA 370 FOR I=0 TO 24 STEP 3:B$
       =SP$:FOR J=1 TO 2:IF F
       {SPACE}THEN B$=MID$(L$,
       I+J,1)
PS 380 PRINT"{RVS}"B$+LF$;:IF
       {SPACE}I<24 THEN PRINT"
       {OFF}";
RC 390 GETKEY A$:IF (A$>"/" AN
       D A$<":") OR(A$>"@" AND
        A$<"G") THEN 470
AC 400 IF A$="+" THEN A$="E":G
       OTO 470
QB 410 IF A$="-" THEN A$="F":G
       OTO 470
FB 420 IF A$=RT$ AND ((I=0) AN
       D (J=1) OR F) THEN PRIN
       T B$;:J=2:NEXT:I=24:GOT
       O 480
RD 430 IF A$="{HOME}" THEN PRI
       NT B$:J=2:NEXT:I=24:NEX
       T:F=0:GOTO 360
XB 440 IF (A$="{RIGHT}") AND F
        THEN PRINT B$+LF$;:GOT
       O 470
JP 450 IF A$<>LF$ AND A$<>DL$
       {SPACE}OR ((I=0) AND (J
       =1)) THEN GOSUB 950:GOT
       O 390
PS 460 A$=LF$+SP$+LF$:PRINT B$
       +LF$;:J=2-J:IF J THEN P
       RINT LF$;:I=I-3
GB 470 PRINT A$;:NEXT J:PRINT
       {SPACE}SP$;
HA 480 NEXT I:PRINT:PRINT"{UP}
       {5 RIGHT}";:L$="
       {27 SPACES}"
DP 490 FOR I=1 TO 25 STEP 3:GE
       T#3,A$,B$:IF A$=SP$ THE
       N I=25:NEXT:CLOSE 3:GOT
       O 220
BA 500 A$=A$+B$:A=DEC(A$):MID$
       (L$,I,2)=A$:IF I<25 THE
       N GOSUB 320:A(I/3)=A:GE
       T#3,A$
AR 510 NEXT I:IF A<>CK THEN GO
       SUB 950:PRINT:PRINT"
       {RVS} ERROR: REENTER LI
       NE ":F=1:GOTO 360
DX 520 PRINT BE$:B=BS+AD-SA:FO
       R I=0 TO 7:POKE B+I,A(I
       ):NEXT I
XB 530 F=0:AD=AD+8:IF AD<=EA T
       HEN 360
CA 540 CLOSE 3:PRINT"{DOWN}
       {BLU}** END OF ENTRY **
       {BLK}{2 DOWN}":GOTO 650
MC 550 PRINT BE$;"{CLR}{DOWN}
       {RVS} DISPLAY DATA ":GO
       SUB 250:IF A$=NL$ THEN
       {SPACE}220
JF 560 BANK 0:PRINT"{DOWN}
       {BLU}PRESS: {RVS}SPACE
       {OFF} TO PAUSE, {RVS}RE
       TURN{OFF} TO BREAK[43
       {DOWN}"
XA 570 PRINT HEX$(AD)+":";:GOS
       UB 310:B=BS+AD-SA
DJ 580 FOR I=B TO B+7:A=PEEK(I
       ):PRINT RIGHT$(HEX$(A),
       2);SP$;:GOSUB 320:NEXT
       {SPACE}I
XB 590 PRINT"{RVS}";RIGHT$(HEX
       $(CK),2)
GR 600 F=1:AD=AD+8:IF AD>EA TH
       EN PRINT"{BLU}** END OF
        DATA **":GOTO 220
EB 610 GET A$:IF A$=RT$ THEN P
       RINT BE$:GOTO 220
QK 620 IF A$=SP$ THEN F=F+1:PR
       INT BE$;
XS 630 ON F GOTO 570,610,570
RF 640 PRINT BE$"{DOWN}{RVS} L
       OAD DATA ":OP=1:GOTO 66
       0
BP 650 PRINT BE$"{DOWN}{RVS} S
       AVE FILE ":OP=0
DM 660 F=0:F$=NL$:INPUT"FILENA
       ME[43";F$:IF F$=NL$ THE
       N 220
RF 670 PRINT"{DOWN}{BLK}{RVS}T
       {OFF}APE OR {RVS}D{OFF}
       ISK: [43";
SQ 680 GETKEY A$:IF A$="T" THE
       N 850:ELSE IF A$<>"D" T
       HEN 680
SP 690 PRINT"DISK{DOWN}":IF OP
        THEN 760
EH 700 DOPEN#1,(F$+",P"),W:IF
       {SPACE}DS THEN A$=D$:GO
       TO 740
JH 710 BANK 0:POKE BS-2,FNLB(S
       A):POKE BS-1,FNHB(SA):P
       RINT"SAVING ";F$:PRINT
MC 720 FOR A=BS-2 TO BS+EA-SA:
       PRINT#1,CHR$(PEEK(A));:
       IF ST THEN A$="DISK WRI
       TE ERROR":GOTO 750
GC 730 NEXT A:CLOSE 1:PRINT"
       {BLU}** SAVE COMPLETED
       {SPACE}WITHOUT ERRORS *
       *":GOTO 220
RA 740 IF DS=63 THEN BEGIN:CLO
       SE 1:INPUT"{BLK}REPLACE
        EXISTING FILE [Y/N][43
       ";A$:IF A$="Y" THEN SCR
       ATCH(F$):PRINT:GOTO 700
       :ELSE PRINT"{BLK}":GOTO
        660:BEND
GA 750 CLOSE 1:GOSUB 950:PRINT
       "{BLK}{RVS} ERROR DURIN
       G SAVE: [43":PRINT A$:G
       OTO 220
FD 760 DOPEN#1,(F$+",P"):IF DS
        THEN A$=DS$:F=4:CLOSE
       {SPACE}1:GOTO 790
```

```
PX 770 GET#1,A$,B$:CLOSE 1:AD=
       ASC(A$)+256*ASC(B$):IF
       {SPACE}AD<>SA THEN F=1:
       GOTO 790
KB 780 PRINT"LOADING ";F$:PRIN
       T:BLOAD(F$),B0,P(BS):AD
       =SA+FNAD(174)-BS-1:F=-2
       *(AD<EA)-3*(AD>EA)
RQ 790 IF F THEN 800:ELSE PRIN
       T"{BLU}** LOAD COMPLETE
       D WITHOUT ERRORS **":GO
       TO 220
ER 800 GOSUB 950:PRINT"{BLK}
       {RVS} ERROR DURING LOAD
       : [4]":ON F GOSUB 810,8
       20,830,840:GOTO220
QJ 810 PRINT"INCORRECT STARTIN
       G ADDRESS (";HEX$(AD);"
       )":RETURN
DP 820 PRINT"LOAD ENDED AT ";H
       EX$(AD):RETURN
EB 830 PRINT"TRUNCATED AT ENDI
       NG ADDRESS ("HEX$(EA)")
       ":RETURN
FP 840 PRINT"DISK ERROR ";A$:R
       ETURN
KS 850 PRINT"TAPE":AD=POINTER(
       F$):BANK 1:A=PEEK(AD):A
       L=PEEK(AD+1):AH=PEEK(AD
       +2)
XX 860 BANK 15:SYS DEC("FF68")
       ,0,1:SYS DEC("FFBA"),1,
       1,0:SYS DEC("FFBD"),A,A
       L,AH:SYS DEC("FF90"),12
       8:IF OP THEN 890
FG 870 PRINT:A=SA:B=EA+1:GOSUB
        920:SYS DEC("E919"),3:
       PRINT"SAVING ";F$
AB 880 A=BS:B=BS+(EA-SA)+1:GOS
       UB 920:SYS DEC("EA18"):
       PRINT"{DOWN}{BLU}** TAP
       E SAVE COMPLETED **":GO
       TO 220
CP 890 SYS DEC("E99A"):PRINT:I
       F PEEK(2816)=5 THEN GOS
       UB 950:PRINT"{DOWN}
       {BLK}{RVS} FILE NOT FOU
       ND ":GOTO 220
GQ 900 PRINT"LOADING ...{DOWN}
       ":AD=FNAD(2817):IF AD<>
       SA THEN F=1:GOTO 800:EL
       SE AD=FNAD(2819)-1:F=-2
       *(AD<EA)-3*(AD>EA)
JD 910 A=BS:B=BS+(EA-SA)+1:GOS
       UB 920:SYS DEC("E9FB"):
       IF ST>0 THEN 800:ELSE 7
       90
XB 920 POKE193,FNLB(A):POKE194
       ,FNHB(A):POKE 174,FNLB(
       B):POKE 175,FNHB(B):RET
       URN
CP 930 CATALOG:PRINT"{DOWN}
       {BLU}** PRESS ANY KEY F
       OR MENU **":GETKEY A$:G
       OTO 220
MM 940 PRINT BE$"{RVS} QUIT
       [4]";RT$;"ARE YOU SURE
       {SPACE}[Y/N]?":GETKEY A
       $:IF A$<>"Y" THEN 220:E
       LSE PRINT"{CLR}":BANK 1
       5:END
JE 950 SOUND 1,500,10:RETURN
AF 960 IF ER=14 AND EL=260 THE
       N RESUME 300
MK 970 IF ER=14 AND EL=500 THE
       N RESUME NEXT
KJ 980 IF ER=4 AND EL=780 THEN
        F=4:A$=DS$:RESUME 800
DQ 990 IF ER=30 THEN RESUME:EL
       SE PRINT ERR$(ER);" ERR
       OR IN LINE";EL
```

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MLX Machine Language Entry Program For Apple

Tim Victor, Editorial Programmer

To make it easier to enter machine language programs into your computer without typos, COMPUTE! is introducing its "MLX" entry program for the Apple II series. It's our best MLX yet. It runs on the II, II+, IIe, and IIc, and with either DOS 3.3 or ProDOS.

A machine language (ML) program is usually listed as a long series of numbers. It's hard to keep your place and even harder to avoid making mistakes as you type in the listing, since an incorrect line looks almost identical to a correct one. To make error-free entry easier, COMPUTE! generally lists ML programs for Commodore and Atari computers in a format designed to be typed in with a utility called "MLX." The MLX program uses a checksum system to catch typing errors almost as soon as they happen.

Apple MLX checks your typing on a line-by-line basis. It won't let you enter invalid characters or let you continue if there's a mistake in a line. It won't even let you enter a line or digit out of sequence. Best of all, you don't have to know anything about machine language to enter ML programs with MLX. Apple MLX makes typing ML programs almost foolproof.

Using Apple MLX

Type in and save some copies of Apple MLX on disk (you'll want to use MLX to enter future ML programs in COMPUTE!). It doesn't matter whether you type it in on a disk formatted for DOS 3.3 or ProDOS. Programs entered with Apple MLX, however, must be saved to a disk formatted with the same operating system as Apple MLX itself.

If you have an Apple IIe or IIc, make sure that the key marked CAPS LOCK is in the down position. Type RUN. You'll be asked for the starting and ending addresses of the ML program. These values vary for each program, so they're given at the beginning of the ML program listing and in the program's accompanying article. Find them and type them in.

Invalid Characters Banned

Apple MLX is fairly flexible about how you type in the numbers. You can put extra spaces between numbers or leave the spaces out entirely, compressing a line into 18 keypresses. Be careful not to put a space between two digits in the middle of a number. Apple MLX will read two single-digit numbers instead of one two-digit number (F 6 means F and 6, not F6).

You can't enter an invalid character with Apple MLX. Only the numerals 0–9 and the letters A–F can be typed in. If you press any other key (with some exceptions noted below), nothing happens. This safeguards against entering extraneous characters. Even better, Apple MLX checks for transposed characters. If you're supposed to type in A0 and instead enter 0A, Apple MLX will catch your mistake.

The next thing you'll see is a menu asking you to select a function. The first is (E)NTER DATA. If you're just starting to type in a program, pick this. Press the E key, and the program asks for the address where you want to begin entering data. Type the first number in the first line of the program listing if you're just starting, or the line number where you left off if you've already typed in part of a program. Hit the RETURN key and begin entering the data.

Once you're in Enter mode, Apple MLX prints the address for each program line for you. You then type in all nine numbers on that line, beginning with the first two-digit number after the colon (:). Each line represents eight bytes and a checksum. When you enter a line and hit RETURN, Apple MLX recalculates the checksum from the eight bytes and the address. If you enter more or less than nine numbers, or the checksum doesn't exactly match, Apple MLX erases the line you just entered and prompts you again for the same line.

Apple MLX also checks to make sure you're typing in the right line. The address (the number to the left of the colon) is part of the checksum recalculation. If you accidentally skip a line and try to enter incorrect values, Apple MLX won't let you continue. Just make sure you enter the correct starting address; if you don't, you won't be able to enter any of the following lines. Apple MLX will stop you.

Editing Features

Apple MLX also includes some editing features. The left- and right-arrow keys allow you to back up and go forward on the line that you are entering, so you can retype data. Pressing the CONTROL (CTRL) and D keys at the same time (*delete*) removes the character under the

cursor, shortening the line by one character. Pressing CTRL-I (*insert*) puts a space under the cursor and shifts the rest of the line to the right, making the line one character longer. If the cursor is at the right end of the line, neither CTRL-D nor CTRL-I has any effect.

When you've entered the entire listing (up to the ending address that you specified earlier), Apple MLX automatically leaves Enter mode and redisplays the functions menu. If you want to leave Enter mode before then, press the RETURN key when Apple MLX prompts you with a new line address. (For instance, you may want to leave Enter mode to enter a program listing in more than one sitting; see below.)

Display Data

The second menu choice, (D)ISPLAY DATA, examines memory and shows the contents in the same format as the program listing. You can use it to check your work or to see how far you've gotten. When you press D, Apple MLX asks you for a starting address. Type in the address of the first line you want to see and hit RETURN. Apple MLX displays program lines until you press any key or until it reaches the end of the program.

Save And Load

Two more menu selections let you save programs on disk and load them back into the computer. These are (S)AVE FILE and (L)OAD FILE. When you press S or L, Apple MLX asks you for the filename. The first time you save an ML program, the name you assign will be the program's filename on the disk. If you press L and specify a filename that doesn't exist on the disk, you'll see a disk error message.

If you're not sure why a disk error has occurred, check the drive. Make sure there's a formatted disk in the drive and that it was formatted by the same operating system you're using for Apple MLX (ProDOS or DOS 3.3). If you're trying to save a file and see an error message, the disk might be full. Either save the file on another disk or quit Apple MLX (by pressing the Q key), delete an old file or two, then run Apple MLX again. Your typing should still be safe in memory.

Apple MLX: Machine Language Entry Program

For instructions on entering this program, please refer to "COMPUTE!'s Guide to Typing In Programs" elsewhere in this issue.

```
80 100 N = 9: HOME : NORMAL : PR
       INT "APPLE MLX": POKE 34,
       2: ONERR GOTO 610
CC 110 VTAB 1: HTAB 20: PRINT "S
       TART ADDRESS";: GOSUB 530
       : IF A = 0 THEN PRINT CHR
       $ (7): GOTO 110
8C 120 S = A
E3 130 VTAB 2: HTAB 20: PRINT "E
       ND ADDRESS  ";: GOSUB 530
       : IF S > = A OR A = 0 THE
       N PRINT CHR$ (7): GOTO 13
       0
20 140 E = A
B5 150 PRINT : PRINT "CHOOSE:(E)
       NTER DATA";: HTAB 22: PRI
       NT "(D)ISPLAY DATA": HTAB
        8: PRINT "(L)OAD FILE  (
       S)AVE FILE  (Q)UIT": PRIN
       T
AE 160 GET A$: FOR I = 1 TO 5: I
       F A$ < > MID$ ("EDLSQ",I,
       1) THEN NEXT : GOTO 160
93 170 ON I GOTO 270,220,180,200
       : POKE 34,0: END
AF 180 INPUT "FILENAME: ";A$: IF
        A$ < > "" THEN PRINT CHR
       $ (4);"BLOAD";A$;",A";S
A1 190 GOTO 150
38 200 INPUT "FILENAME: ";A$: IF
        A$ < > "" THEN PRINT CHR
       $ (4);"BSAVE";A$;",A";S;"
       ,L";(E - S) + 1
92 210 GOTO 150
C2 220 GOSUB 590: IF B = 0 THEN
       150
9E 230 FOR B = B TO E STEP 8:L =
        4:A = B: GOSUB 580: PRIN
       T A$;": ";:L = 2
85 240 FOR F = 0 TO 7:V(F + 1) =
        PEEK (B + F): NEXT : GOS
       UB 560:V(9) = C
F2 250 FOR F = 1 TO N:A = V(F):
       GOSUB 580: PRINT A$" ";:
       NEXT : PRINT : IF PEEK (4
       9152) < 128 THEN NEXT
94 260 POKE 49168,0: GOTO 150
CC 270 GOSUB 590: IF B = 0 THEN
       150
48 280 FOR B = B TO E STEP 8
A6 290 HTAB 1:A = B:L = 4: GOSUB
        580: PRINT A$;": ";: CAL
       L 64668:A$ = "":P = 0: GO
       SUB 330: IF L = 0 THEN 15
       0
F9 300 GOSUB 470: IF F < > N THE
       N PRINT CHR$ (7);: GOTO 2
       90
27 310 IF N = 9 THEN GOSUB 560:
       IF C < > V(9) THEN PRINT
       CHR$ (7);: GOTO 290
72 320 FOR F = 1 TO 8: POKE B +
       F - 1,V(F): NEXT : PRINT
       : NEXT : GOTO 150
0E 330 IF LEN (A$) = 33 THEN A$
       = 0$:P = 0: PRINT CHR$ (7
       );
22 340 L = LEN (A$):0$ = A$:0 =
       P:L$ = "": IF P > 0 THEN
       L$ = LEFT$ (A$,P)
E0 350 R$ = "": IF P < L - 1 THE
       N R$ = RIGHT$ (A$,L - P -
        1)
55 360 HTAB 7: PRINT L$;: FLASH
       : IF P < L THEN PRINT MID
       $ (A$,P + 1,1);: NORMAL :
        PRINT R$;
7B 370 PRINT " ";: NORMAL
E6 380 K = PEEK (49152): IF K <
       128 THEN 380
C1 390 POKE 49168,0:K = K - 128
5B 400 IF K = 13 THEN HTAB 7: PR
       INT A$;" ";: RETURN
8A 410 IF K = 32 OR K > 47 AND K
        < 58 OR K > 64 AND K < 7
       1 THEN A$ = L$ + CHR$ (K)
        + R$:P = P + 1
C1 420 IF K = 4 THEN A$ = L$ + R
       $
5F 430 IF K = 9 THEN A$ = L$ + "
        " + MID$ (A$,P + 1,1) +
       R$
0A 440 IF K = 8 THEN P = P - (P
       > 0)
93 450 IF K = 21 THEN P = P + (P
       < L)
9D 460 GOTO 330
37 470 F = 1:D = 0: FOR P = 1 TO
        LEN (A$):C$ = MID$ (A$,P
       ,1): IF F > N AND C$ < >
       " " THEN RETURN
BB 480 IF C$ < > " " THEN GOSUB
       520:V(F) = J + 16 * (D =
       1) * V(F):D = D + 1
5F 490 IF D > 0 AND C$ = " " OR
       D = 2 THEN D = 0:F = F +
       1
08 500 NEXT : IF D = 0 THEN F =
       F - 1
17 510 RETURN
B5 520 J = ASC (C$):J = J - 48 -
        7 * (J > 64): RETURN
AB 530 A = 0: INPUT A$:A$ = LEFT
       $ (A$,4): IF LEN (A$) = 0
        THEN RETURN
6F 540 FOR P = 1 TO LEN (A$):C$
       = MID$ (A$,P,1): IF C$ <
       "0" OR C$ > "9" AND C$ <
       "A" OR C$ > "Z" THEN A =
       0: RETURN
2D 550 GOSUB 520:A = A * 16 + J:
        NEXT : RETURN
28 560 C = INT (B / 256):C = B -
        254 * C - 255 * (C > 127
       ):C = C - 255 * (C > 255)
20 570 FOR F = 1 TO 8:C = C * 2
       - 255 * (C > 127) + V(F):
       C = C - 255 * (C > 255):
       NEXT : RETURN
DA 580 I = FRE (0):A$ = "": FOR
       I = 1 TO L:T = INT (A / 1
       6):A$ = MID$ ("0123456789
       ABCDEF",A - 16 * T + 1,1)
        + A$:A = T: NEXT : RETUR
       N
1F 590 PRINT "FROM ADDRESS ";: G
       OSUB 530: IF S > A OR E <
        A OR A = 0 THEN B = 0: R
       ETURN
0D 600 B = S + 8 * INT ((A - S)
       / 8): RETURN
B6 610 PRINT "DISK ERROR": GOTO
       150
```

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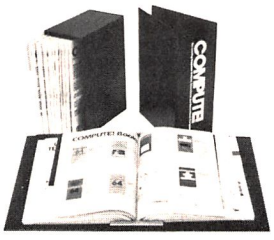
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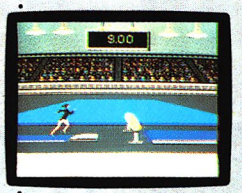
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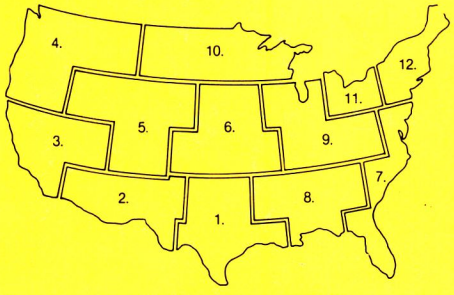
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