

A Buyer's Guide To Printers

# COMPUTE!

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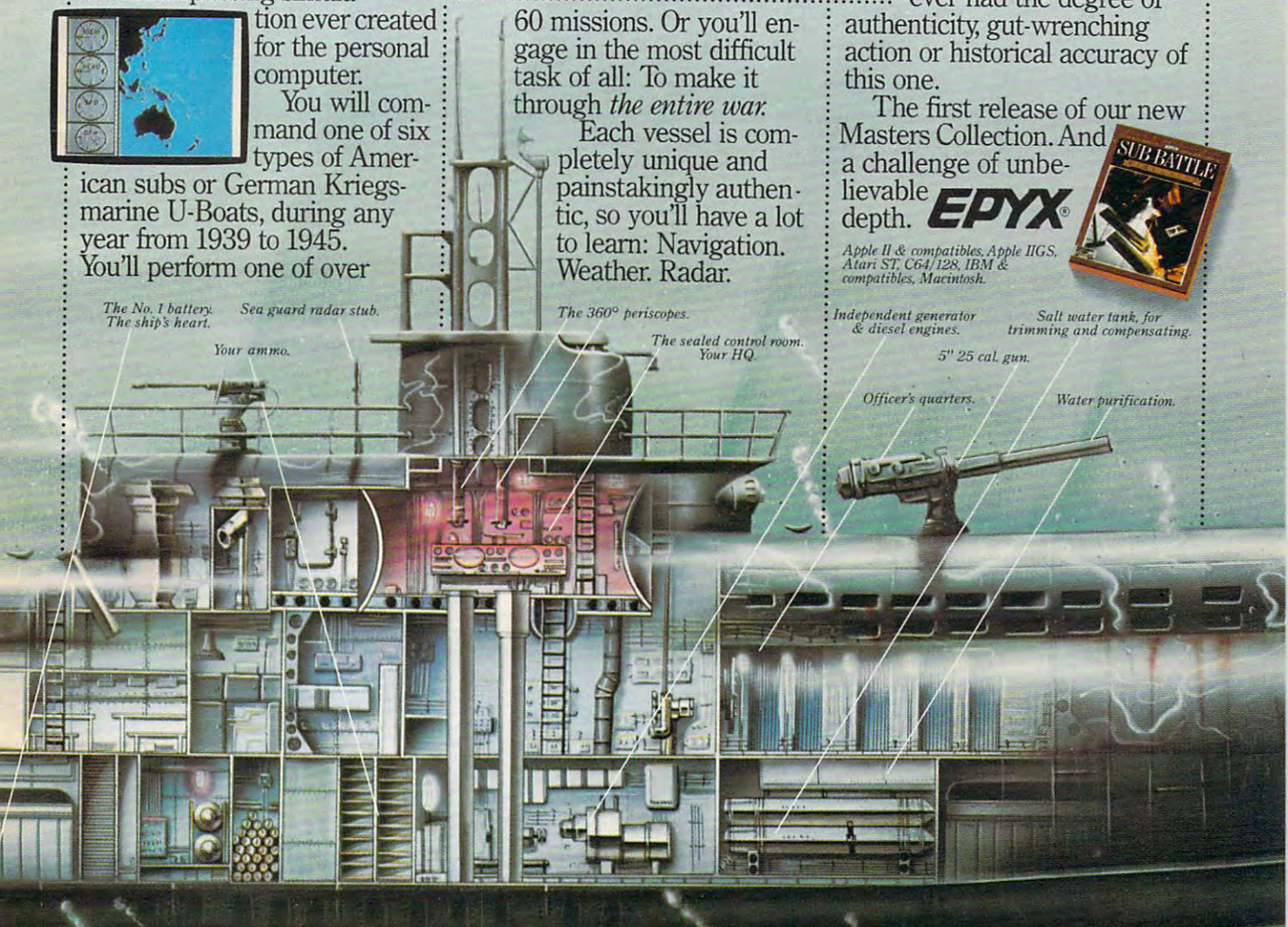
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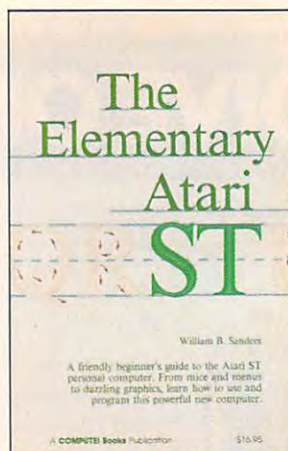
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# COMPUTER

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## FEATURES

- |    |                                                                    |                  |
|----|--------------------------------------------------------------------|------------------|
| 8  | Commodore's New, Expandable Amiga 2000:<br>A Hands-On Report ..... | Philip I. Nelson |
| 18 | New Peripheral Technologies .....                                  |                  |
| 19 | An Introduction to Hard Disk Drives .....                          | Philip I. Nelson |
| 24 | The New High-Quality Dot-Matrix Printers .....                     | Kathy Yakal      |
| 37 | The Big Picture: Advances in Screen Display .....                  | Selby Bateman    |
| 40 | A Buyer's Guide to Printers .....                                  |                  |
| 46 | Euchre .....                                                       | David Shimoda    |

## GUIDE TO ARTICLES AND PROGRAMS

AP/AT/AM/64/  
PC/PCjr

## REVIEWS

- |           |                                                                      |                  |
|-----------|----------------------------------------------------------------------|------------------|
| <b>70</b> | <i>Little Computer People</i> .....                                  | Neil Randall     |
| <b>74</b> | <i>Certificate Maker and Walt Disney Card &amp; Party Shop</i> ..... | Karen McCullough |
| <b>78</b> | <i>Roadwar 2000</i> .....                                            | James V. Trunzo  |

AP/ST/AM/64  
AP/64/PC  
AP/ST/64/PC

## COLUMNS AND DEPARTMENTS

- |    |                                                                                   |                                     |
|----|-----------------------------------------------------------------------------------|-------------------------------------|
| 4  | The Editor's Notes .....                                                          | Richard Mansfield                   |
| 65 | Readers' Feedback .....                                                           | The Editors and Readers of COMPUTE! |
| 79 | Computers and Society: Demons and Events, Part 2 .....                            | David D. Thornburg                  |
| 81 | Microscope .....                                                                  | Sheldon Leemon                      |
| 82 | Telecomputing Today: Packet-Switching Rule Changes .....                          | Arlan R. Levitan                    |
| 83 | The World Inside the Computer:<br>When Buying a New Computer: Don't Ask Me! ..... | Fred D'Ignazio                      |
| 84 | The Beginner's Page: Getting Started with a Printer .....                         | C. Regena                           |
| 85 | ST Outlook: Who Is That Man, and Why Is He Smiling? .....                         | Philip I. Nelson                    |
| 87 | AmigaView: The Sidecar Arrives .....                                              | Sheldon Leemon                      |
| 88 | IBM Personal Computing: Two Winners and a Loser .....                             | Donald B. Trivette                  |
| 89 | INSIGHT: Atari—Corrected File Conversions .....                                   | Bill Wilkinson                      |

ST  
AM  
PC  
AT

# THE JOURNAL

- |            |                                            |                               |
|------------|--------------------------------------------|-------------------------------|
| <b>90</b>  | 3-D Surfaces for Amiga                     | Martin Staley                 |
| <b>94</b>  | Fixing Atari Revision-B BASIC              | Barry Hart                    |
| <b>95</b>  | Custom Characters for Atari XL and XE      | S. M. Baugh                   |
| <b>97</b>  | Applecode                                  | Adam Levin                    |
| <b>100</b> | 128 File Viewer                            | Jeffrey D. Partch             |
| <b>102</b> | Filedump for IBM PC/PCjr                   | Harry Faulkner                |
| <b>104</b> | DOS Calc                                   | Steve Kelly                   |
| <b>108</b> | Diskcheck: Apple Sector Editor for DOS 3.3 | Steve Meyles                  |
| <b>110</b> | 128 Editing Functions for Commodore 64     | Jim Allen                     |
| <b>113</b> | Amiga Banner Printer                       | Walter Bulawa                 |
| <b>116</b> | Using PUT and GET on the PC/PCjr           | Rafael Gonzalez               |
| <b>118</b> | Superplotter                               | Greg Perkins and Derry Bryson |

AM  
AT  
AT  
AP  
128  
PC/PCjr  
64  
AP  
64  
AM  
PC/PCjr  
64

## 80 CAPUTEI Modifications or Corrections to Previous Articles

- 122 **COMPUTE!**'s Author's Guide  
123 **COMPUTE!**'s Guide to Typing In Programs  
126 **MLX: Machine Language Entry Program**  
for Commodore 64 and 128  
130 **MLX: Machine Language Entry Program for Apple**  
132 **Advertisers Index**

NOTE: See page 123  
before typing in  
programs.

**AP** Apple, **Mac** Macintosh, **AT** Atari, **ST**, Atari ST, **64** Commodore 64, **128** Commodore 128, **P** PET/CBM, **PC** IBM PC, **PCjr** IBM PCjr, **AM** Amiga, \*General interest

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As microprocessors, computer chips, become increasingly a fact of modern life—stamped into everything from coffee makers 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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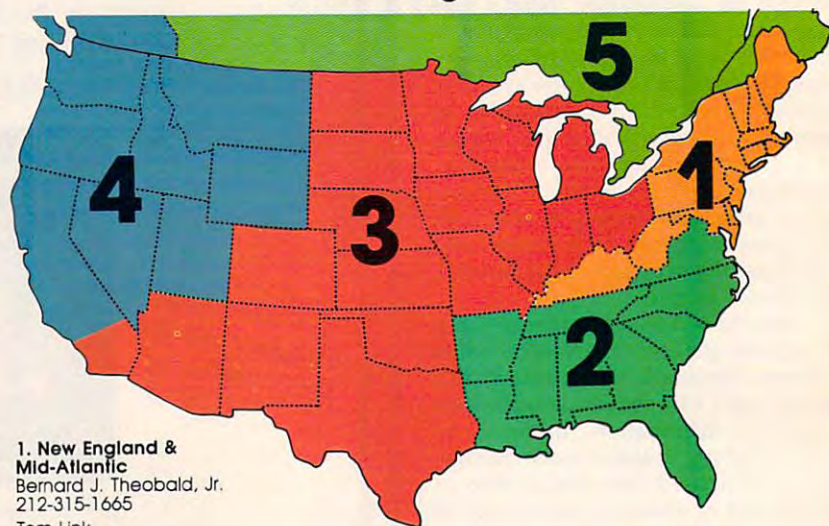
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It's not impossible to imagine TV eventually becoming so specialized that there would be channels devoted to, say, showing only Kubrick films. If that happened, whatever you might want to see or hear would always be on.

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.

There will be some spectacular advances in the coming years as the quality and convenience of our domestic devices continue to benefit from the microprocessor revolution. And whatever words are used in advertising, many of our household machines are clearly in the process of becoming more computer than appliance.

*Richard Mansfield*

Richard Mansfield  
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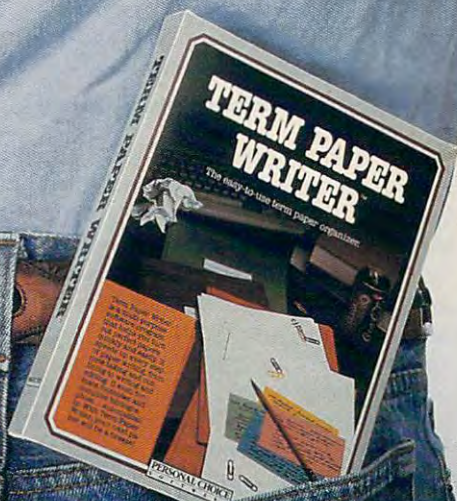
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# COMMODORE'S

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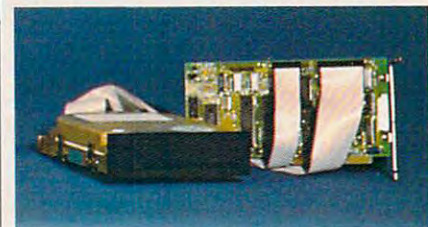
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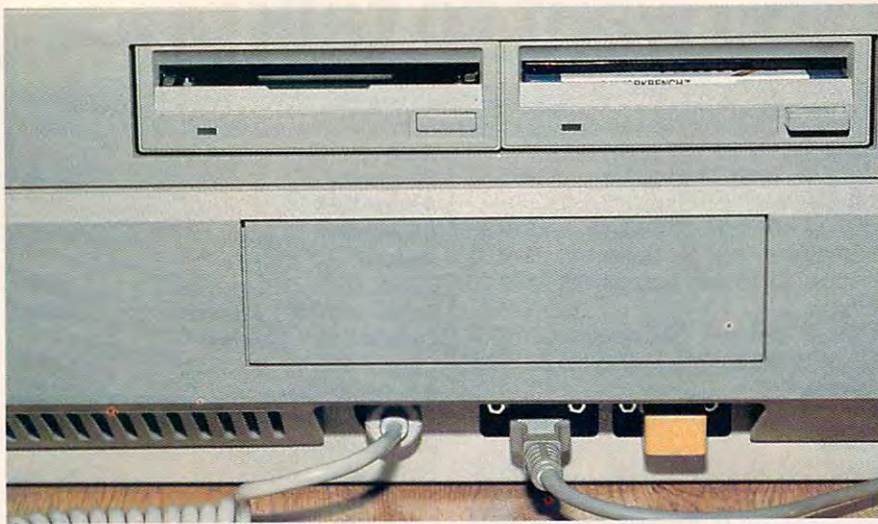
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The Amiga 2000's keyboard, mouse, and joystick cables plug into the front panel of the computer. In this photo, the joystick port is occupied by a security device ("dongle") for running a copy-protected commercial program.

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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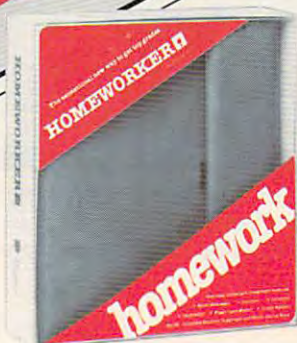
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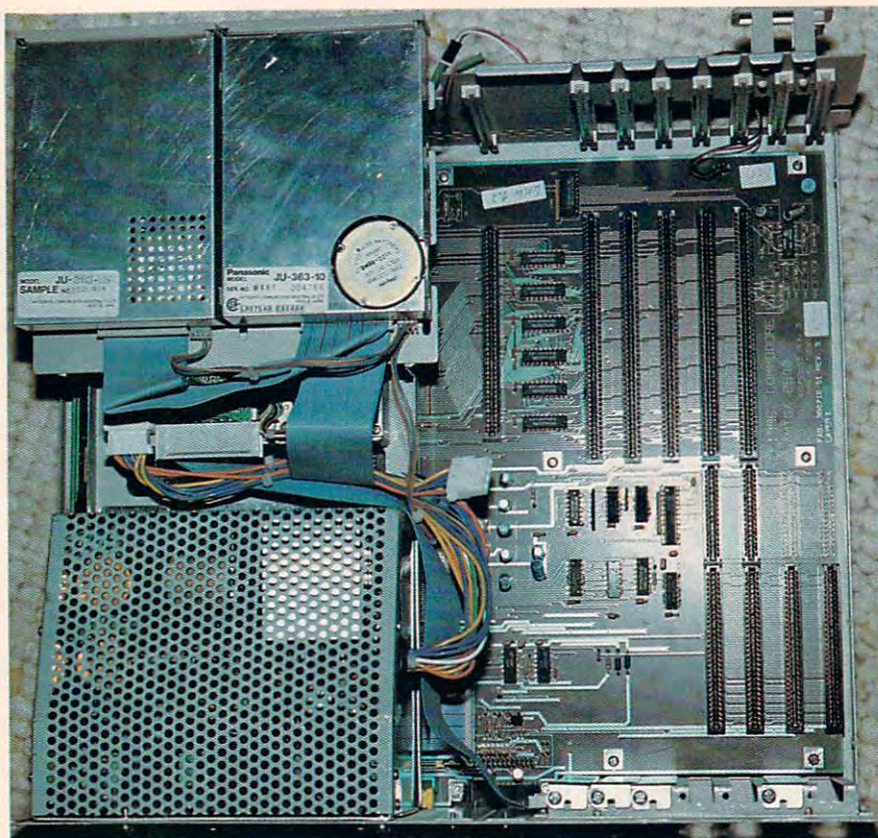
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An overhead look at the inside of an Amiga 2000, showing the expansion area to the left and the power supply and internal floppy drives to the right. The bulk of the Amiga's internal circuitry, including its 68000 microprocessor, is not visible from 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 "Amiga-View" 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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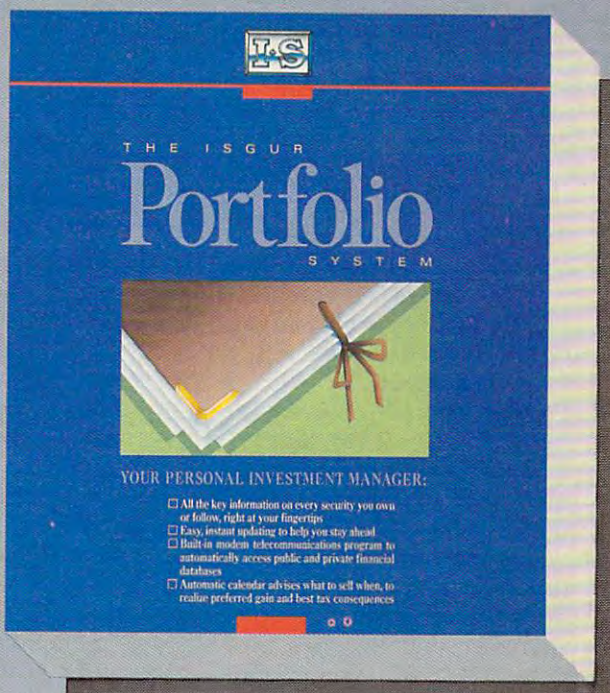
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The Amiga Bridge card supplies everything which the Amiga 2000 needs to run IBM PC software, including an Intel 8088 microprocessor, 512K of RAM, and a floppy disk controller for 5¼-inch PC-compatible floppy disk drives. The board can also accept an 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.

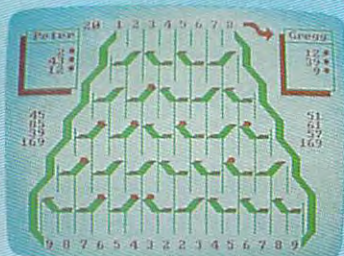
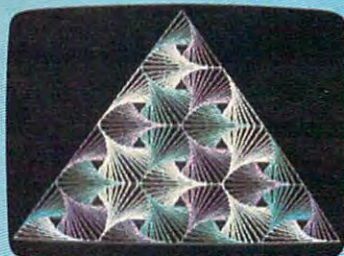
To the Amiga's multitasking operating system, the PC application is just another task to run. Of course, since the PC's MS-DOS operating system cannot multitask, and the Bridge card has only a single 8088 processor, you're limited to running one PC application at a time. A PC screen can be "frozen,"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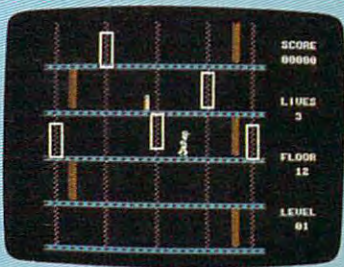
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# New Peripheral Technologies

A personal computer system is only as strong as the peripherals that surround it—the monitors, disk drives, printers, modems, and other pieces of hardware that let you use your computer to its maximum potential.

Over the past few years, more advanced computers such as the Apple Macintosh, the Atari ST, and the Commodore Amiga have brought new levels of power and flexibility to personal computing. At the same time, there have been major advances among the peripherals that support these computers, the IBM PC and compatibles family, and the earlier eight-bit machines like the Commodore 64, Apple II family, and Atari 400/800/XL/XE computers.

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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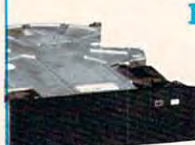


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located closer together than floppy disk sectors, and the data on each sector is packed more densely. Locating sectors close together reduces *access time*, the average amount of time it takes the read/write head to find a sector. This factor, together 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 vi-

sualize 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

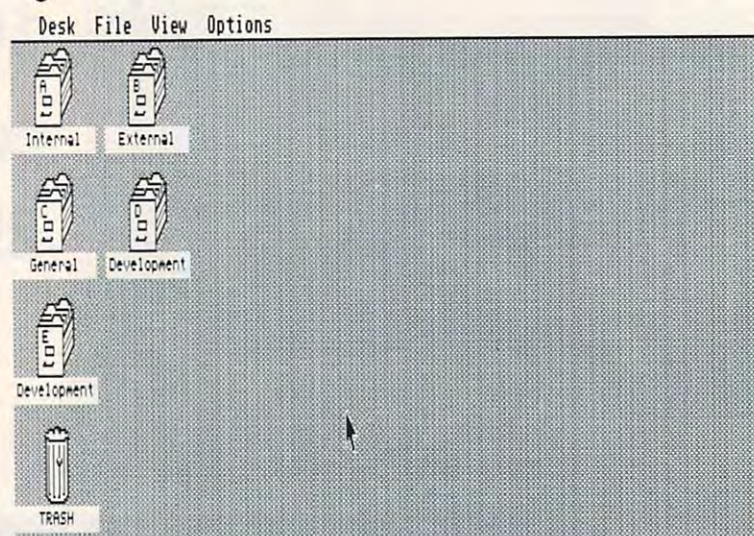
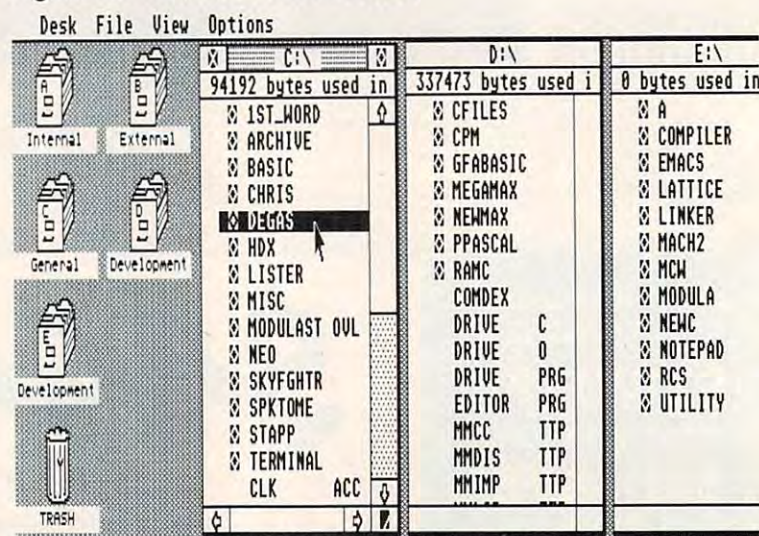


Figure 2: Partition Directories





**Figure 3: Subdirectories**

Desk File View Options				C:\DEGAS\		E:\	
512851 bytes used in 64 items.						used in	
Internal	External	General	Development	AUTO	10-29-86	09:26 am	
				BLOCKS	10-29-86	09:26 am	PILER
General	Development	Development	Development	BRUSHES	10-29-86	09:27 am	CS
				FILLS	10-29-86	09:27 am	TICE
Development	Trash			PRINTERS	10-29-86	09:27 am	KER
				ASSIGN SYS	10-29-86	09:28 am	H2
Trash				BOXES FIL	11-20-85	12:17 am	ULA
				BRUSH1 BRU	11-20-85	12:17 am	C
				CASCADE FIL	11-20-85	12:17 am	EPAD
				CHECKER FIL	11-20-85	12:17 am	LITY
				CIRCLE BRU	11-20-85	12:18 am	
				CLUB FIL	11-20-85	12:18 am	
				COMPUTER FNT	11-20-85	12:18 am	
				CRAP FNT	11-20-85	07:33 am	
				DEGAS DRG	11-20-85	12:19 am	

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.



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  $5 \times 7$  or  $8 \times 8$  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-

# The New, High-Quality Dot-Matrix Printers

Kathy Yakal, Assistant Features Editor

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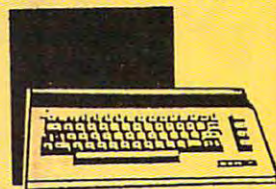
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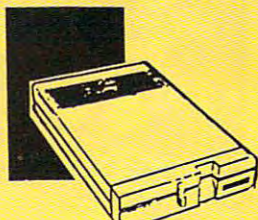
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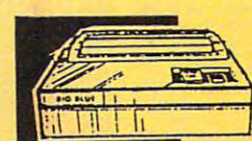
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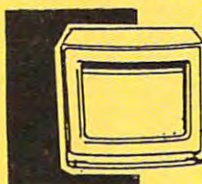
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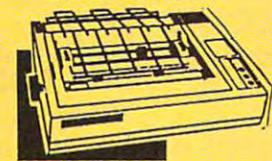
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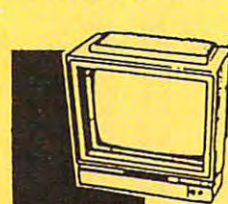


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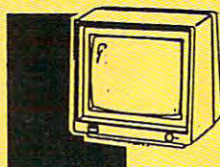


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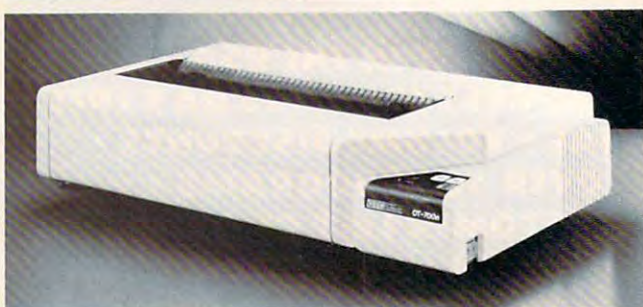
ness market," says Brian Kennedy, marketing manager for Star Micronics, a major printer manufacturer. "This is determined by the price. In general, they start at \$900-\$1,000, so this is not going to penetrate the consumer market too much."

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 X 360), can print on forms as small as a business card or as large as 17 X 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.

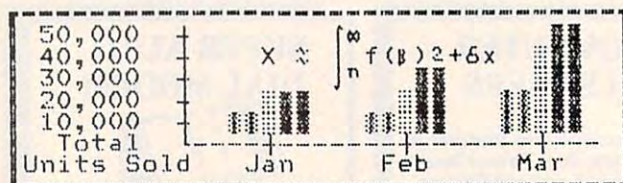


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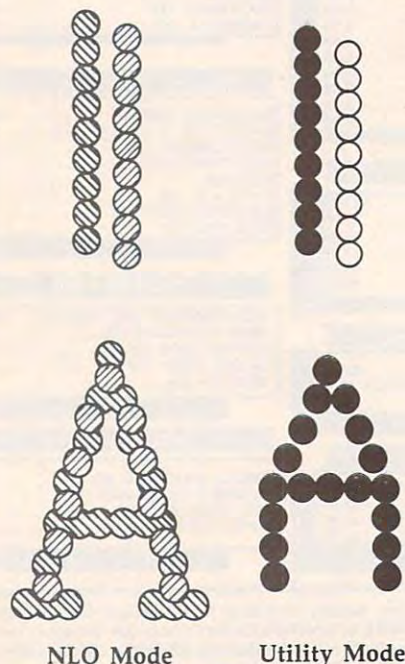
Example Report Legend:

▨ = Last Year's Actual Sales

▤ = This Year's Projected Sales

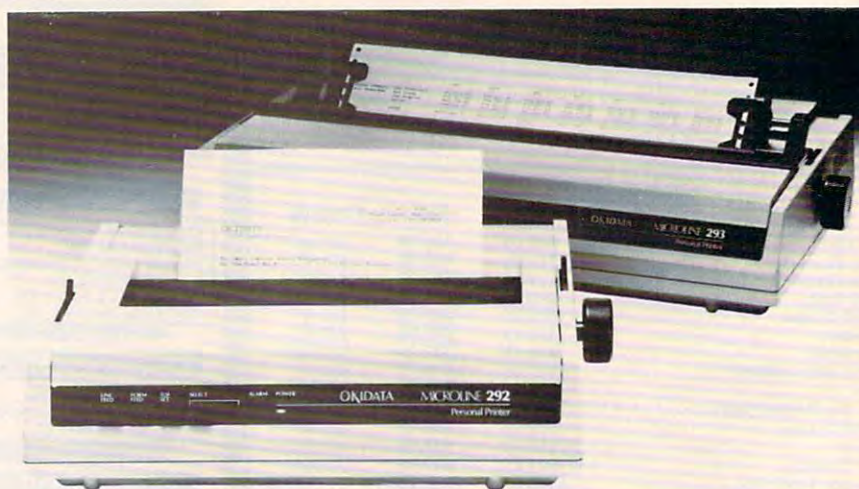
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NLQ Mode

Utility Mode



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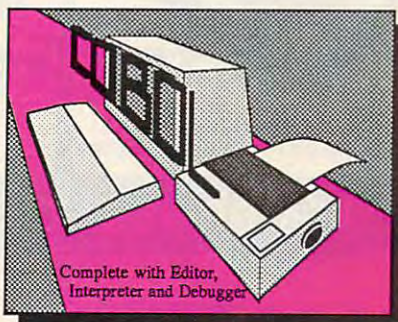
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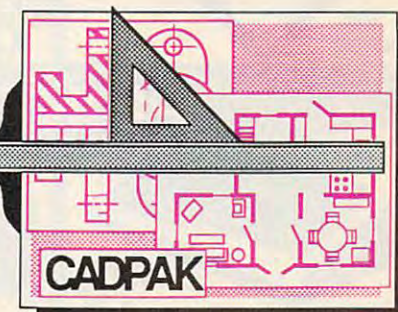
Use your 64 or 128 to communicate with the outside world



SpeedTerm

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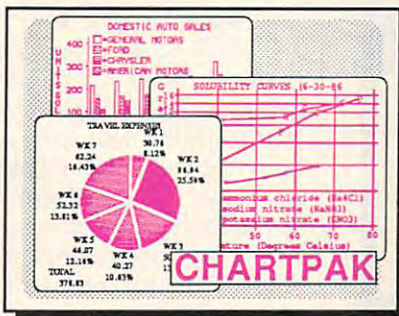
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Symbol	Type	Unit	Per Date	Cost	Price	Gain	Loss	Net
IBM	Stock	50	04/29/1988	1812.10	2347.15	635.05	17.34	87
IBM	Stock	50	07/29/1988	1285.10	1672.25	1075.01	14.84	87

<div> <div>Income</div> <div>Portfolio: port</div> <div>Allen Bender 1825 Riverview Rd. Grand Rapids MI 49518</div> <div>10/1/1988</div> </div>								
Symbol	Type	Unit	Per Date	Amount				
IBM	Stock	05/11/1988		83.30				
IBM Div.	Cash	Stock	05/12/1988	50.00				
IBM Div.	Cash	Stock	06/30/1988	50.00				
IBM Div.	Cash	Stock	06/30/1988	75.00				
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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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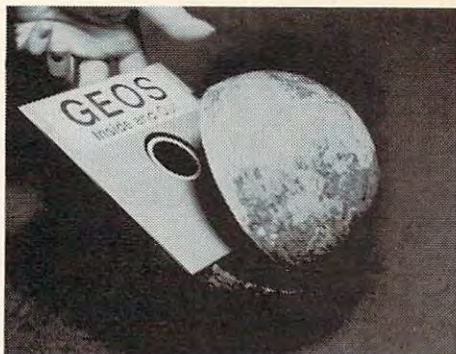
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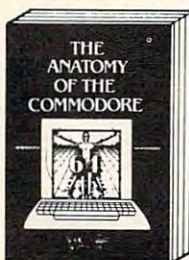
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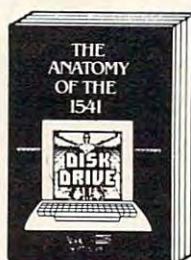
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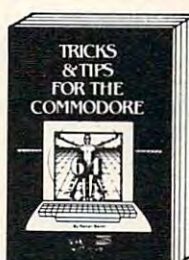
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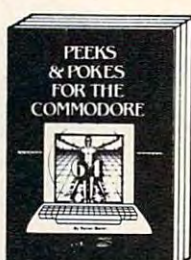
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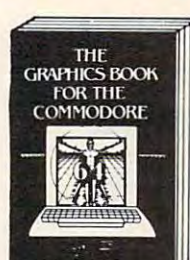
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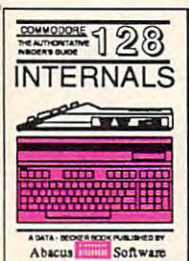
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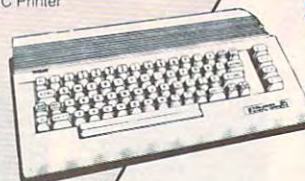
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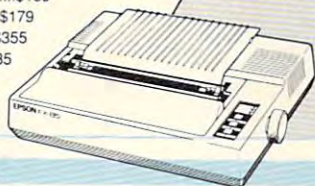
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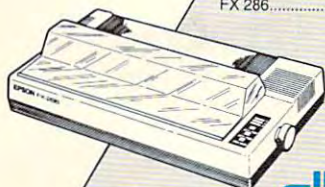
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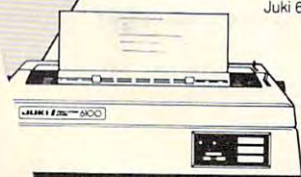
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turers have already started to see the effects from the proliferation of these machines into the consumer and business arenas, raising the demand for low-end printers even further. Some budget-conscious new owners may choose to buy the most inexpensive printer available, but those willing to spend \$500-\$1,000 will likely opt for one more fully featured.

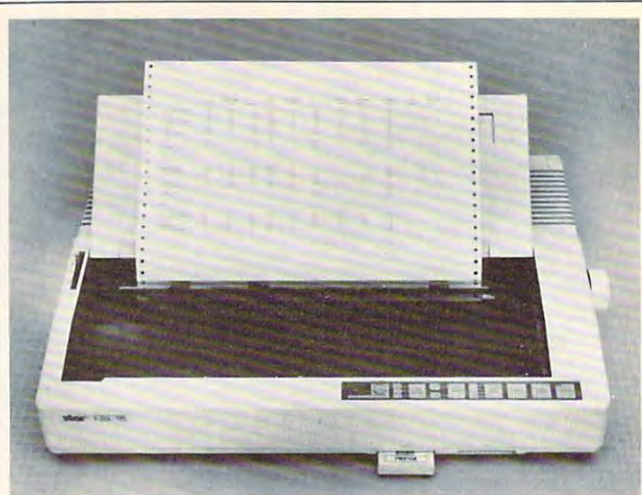
## Other Technologies

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.*

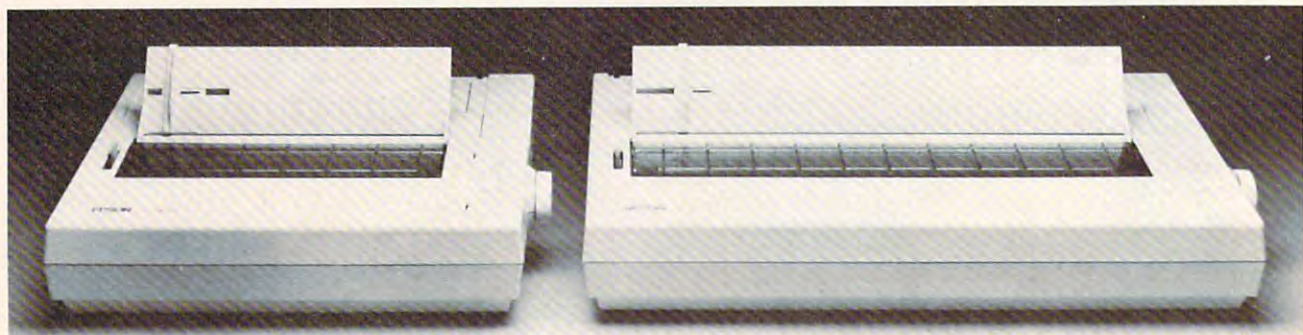
## A Significant Impact

So far 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.*



## 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



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.

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.

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.



# From the publishers of *COMPUTE!*



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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 print-head 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 <i>Fleetwriter III</i> 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 <i>Fleetwriter III</i> 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 opt) (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	

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 Merrimack, NH 03054  
 Fujitsu America  
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 San Jose, CA 95134  
 General Electric  
 Electronics Park  
 Syracuse, NY 13221  
 Hitachi Seiko Computer Peripherals  
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 Mahwah, NJ 07430  
 Hewlett-Packard  
 Personal Computer Group  
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 Cupertino, CA 95014  
 Mannesmann Tally  
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 NEC Information Systems  
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# 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

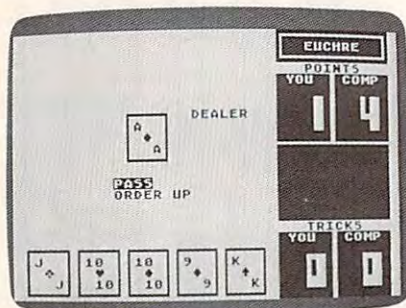
more varied than if the computer players always stick to the same, predictable strategy. One of the more difficult combinations is to choose a normal partner and aggressive opponents. Of course, your own style of play will have an impact on which combination you prefer.

## Dealing And Trump

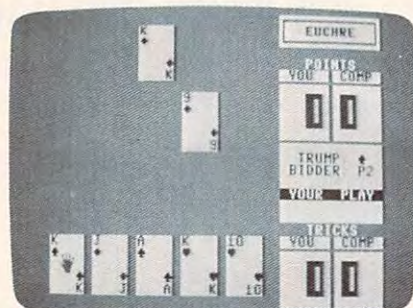
This Euchre variation uses only 24 cards from the standard 52-card deck. Each suit includes only the 9, 10, jack, queen, king, and ace. (The ace is high.) Before actual play begins, the first dealer must be selected. This is done by dealing out cards until a black jack is thrown. The first person who 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.)

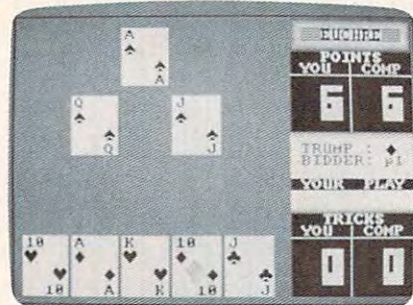
The next step is to choose trump; the trump suit is the most powerful of the four suits for the current hand. Trump is determined by moving around the table in clockwise order, giving each player an opportunity to choose whether the dealer should pick up the center card. Each player can either pass or 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 part-

ner 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 POKEY,12:POKEY,30:SYSPLT
:PRINT"{BLK}NO{2 SPACES}
BIDS";
XQ 40 POKEY,13:POKEY,28:SYSPLT
:PRINT"HAND{2 SPACES}DUM
PED";
XG 50 GOSUB1400:FORI=0TO4:POKE
X,19:POKEY,I*5+2:SYSPLT:
PRINTEC$:NEXT
XP 51 DL=FNNP(DL):POKEY,7:POKE
Y,12:SYSPLT:PRINTEC$;
DH 55 GOSUB1900:GOTO25
FR 70 POKEY,12:POKEY,30:SYSPLT
:PRINT"{BLK}TRUMP: "CO$(
TP)S$(TP);
JJ 75 POKEY,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 POKEY,15:POKEY,28:SYSPL
T:PRINT"{BLK}PICK DISCA
RD";
FD 121 GOSUB2200:POKEY,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 POKEY,7:POKEY,12:SYSPLT
:PRINTEC$;
MK 140 GOSUB2500:GOSUB3000:IF(
PW(0)>9)OR(PW(1)>9)THEN
300
GS 150 POKEY,21:POKEY,31:SYSPL
T:N=0:GOSUB1465
MP 151 POKEY,21:POKEY,35:SYSPL
T:N=0:GOSUB1465
AG 200 POKEY,7:POKEY,31:SYSPLT
:N=PW(0):GOSUB1465
BS 205 POKEY,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 POKE5,7:POKEY,29+WT*6:S
YSPLT:N=1:GOSUB1465
EQ 310 POKE5,7:POKEY,31+WT*6:S
YSPLT:N=PW(WT)-10:GOSUB
1465
KM 315 FORDE=1TO2000:NEXT
EM 320 GOSUB1450:POKE5,13:POKE
Y,30:SYSPLT:PRINT"[RED]
YOU";
DE 321 IFWT=0THENPRINT"WIN!";
PQ 322 IFWT=1THENPRINT"LOSE";
PJ 325 POKE5,15: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
CCCCCCCC{S}";
SG 1025 PRINTSPC(28)"B{RED}
{2 SPACES}EUCHRE
{2 SPACES}{BLU}B";
{32 SPACES}
DD 1030 PRINTSPC(28)"Z{CCCCC
CCCCX}";
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]
E5 Y{POE5 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]
E5 Y{POE5 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 POKE5,7:POKEY,31:SYSPL
T:GOSUB1465:POKE5,7:PO
KEY,35:SYSPLT:GOSUB146
5
SB 1082 POKE5,21:POKEY,31:SYSP
LT:GOSUB1465:POKE5,21:
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
$(I):NEXT
EF 1110 DATA"Z","{RED}","X","
{BLK}","S","{RED}","A"
,"{BLK}"
PE 1111 FORI=0TO6:READNF(I):NE
XT:DATA4,0,1,2,3,4,0
JH 1115 FORI=0TO7:READCL$(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$+
"OFF"
KS 1150 FORI=0TO3:FORI=0TO5
AP 1155 DC(J*6+I)=I:DS(J*6+I)=
J
RF 1160 NEXTI:NEXTJ
EK 1161 FORI=0TO3:READPX(I),PY
(I):NEXT:DATA13,12,7,7
,1,12,7,17
PD 1165 FORI=0TO3:READCX(I),CY
(I):NEXT
CF 1170 DATA17,11,10,4,3,11,10
,21
SQ 1171 FORI=0TO2:FORJ=0TO9:RE
ADNMS(J,I):NEXT:NEXT
BR 1172 DATA"[RVS]{F}","[RVS]
{K}{OFF}{K}","[RVS]{I}
","[RVS]{I}","{2 K}
","[RVS]{I}","[RVS]
{I}","[RVS]{I}","
{RVS}{F}","[RVS]{D} "
BX 1173 DATA"[K]","[RVS]{K}
{OFF}{K}","{I}","{I}
{SPACE}","[RVS]{2 C}
","{I}","{F}","{OFF}
{RVS}","{F}","{F}","{C} "
DH 1174 DATA"[RVS]{V}","[RVS]
{K}{OFF}{K}","{OFF}
{I}","{OFF}{I}{RVS} "
,"{OFF}{K}","{OFF}{I}
{RVS}","{V}","{OFF}
{SPACE}{RVS}","{V}
","{OFF}{I}{RVS} "
EA 1175 DEF FNNP(X)=(X+1)/4-I
NT((X+1)/4)*4
HH 1176 FORI=0TO5:READCP(I):NE
XT:DATA1,1,8,1,2,-1
QA 1177 FORI=0TO13:README$(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}","NORMA
L{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(1,0),MS(1
,1),MS(1,2),MS(1,3),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 PRINTCOS(S)CL$(C)
{2 SPACES}{DOWN}
{4 LEFT}"S$(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:POKE5,19: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:POKE5,12:POK
EY,28:SYSPLT
DF 1305 PRINT"[BLK]FIRST
{2 SPACES}BLACK";
EX 1310 POKE5,13:POKEY,29:SYSP
LT
GB 1315 PRINT"JACK DEALS";
XD 1320 GOSUB1250:DL=0:CC=0
SD 1325 POKE5,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 POKE5,CX(DL):POKEY,CY(
DL):SYSPLT
RC 1337 FORDE=1TO100:NEXT
MS 1340 PRINTEC$;:CC=CC+1:DL=F
NNP(DL):GOTO1325
JK 1355 GOSUB1450:PRINT"[BLK]"
;:POKE5,12:POKEY,29:SY
SPLT
RM 1356 IFDL=0THEN1370
HH 1360 PRINT"PLAYERDL";
RE 1362 POKE5,13:POKEY,31:SYSP
LT
AG 1365 PRINT"DEALS";:GOTO1375
KX 1370 PRINT"YOUR{2 SPACES}DE
AL";
PR 1375 GOSUB1400
EB 1376 POKE5,CX(DL):POKEY,CY(
DL):SYSPLT:PRINTEC$;
JG 1380 RETURN
JM 1400 POKE5,15:POKEY,28:SYSP
LT
EE 1405 GOSUB6000:PRINT"[BLK]
{RVS} HIT BUTTON {OFF}
";:POKE198,0
RR 1410 GETWT$:IF(WT$<>CHR$(13

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))AND(PEEK(56320)<>111
)THEN1410
DA 1415 PRINT"[BLU]";:GOSUB145
0
HP 1430 RETURN
EM 1450 FORR=12TO16:POKEY,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)=0THENS(P,I)=0:SS=S
+1
BJ 1530 NEXT:FORI=0TO3:SP(P,I)
=SP(P,I)+SS:NEXT
EC 1535 IFF<>DLTHEN1550
PX 1540 IFKC=5THENS(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 POKEY,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:POKEY,
MX(BD)+2:POKEY,MY(BD):
SYSPLT:PRINT"[RVS]LONE
HAND{OFF}";
CB 1619 POKEY,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=5THENS
B=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
KEY,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 PRINTCOS(I-LO-1);
HJ 1925 POKEY,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 POKEY,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 POKEY,7:POKEY,12:SYSP
LT:C=KC:S=KS:GOSUB1200
HX 2007 IFDL<>0THENPOKEY,MX(DL
):POKEY,MY(DL)+1:SYSP
LT:PRINT"[RVS]DEALER"
BA 2010 GOSUB1500
XS 2015 IFF=0THENGOSUB1600:GOT
O2040
BH 2016 IFABS(P-DL)<>2THEN2020
RS 2017 GOSUB1625:IFLH=1THENTP
=KS:GOTO2025
RG 2020 GOSUB1650
XA 2025 POKEY,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:POKEY,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 POKEY,7:POKEY,12:SYSP
LT:PRINTC$:IFTP<>4THE
N2105
QC 2073 GOSUB1900:PS=0
HX 2075 P=FNNP(P)
JS 2080 IFF=0THENGOSUB1800:GOT
O2090
PK 2085 GOSUB1850:POKEY,MX(P):
POKEY,MY(P):SYSPLT:PRI
NT"[RVS]";
RS 2086 FORDE=1TO600:NEXT
FC 2088 IFTP=4THENPRINT"
{2 SPACES}PASS";:GOTO2
090
RS 2089 BD=P:PRINTRIGHT$(ME$(T
P+5),8);
HD 2090 IF(P<>DL)AND(TP=4)THEN
PS=PS+1:GOTO2075
PK 2100 GOTO2109
KK 2105 KU=1:IF(BD=0)AND(DL=2)
THENLH=1:GOTO2120
DR 2109 IFTP=4THEN2140
RA 2110 IF(LH=1)AND(BD<>0)THEN
2120
DP 2111 IFBD=0THENGOSUB1615:GO
TO2140
RS 2112 GOSUB1625
MA 2115 IFLH=0THEN2140
EX 2120 POKEY,MX(BD)+2:POKEY,M
Y(BD):SYSPLT:PRINT"
[RVS]LONEHAND";
CF 2140 PRINT"[OFF]";:FORDE=1T
O2000:NEXT
DX 2145 GOSUB1900
PG 2150 RETURN
DF 2200 POKE198,0:F=-1
GE 2205 F=F+1:IFC(0,F)=-1THEN2
205
PQ 2210 G=F:POKESX+1,214:POKES
X,(F*5+3)*8+22:POKE532
69,1
AG 2215 POKESX+1,214:POKESX,(F
*5+3)*8+22
QS 2220 GETR$: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)THENG
O2331
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)=TPTHENTP(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}OPONENT
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:PRINTECS;: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))=TPTHENL=
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=1TO4000: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 POKE53269,2:POKEY,31+4*WT
:SYSPLT:N=TR(WT):GOSUB
1465:POKE53269,0
QF 3075 FORI=0TO3:POKEY,PX(I):
POKEY,PY(I):SYSPLT:PRI
NTECS;:C(I,PC(I))=-1:N
EXT:NEXT
KJ 3078 POKE53269,2:POKEY,M
Y(BD):SYSPLT:PRINT"
{RVS}{9 SPACES}{OFF}";
BT=BDAND253:POKEY,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
1":GOTO3200
QM 3115 IFTR(1)<3THENPRINT"
{2 SPACES}COMPUTER
{DOWN}{8 LEFT}EUCHRED1
";:
GH 3119 FORDE=1TO4000:NEXT
EG 3200 FORDE=1TO4000:NEXT:PRI
NT"{BLU}";
GJ 3205 RETURN
JJ 3500 IFP=0THEN3509
EG 3501 POKEY,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:POKEY,19:P
OKEY,F*5+2:SYSPLT:PRIN
TECS;:GOTO3530
PE 3507 POKEY,15:POKEY,28:SYSP
LT:PRINT"{12 SPACES}"
BG 3508 POKE53269,0:POKEY,19:P
OKEY,F*5+2:SYSPLT:PRIN
TECS;: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:POKEY,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=0TO4:IFS(P,A)
      )=SPTHENIFC(P,A)>VTHEN
      V=C(P,A):F=A
MS 5155 NEXT:RETURN
SJ 5160 V=10:FORA=0TO4
EH 5161 IFS(P,A)=SPTHENIFC(P,A)
      )>0AND(C(P,A)<V)THE
      NV=C(P,A):F=A
RR 5165 NEXT:RETURN
SM 5180 V=10:FORA=0TO4: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=0
QM 5205 HT=HT-1:IFHT>0THENIFCL
      (HT,TP)=1THEN5205
GJ 5210 IFHT<0THEN5240
QS 5215 FORA=0TO4:IFS(P,A)=TPT
      HENIFC(P,A)=HTTHENF=1
BG 5220 NEXT
DM 5240 RETURN
XG 5250 F=1:FORA=0TO4:IFC(P,A)
      )>-1THENIF(S(P,A)<>TP)A
      ND(C(P,A)<5)THENF=0
PH 5255 NEXT:RETURN
DD 5300 F=0:FORA=0TO4:IFS(P,A)
      )=S(WP,PC(WP))THENIFC(P,A)
      )>C(WP,PC(WP))THENF=1
AF 5305 NEXT:RETURN
ES 5350 F=0:FORA=0TO4:IFS(P,A)
      )=S(WP,PC(WP))THENIFC(P,A)
      )>C(WP,PC(WP))=1THEN
      F=1
BK 5355 NEXT:RETURN
PH 5400 D=10:FORA=0TO4
BC 5405 IFS(P,A)=S(WP,PC(WP))T
      HENE=C(P,A)-C(WP,PC(WP))
      ):IF(E<D)AND(E>0)THEN
      D=E:F=A
MX 5410 NEXT:RETURN
QE 6000 FORR=54272TO54296:POKE
      R,0:NEXT:POKE54275,1
QC 6010 POKE54277,21:POKE54278
      ,135:POKE54273,150:POK
      E54276,17
HX 6020 FORR=15TO0STEP-.2:POKE
      54296,R:NEXT
FR 6030 POKE54276,16:POKE54296
      ,0:RETURN
QG 10000 POKE53285,13:POKE5328
      7,11:POKE53288,5:POKE
      53276,2:POKE2040,13:P
      OKE2041,14
SX 10010 SA=832:FORJ=0TO1:SA=S
      A+J*64:FORI=0TO63:REA
      DA:POKESA+I,A:NEXT:NE
      XT:RETURN
PJ 10050 DATA 0,96,0,6,108,0,6
      ,108
SX 10051 DATA 0,6,109,128,3,10
      9,128,3
DF 10052 DATA 253,128,27,255,0
      ,13,255,0
PF 10053 DATA 15,255,0,7,254,0
      ,3,254
AX 10054 DATA 0,1,252,0,0,252,
      0,0
GF 10055 DATA 252,0,0,0,0,0,0,
      0
HS 10056 DATA 0,0,0,0,0,0,0,0
RH 10057 DATA 0,0,0,0,0,0,0,19
      0
PP 10060 DATA 10,170,168,10,14
      9,168,10,85
SR 10061 DATA 104,9,89,88,9,10
      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 10,85,104,10,149
      ,168,10,170
FX 10067 DATA 168,0,0,0,0,0,0,
      0

```

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

```

DH 1 GRAPHICS 0:POKE 710,6:P
      OKE 709,0:POKE 712,112:
      PRINT "PLEASE WAIT"
EI 2 FOR I=0 TO 11:READ A:PO
      KE 1664+I,A:NEXT I
JB 5 DATA 104,165,203,37,204
      ,133,212,169,0,133,213,
      96
ID 10 POKE 752,1:GOSUB 1100:
      GOSUB 1000:GOSUB 2700:
      GOSUB 1300
KJ 25 GOSUB 2000
NK 30 IF TP<>4 THEN 70
JC 35 POSITION 29,11:?"NO
      BIDS"
KI 40 POSITION 27,12:?"HAND
      DUMPED"
KK 50 GOSUB 1400:X=19:FOR I=
      0 TO 4:Y=I*5+1:GOSUB 9
      000:NEXT I
AO 51 J=DL:GOSUB 8100:DL=K:X
      =7:Y=12:GOSUB 9000
IO 55 GOSUB 1900:GOTO 25
CE 70 POSITION 28,11:?"TRUM
      P:":RS$(TP+1,TP+1)
NI 75 POSITION 28,12:?"BIDD
      ER:":IF BD=0 THEN ?
      "YOU:":GOTO 90
CK 80 ? "E";CHR$(ASC(STR$(BD
      ))+128)
MN 90 IF KU=0 THEN 135
OF 100 IF DL>0 THEN 125
OE 115 POSITION 27,14:?"PIC
      K DISCARD"
AA 121 GOSUB 2200:POSITION 2
      7,14:?"{12 SPACES}";:
      GOTO 130
NN 125 GOSUB 2300
CP 130 C(DL,F)=KC:S(DL,F)=KS
      :GOSUB 1220
BK 135 X=7:Y=11:GOSUB 9000
GB 140 GOSUB 2500:GOSUB 3000
      :IF (PW(0)>9) OR (PW(
      1)>9) THEN 300
DP 150 X=30:Y=20:N=0:GOSUB 1
      465
EG 151 X=36:Y=20:N=0:GOSUB 1
      465
AH 200 X=30:Y=6:N=PW(0):GOSU
      B 1465
BD 205 X=36:Y=6:N=PW(1):GOSU
      B 1465
OB 210 J=DL:GOSUB 8100:DL=K:
      GOSUB 1355:GOTO 25
MB 300 WT=0:IF PW(1)>=10 THE
      N WT=1
FC 305 X=27+WT*6:Y=6:N=1:GOS
      UB 1465
EI 310 X=30+WT*6:Y=6:N=PW(WT
      )-10:GOSUB 1465
KN 315 FOR DE=1 TO 100:NEXT
      DE
PO 320 GOSUB 1450:POSITION 2
      9,13:?"YOU:":
JO 321 IF WT=0 THEN ? "WENT
      "
ME 322 IF WT=1 THEN ? "LOSE
      "
DB 325 POSITION 2,2:?"PLAY
      AGAIN?"
JB 330 LO=11:HI=12:XP=2:YP=1
      4:GOSUB 1910

```

```

HI 340 IF AN=11 THEN RUN
CK 350 GRAPHICS 0:END
OK 1000 ? CHR$(125)
IH 1005 POSITION 27,0:?"
      {E}{10 E}{E}"
OO 1010 POSITION 27,1:?"I
      EUCHRE"
JB 1015 POSITION 27,2:?"
      {E}{10 E}{E}"
JJ 1025 POSITION 30,3:?"POI
      NTS"
GD 1030 POSITION 27,4:?"YE
      U{E}{U}COMP"
PN 1040 FOR I=0 TO 4:POSITIO
      N 27,5+I:?"
      {5 SPACES}{E}{U}
      {5 SPACES}":NEXT I
IL 1042 POSITION 27,10:?"
      {12 E}"
HG 1043 POSITION 27,16:?"
      {12 SPACES}"
MD 1045 POSITION 30,17:?"TR
      ICKS"
JK 1050 POSITION 27,18:?"Y
      OU{E}{U}COMP"
HD 1055 FOR I=0 TO 4:POSITIO
      N 27,19+I:?"
      {5 SPACES}{E}{U}
      {5 SPACES}";:NEXT I
AJ 1081 N=0:X=30:Y=6:GOSUB 1
      465:X=36:GOSUB 1465
EB 1082 X=30:Y=20:GOSUB 1465
      :X=36:GOSUB 1465
CO 1090 GOSUB 1450:RETURN
MM 1100 DIM C$(16),C2$(16),
      ME$(10),TME$(140),BL
      $(10),FC(2),DC(23),D
      S(23),EC$(5),MX(3),M
      Y(3)
KD 1101 DIM CX(3),CY(3),C(3,
      4),S(3,4),A$(10),S$(
      4),OB(6),JU(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$(4),LTME(13
      ),PT(4),SL(3),TR(1),
      PC(3),NM1$(30),NM2$(
      30),NM3$(30),PW(1)
OL 1103 S$="{ } { } { } { }":RS
      $="{ } { } { } { }":BL$
      =" {10 SPACES}":EC$="
      {5 SPACES}"
CB 1105 FOR I=0 TO 3:FOR J=0
      TO 5:SP(I,J)=0:NS(I
      ,J)=0:NEXT J:NEXT I
DB 1110 C1$="9 10J Q K A J
      J"
DH 1115 C2$=" 910 J Q K A J
      J"
FF 1120 RESTORE 1120:FOR I=0
      TO 6:READ A:NF(I)=A
      :NEXT I:DATA 4,0,1,2
      ,3,4,0
OK 1150 FOR J=0 TO 3:FOR I=0
      TO 5
AP 1155 DC(J*6+I)=I:DS(J*6+I
      )=J
LC 1160 NEXT I:NEXT J:PW(0)=
      0:PW(1)=0
AM 1161 RESTORE 1161:FOR I=0
      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=0
      TO 5:READ A:CP(I)=A
      :NEXT I:DATA 1,1,8,1
      ,2,-1
AK 1165 RESTORE 1170:FOR I=0
      TO 3:READ A,B:CY(I)
      =A:CY(I)=B:NEXT I
HL 1170 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
      $:NEXT I
AI 1178 DATA PASS,ORDER UP,P
      ASS,PICK UP, PASS,
      (. ) DIAMONDS
OD 1179 DATA (P) CLUBS,(, ) H
      EARTS,(, ) SPADES,NOR
      MAL,AGGRESSIVE,YES,N
      O,YES
MI 1185 RESTORE 1185:FOR I=1
      TO 3:READ A,B:MX(I)
      =A:MY(I)=B:NEXT I:DA
      TA 7,1,1,9,7,17
PA 1186 RESTORE 1190:FOR I=0
      TO 6:READ A,B,C,D,E
      ,F,G,H:OB(I)=A:OU(I)
      =B:PU(I)=C
IK 1187 MS(I,0)=D:MS(I,1)=E:
      MS(I,2)=F:MS(I,3)=G:
      GA(I)=H:NEXT I
KJ 1190 DATA 99,99,99,99,99,
      99,99,99
KK 1191 DATA 99,99,99,99,99,
      99,99,99
GI 1192 DATA 99,99,14,14,14,
      13,13,99
GC 1193 DATA 20,12,8,8,8,8,7
      ,19
AJ 1194 DATA 14,0,0,0,0,0,0,
      16
ND 1195 DATA 0,0,0,0,0,0,0,1
      4
JP 1196 DATA 0,0,0,0,0,0,0,0
LE 1199 RETURN
GO 1200 IF (S=TP) AND (C=6)
      THEN S=S+2:S=(S/4-INT
      (S/4))*4
CC 1201 NC=C*2+1:POSITION Y,
      X:? "Q{3 R}{E}"
HF 1202 POSITION Y,X+1:? "I"
      ;C1$(NC,NC+1);"I"
DG 1203 POSITION Y,X+2:? "I"
      ;S$(S+1,S+1);"I"
HK 1204 POSITION Y,X+3:? "I"
      ;C2$(NC,NC+1);"I"
ME 1205 POSITION Y,X+4:? "I"
      ;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
KB 1230 RETURN
BA 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
OH 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:? "R
      S T BLACK"
JC 1310 POSITION 28,12:? "R
      S T BLACK"
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
IM 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:? "R
      S T BLACK"
NG 1370 POSITION 28,12:? "R
      S T BLACK"
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
BF 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 1690 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
GC 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
PH 1920 FOR J=1 TO LEN(ME$):
      ME$(J,J)=CHR$(ASC(ME
      $(J,J))+128):NEXT J
JB 1925 POSITION Y1,X1:? ME$
      ;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":POS
ITION MY(BD),MX(BD)+1
:?" {8 SPACES}"
NL 2140 FOR DE=1 TO 100:NEXT
DE
GG 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:?" {U}
{3 R}{E}";
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
OG 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
EQ 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
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
FB 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
BJ 3090 IF BT=0 THEN ? "YOU
WON":POSITION 2
7,15:?" {ALL TRICKS
}":GOTO 3200
EB 3095 IF BT=1 THEN ? "COME
ENTER WON":POSITI
ON 27,15:?" {ALL TRICKS
}":GOTO 3200
II 3097 PW(BT)=PW(BT)+1
FL 3100 IF TR(0)>2 THEN ? "YOU
WON HANE":GOTO 3
200

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NP 3105 IF TR(1)>2 THEN ? "
      COMPUTER":POSITIO
      N 27,15: ? "WON HAK
      D":GOTO 3200
DO 3108 PW(1-BT)=PW(1-BT)+2
PF 3110 IF TR(0)<3 THEN ? "
      OUVRE BEEK":POSITIO
      N 27,15: ? "EUCHRE
      D":GOTO 3200
JJ 3115 IF TR(1)<3 THEN ? "
      COMPUTER":POSITIO
      N 27,15: ? "EUCHRE
      D":
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=1
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
KH 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
HG 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
KK 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

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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
MM 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
      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
BF 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

```

```

BK 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
I3 35 VTAB 12: HTAB 30: PRINT "N
      O BIDDERS"
IF 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

```







```

85 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
85 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
40 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
8D 1910 AN = LO
54 1915 X1 = XP:Y1 = YP: FOR I =
    LO TO HI: NORMAL: IF I
    = AN THEN INVERSE
80 1925 VTAB X1: HTAB Y1: PRINT
    ME$(I);X1 = X1 + 1: NEX
    T
E1 1930 K = PEEK (49152):J = RND
    (1): IF K > 127 THEN PO
    KE 49168,0
83 1932 IF K < > 136 THEN 1940
CD 1935 AN = AN - 1: IF AN < LO
    THEN AN = HI
C7 1940 IF K < > 149 THEN 1950
EF 1945 AN = AN + 1: IF AN > HI
    THEN AN = LO
DC 1950 IF K < > 141 THEN GOTO 1
    915
42 1955 X1 = XP:Y1 = YP: NORMAL
    : FOR I = LO TO HI: VTAB
    X1: HTAB Y1: PRINT BL$;
    :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)
E8 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
82 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)
84 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

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```

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
BB 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
IF 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
88 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
84 2340 IF C(P,I) = 5 THEN PT(I)
    = 9: GOTO 2350
18 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

```



```

37 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
3A 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
9B 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: HPLLOT 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 3108
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
6B 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
B5 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
10 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
4B 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
BF 4210 IF ABS (WP - P) < > 2 TH
EN 4225
BD 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
AB 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
B7 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
1B 4300 GOSUB 5250: IF F = 1 THE
N SP = TP: GOTO 5160
B1 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
2B 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
BF 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 3656B,0,Y * 7 - 1,X
    * 8: RETURN

```

## Program 4: Graphics File For Apple Eucre

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

```

8CAB: 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
8CDB: A0 00 B1 1A 24 32 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 D3
8D00: 00 00 00 00 00 00 00 1B
8D08: 00 30 30 30 30 00 30 1A
8D10: 00 00 00 00 00 00 00 2B
8D18: FF FF FF FF 87 87 87 24
8D20: 87 87 87 87 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 8B
8D78: 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 9D
8DD8: F0 F0 F0 F0 F0 F0 F0 F3
8DE0: 83 83 83 83 83 83 83 FB
8DE8: 87 87 87 87 87 87 87 04
8DF0: 7F 7F 7F 7F 00 00 00 93
8DF8: 80 BC E6 B0 98 98 98 E3
8E00: FF FF FF FF FF FF FF 1D
8E08: 80 FC E6 E6 FE E6 E6 80 D1
8E10: 80 BC 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 41
8E50: 80 E0 E0 E0 E0 E6 BC 80 AC
8E58: 80 E6 E6 86 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 86 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 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 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: 80 79 20 49 91 B0 7A 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 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 6D AD 00 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 D0 91 AD E0 91 09 A6
9010: 7F 8D D3 91 AC D6 91 F0 BC
9018: 15 A2 00 E0 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 FB 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 AB 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 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: 00 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 5F 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 7F 7F 7F 9F
9190: 7F 7F 7E 7A 7E 7F 7F 7F 1F
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 Eucre

```

N1 5 KEY OFF:DEF SEG=0:DEFINT A-
Z:POKE 1047,PEEK(1047) OR 6
4:RANDOMIZE TIMER
K1 10 GOSUB 1100:GOSUB 1000:GOSU
B 2700:GOSUB 1300
M1 25 GOSUB 2000:COLOR 1,7
P1 30 IF TP<>4 THEN 70
M1 35 LOCATE 12,29:PRINT "NO BID
DERS"
M1 40 LOCATE 13,28:PRINT "HAND
DUMPED"
J1 50 GOSUB 1400:X=20:FOR I=0 TO
4:Y=I*5+3:GOSUB 9000:NEXT
I
E1 51 DL=FNNP(DL):X=8:Y=13:GOSUB
9000
D1 55 GOSUB 1900:GOTO 25
L1 70 COLOR 9,7:LOCATE 12,29:PRI
NT "TRUMP : ";:COLOR CO(TP
):PRINT S$(TP):COLOR 9
J1 75 LOCATE 13,29:PRINT "BIDDER
: ";:IF BD=0 THEN PRINT "y
ou":GOTO 90
J1 80 PRINT "p";RIGHT$(STR$(BD),
1)
B1 90 IF KU=0 THEN 135
O1 100 IF DL>0 THEN 125
F1 115 COLOR 14,0:LOCATE 15,28:P
RINT "PICK DISCARD"
G1 121 GOSUB 2200:LOCATE 15,28:P
RINT " ";:GOTO
130
B1 125 GOSUB 2300
H1 130 C(DL,F)=KC:S(DL,F)=KS:GOS
UB 1220
G1 135 X=8:Y=13:GOSUB 9000
P1 140 GOSUB 2500:GOSUB 3000:COL
OR 0,4:IF (PW(0)>9) OR (P
W(1)>9) THEN 300
K1 150 X=21:Y=31:N=0:GOSUB 1465
P1 151 X=21:Y=37:N=0:GOSUB 1465
G1 200 X=7:Y=31:N=PW(0):GOSUB 14
65
M1 205 X=7:Y=37:N=PW(1):GOSUB 14
65
B1 210 DL=FNNP(DL):GOSUB 1355:GO
TO 25

```







```

PD 1801 IF AN=5=KS THEN 1800
GM 1805 IF AN>4 THEN TP=AN-5
BO 1810 RETURN
DO 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
OK 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$;:X1=X1+1:NEX
T
LD 1965 RETURN
JG 2000 GOSUB 1250:GOSUB 1220:P=
FNNP(DL):TP=4:BD=0:KU=0
LK 2005 X=8:Y=13:C=KC:S=KS:GOSUB
1200:COLOR 7,1
EJ 2007 IF DL<>0 THEN LOCATE MX(
DL),MY(DL):PRINT "dealer
"
FO 2010 GOSUB 1500
DJ 2015 IF P=0 THEN GOSUB 1600:G
OTO 2040
LG 2016 IF ABS(P-DL)<>2 THEN 202
0
CG 2017 GOSUB 1625:IF LH=1 THEN
TP=KS:GOTO 2025
KE 2020 GOSUB 1650
BB 2025 LOCATE MX(P),MY(P)
QJ 2030 COLOR 7,1:IF TP=4 THEN P
RINT " pass":GOTO 2040
NH 2035 BD=P:PRINT "order up"
HE 2040 P=FNNP(P):IF (P<>DL) AND
(TP=4) THEN 2010
IH 2045 P=DL:GOSUB 1500:IF TP<>4
THEN 2105
NC 2050 IF DL=0 THEN GOSUB 1700:
GOTO 2070
ML 2055 GOSUB 1750:LOCATE MX(DL)
,MY(DL)
LB 2060 IF TP=4 THEN PRINT "turn
ed":LOCATE MX(DL)+1,MY(D
L):PRINT " down":GOTO 20
70
CB 2065 BD=P:PRINT "picked":LOCA
TE MX(DL)+1,MY(DL):PRINT
" up"
BA 2070 FOR DE=1 TO 1000:NEXT
IB 2071 IF (BD=0) AND (TP<>4) TH
EN 2105
DA 2072 X=8:Y=13:GOSUB 9000:IF T
P<>4 THEN 2105
LN 2073 GOSUB 1900:PS=0
ND 2075 P=FNNP(P)
BA 2080 IF P=0 THEN GOSUB 1800:G
OTO 2090
DE 2085 GOSUB 1850:LOCATE MX(P),
MY(P)
OG 2086 FOR DE=1 TO 300:NEXT
DO 2088 IF TP=4 THEN PRINT " pa
ss":GOTO 2090
BJ 2089 BD=P:PRINT RIGHT$(ME$(TP
+5),8);
EO 2090 IF (P<>DL) AND (TP=4) TH
EN PS=PS+1:GOTO 2075
GO 2100 GOTO 2109
DO 2105 KU=1:IF (BD=0) AND (DL=2
) THEN LH=1:GOTO 2120
IH 2109 IF TP=4 THEN 2140
LG 2110 IF (LH=1) AND (BD<>0) TH
EN 2120
LM 2111 IF BD=0 THEN GOSUB 1615:
GOTO 2140
NM 2112 GOSUB 1625
LC 2115 IF LH=0 THEN 2140
LP 2120 LOCATE 1,1:PRINT "loncha
nd"
BJ 2140 FOR DE=1 TO 1000:NEXT
KB 2145 GOSUB 1900
JN 2150 RETURN
PG 2200 F=-1
NB 2205 F=F+1:IF C(0,F)=-1 THEN
2205
BO 2210 G=F
OB 2215 COLOR ,7:Y=G*5+4:LOCATE
21,Y:PRINT " ":LOCATE 2
2,Y:PRINT " ":LOCATE 23
,Y:PRINT " ";
KK 2218 COLOR 10,2:Y=F*5+4:LOCAT
E 21,Y:PRINT " "":LOCATE
22,Y:PRINT " "":LOCATE
23,Y:PRINT " ";
BL 2220 K$=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
BK 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
NEXT I
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
OB 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
OB 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
KB 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
EO 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
OK 3070 PRINT " ";CD$;CL$;" ";N
L$;CD$;" ";CD$;CL$;" ";
OL 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=PY
(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
DC 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
MD 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
SA 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))
OD 4205 IF (SP<>TP) AND (TL=1) T
HEN 5160
NE 4210 IF ABS(WP-P)<>2 THEN 422

```

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5
LN 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
(LC(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
OD 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
BF 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<0) 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

```

## Program 6: Amiga Euchre

```

Euchre:4
DEFINT a-z:DEFSNG r,g,b,cy:RANDO
MIZE TIMER4
SCREEN 1,320,200,4,1:WINDOW 3,""
,(0,0)-(311,186),16,1:WINDOW OUT
PUT 3:COLOR 3,04
RESTORE PaLETTEData:FOR i=0 TO 1
5:READ r,g,b:PALETTE i,r,g,b:NEX
T4
PaLETTEData:4
DATA .2,.2,.9,0,0,0,0,0,0,.8,0,0
4
DATA .8,.8,.8,0,0,1,1,1,0,.93,.9
3,04
DATA .87,.87,0,0,.8,0,0,1,0,1,1,
04
DATA .3,.3,.3,.5,.5,.5,.6,.6,.6,
.7,.7,.74
GOSUB InitiaLize:GOSUB DispLay:G
OSUB PLayer:GOSUB PickDeaLer4
NewHand:4
GOSUB Bidding4
IF tp=4 THEN4
COLOR 0,4:LOCATE 12,29:PRINT "NO
BIDDERS"4
LOCATE 13,28:PRINT "HAND DUMPED
"4
GOSUB WaitKey:x=20:FOR i=0 TO 4:
y=i*5+2:GOSUB EraseCard:NEXT 4
dL=FNnp(dL):x=8:y=12:GOSUB Erase
Card4
COLOR ,0:GOSUB CLRMess:GOTO NewH
and4
END IF:COLOR 5,4:LOCATE 12,29:PR
INT "TRUMP : "4
LOCATE 13,29:PRINT "BIDDER: ";4
IF bd=0 THEN 4
PRINT "you";4
ELSE4
PRINT "p";RIGHT$(STR$(bd),1)4
END IF:PUT(288,88),sb(0,tp),PSET
4
IF ku<>0 THEN 4
IF dL=0 THEN 4
COLOR 11,2:LOCATE 15,28:PRINT "P
ICK DISCARD"4
GOSUB UpickCard:COLOR ,4:LOCATE
15,28:PRINT " ";4
ELSE4
GOSUB Udiscard4
END IF:c(dL,f)=kc:s(dL,f)=ks:GOS

```



```

UB PutHand4
END IF:x=8:y=12:GOSUB EraseCard4
GOSUB ResetHand:GOSUB PlayHand:C
OLOR 0,4
IF NOT((pw(0)>9) OR (pw(1)>9)) T
HEN 4
x=21:y=31:n=0:GOSUB PrintScore4
x=21:y=37:n=0:GOSUB PrintScore4
x=7:y=31:n=pw(0):GOSUB PrintScor
e4
x=7:y=37:n=pw(1):GOSUB PrintScor
e4
dL=FNnp(dL):GOSUB ExitLoopPD:GOT
O NewHand4
END IF:wt=0:IF pw(1)>=10 THEN wt
=14
x=7:y=28+wt*6:n=1:GOSUB PrintSco
re4
x=7:y=31+wt*6:n=pw(wt)-10:GOSUB
PrintScore4
FOR de=1 TO 2000:NEXT4
GOSUB ClearWindow:COLOR 11,3:LOC
ATE 13,28:PRINT " YOU";4
IF wt=0 THEN PRINT " WIN! "4
IF wt=1 THEN PRINT " LOSE "4
COLOR 4,0:LOCATE 2,2:PRINT "Play
again?"4
Lo=11:hi=12:xp=2:yp=14:GOSUB SeL
ection4
SCREEN CLOSE 1:WINDOW CLOSE 34
IF an=11 THEN RUN 4
END4
4
Display: 4
GOSUB InitShapes:WIDTH 40:CLS:CO
LOR ,04
LINE(0,0)-(3,3),2,bf:GET(0,0)-(3
,3),en4
LINE(0,0)-(3,3),11,bf:GET(0,0)-(
3,3),nb4
GET(4,4)-(40,44),ec:LINE(4,4)-(4
0,44),4,bf4
GET(4,4)-(40,44),cb:GET(4,4)-(17
,21),eh:CLS4
FOR i=0 TO 3:j=i*2:LINE(216+j,j)
-(311-j,23-j),i+12,bf:NEXT4
COLOR 2,4:FOR i=0 TO 6 STEP 2:LI
NE(224,7+i)-(303,7+i):NEXT4
LOCATE 2,31:PRINT "EUCHRE":LINE(
224,15)-(303,15)4
COLOR 10,2:LOCATE 4,28:PRINT "
POINTS "4
LOCATE 18,28:PRINT " TRICKS
"4
COLOR 9,2:LOCATE 5,28:PRINT " YO
U COMP "4
LOCATE 19,28:PRINT " YOU COMP
"4
FOR i=0 TO 4:LOCATE 6+i,28:PRINT
w$:LOCATE 20+i,28:PRINT w$;:NEXT
4
LINE(216,40)-(311,40),9:LINE(216
,152)-(311,152),94
LINE(262,32)-(262,79),9:LINE(262
,144)-(262,191),94
COLOR 4,4:LOCATE 11,28:PRINT w$:L
OCATE 17,28:PRINT w$:GOSUB CLear
Window4
FOR i=0 TO 3:LINE(216,80+i)-(311
,80+i),i+124
LINE(216,132+i)-(311,132+i),15-i
:NEXT 4
n=0:x=7:y=31:GOSUB PrintScore:y=
37:GOSUB PrintScore4
x=21:y=31:GOSUB PrintScore:y=37:
GOSUB PrintScore4
COLOR 4,0:RETURN4
4
Initialize:4
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)4
DIM en(19),nb(19),eh(75),hb(75),
ec(507),cb(507),sb(30,3)4

```

```

DEF FNnp(x)=((x+1)/4-INT((x+1)/4
))*44
bL$=SPACE$(10):w$=SPACE$(12):c$=
"9 10J Q K A J J 910 J Q K A J
J"4
FOR i=0 TO 3:READ co(i):NEXT:DAT
A 3,2,3,24
FOR i=0 TO 6:READ nf(i):NEXT:DAT
A 4,0,1,2,3,4,04
FOR j=0 TO 3:FOR i=0 TO 5:dc(j*6
+i)=i:ds(j*6+i)=j:NEXT i,j4
FOR i=0 TO 3:READ px(i),py(i):NE
XT:DATA 14,12,8,7,2,12,8,174
FOR i=0 TO 3:READ cx(i),cy(i):NE
XT:DATA 18,11,11,4,4,11,11,184
FOR i=0 TO 5:READ cp(i):NEXT:DAT
A 1,1,8,1,2,-14
FOR i=0 TO 13:READ me$(i):NEXT4
DATA "pass ", "order up", "pass
", "pick up", " PASS ", "diamonds
"4
DATA "clubs ", "hearts ", "spad
es ", "normal ", "aggressive",
"yes", "no ", "yes"4
FOR i=0 TO 3:READ mx(i),my(i):NE
XT:DATA 1,1,8,3,2,11,8,194
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):NEXT4
DATA 99,99,99,99,99,99,99,994
DATA 99,99,99,99,99,99,99,994
DATA 99,99,14,14,14,13,13,994
DATA 20,12,8,8,8,8,7,194
DATA 14,0,0,0,0,0,0,164
DATA 0,0,0,0,0,0,0,144
DATA 0,0,0,0,0,0,0,04
FOR i=0 TO 9:READ pt&(i):NEXT4
DATA 16768479&,13421772&,1671982
3&,16764879&,13434333&4
DATA 16764703&,16768799&,1342179
1&,16768991&,13422559& 4
RETURN4
4
PutCard: 4
IF (s=tp) AND (c=6) THEN s=s+2:s
=(s/4-INT(s/4))*44
NC=c*2+1:COLOR co(s),4:px=(y-1)*
8-2:py=(x-1)*8-14
PUT(px,py),cb,PSET:px=px+1:py=p
y+2:PUT(px,py+8),sb(0,s),PSET4
px=px+2:py=py-1:PUT(px+22,py+21)
,sb(0,s),PSET4
LOCATE x,y:PRINT MID$(c$,NC,2):L
OCATE x+4,y+2:PRINT MID$(c$,NC+1
6,2);4
RETURN 4
4
PutHand: FOR u=0 TO 4:x=20:y=u*5
+24
c=c(0,u):s=s(0,u):GOSUB PutCard:
NEXT:RETURN4
4
DealCards: FOR i=0 TO 23:j=INT(R
ND(1)*24):t=dc(i):dc(i)=dc(j):dc
(j)=t4
t=ds(i):ds(i)=ds(j):ds(j)=t:NEXT
4
FOR j=0 TO 3:FOR i=0 TO 44
c(j,i)=dc(j*5+i):s(j,i)=ds(j*5+i
):NEXT i,j:kc=dc(20):ks=ds(20):R
ETURN4
4
PickDeaLer: 4
COLOR 0,4:LOCATE 13,28:PRINT "FI
RST BLACK":LOCATE 14,29:PRINT "
JACK DEALS"4
GOSUB DealCards:dL=0:cc=04
LoopPD: c=dc(cc):s=ds(cc):x=cx(d
L):y=cy(dL):GOSUB PutCard4
FOR de=1 TO 500:NEXT 4
IF (dc(cc)=2) AND ((ds(cc) AND 2
53)=1) THEN ExitLoopPD4
x=cx(dL):y=cy(dL):GOSUB EraseCar
d4
FOR de=1 TO 100:NEXT 4

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cc=cc+1:dL=FNnp(dL):GOTO LoopPD4
ExitLoopPD: GOSUB ClearWindow:CO
LOR 0,4:LOCATE 12,294
IF dL<0 THEN 4
PRINT " PLAYER";STR$(dL)4
LOCATE 13,30:PRINT " DEALS";4
ELSE4
PRINT "YOUR DEAL";4
END IF:GOSUB WaitKey4
x=cx(dL):y=cy(dL):GOSUB EraseCar
d:COLOR 7,1:RETURN4
4
WaitKey: COLOR 3,2:LOCATE 15,28:
PRINT " HIT RETURN ":SOUND 2000,
64
WHILE INKEY$<>CHR$(13):WEND:GOSU
B ClearWindow:COLOR 7,1:RETURN4
4
ClearWindow: COLOR ,4:FOR i=12 T
O 16:LOCATE i,28:PRINT w$:NEXT:R
ETURN4
4
PrintScore:4
tx=(y-1)*8:py=(x-1)*8:bt&=1:i&=p
t&(n)4
FOR q=0 TO 5:FOR p=0 TO 3:px=tx+
p*44
IF (bt& AND i&)<>0 THEN PUT(px,p
y),nb,PSET ELSE PUT(px,py),en,PS
ET4
px=tx+p*4:bt&=bt&*2:NEXT p:py=py
+4:NEXT:RETURN4
4
SetPoints: 4
FOR i=0 TO 3:sp(p,i)=fc(p AND 25
3):ns(p,i)=0:NEXT 4
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)+14
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)+14
IF c=5 THEN 4
FOR j=0 TO 3:sp(p,j)=sp(p,j)+4:N
EXT 4
END IF:NEXT:ss=0:FOR i=0 TO 4:IF
ns(p,i)=0 THEN sp(p,i)=0:ss=ss+1
4
NEXT:FOR i=0 TO 3:sp(p,i)=sp(p,i
)+ss:NEXT 4
IF p=dL THEN 4
IF kc=5 THEN sp(p,ks)=sp(p,ks)+4
4
sp(p,ks)=sp(p,ks)+cp(kc):ns(p,ks
)=ns(p,ks)+14
END IF:RETURN 4
4
UOrderUp: Lo=0:hi=1:xp=14:yp=10:
GOSUB Selection4
IF an=1 THEN tp=ks4
RETURN 4
4
ULoneHand: LOCATE 14,9:PRINT "Lo
nehand";4
Lo=12:hi=13:xp=14:yp=18:GOSUB Se
lection:Lh=04
IF an=13 THEN Lh=1:LOCATE mx(bd)
,my(bd):PRINT "Lonehand";4
LOCATE 14,9:PRINT " ";4
RETURN 4
4
CGoALone: Lh=0:IF sp(p,tp)>ga(ns
(p,tp)) THEN Lh=14
RETURN4
4
COrderUp: IF FNnp(FNnp(p))=dL TH
EN GOSUB CGoALone:f=Lh:GOTO Exit
COU4
f=0:IF kc<2 THEN 4
IF sp(p,ks)>ou(ns(p,ks)) THEN f=
14
END IF:IF sp(p,ks)>ob(ns(p,ks))
THEN f=14
IF (f=0) OR (p<>FNnp(dL)) THEN E

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xitCOU4
sb=cp(kc):IF kc=5 THEN sb=34
FOR i=0 TO 3:IF i>ks THEN IF sp
(p,i)>=(sp(p,ks)-sb) THEN f=04
NEXT 4
ExitCOU: IF f=1 THEN tp=ks4
RETURN 4
4
UPickUp: Lo=2:hi=3:xp=14:yp=10:G
OSUB SeLecton4
IF an=3 THEN tp=ks4
RETURN 4
4
CPickUp: IF sp(p,ks)>PU(ns(p,ks)
) THEN tp=ks4
RETURN 4
4
UMake: Lo=4:hi=8:xp=14:yp=10:GOS
UB SeLecton4
IF an=5=ks THEN UMake4
IF an>4 THEN tp=an-54
RETURN 4
4
CMake: df=0:FOR i=0 TO 34
IF i>ks THEN4
IF sp(p,i)-ms(ns(p,i),ps)>=df TH
EN df=sp(p,i)-ms(ns(p,i),ps):tp=
i4
END IF:NEXT4
RETURN4
4
CLRMess: FOR i=1 TO 3:FOR j=0 TO
2:LOCATE mx(i)+j,my(i):PRINT SPA
CES(8);4
NEXT j,i:RETURN4
4
SeLecton: 4
an=Lo:k$="":WHILE k$<>CHR$(13)4
xl=xp:yl=yp:FOR i=Lo TO hi:COLOR
4,04
IF i=an THEN 4
IF (an=Lo) OR (hi-Lo=1) THEN COL
OR 0,4 ELSE COLOR ,co(i-Lo-1)4
END IF:LOCATE xl,yl:PRINT me$(i)
;xl=xl+1:NEXT4
WaitS: k$=INKEY$:IF k$="" THEN W
aitS 4
IF k$=CHR$(28) THEN 4
an=an-1:IF an<Lo THEN an=hi4
ELSEIF k$=CHR$(29) THEN 4
an=an+1:IF an>hi THEN an=Lo4
END IF:WEND:xl=xp:yl=yp:COLOR 4,
04
FOR i=Lo TO hi:LOCATE xl,yl:PRIN
T bL$;xl=xl+1:NEXT4
RETURN4
4
Bidding: 4
GOSUB DealCards:GOSUB PutHand:p=
FNnp(dL):tp=4:bd=0:ku=04
x=8:y=12:c=kc:s=ks:GOSUB PutCard
:COLOR 4,04
IF dL<>0 THEN LOCATE mx(dL),my(d
L):PRINT "dealer"4
5 GOSUB SetPoints4
IF p=0 THEN GOSUB UOrderUp:GOTO
204
IF ABS(p-dL)<>2 THEN 7 4
GOSUB CGoALone:IF Lh=1 THEN tp=k
s:GOTO 104
7 GOSUB CorderUp4
10 LOCATE mx(p),my(p):COLOR 4,04
IF tp=4 THEN PRINT " pass":GOTO
204
bd=p:PRINT "order up"4
20 p=FNnp(p):IF (p<>dL) AND (tp=
4) THEN 54
p=dL:GOSUB SetPoints:IF tp<>4 TH
EN 454
IF dL=0 THEN GOSUB UPickUp:GOTO
304
GOSUB CPickUp:LOCATE mx(dL),my(d
L)4
IF tp=4 THEN PRINT "turned":LOCA

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TE mx(dL)+1,my(dL):PRINT " down"
:GOTO 304
bd=p:PRINT "picked":LOCATE mx(dL
)+1,my(dL):PRINT " up"4
30 FOR de=1 TO 2000:NEXT4
IF (bd=0) AND (tp<>4) THEN 45 4
x=8:y=12:GOSUB EraseCard:IF tp<>
4 THEN 454
GOSUB CLRMess:ps=04
35 p=FNnp(p)4
IF p=0 THEN GOSUB UMake:GOTO 404
GOSUB CMake:LOCATE mx(p),my(p)4
FOR de=1 TO 600:NEXT4
IF tp=4 THEN PRINT " pass";:GOT
O 404
bd=p:PRINT me$(tp+5);4
40 IF (p<>dL) AND (tp=4) THEN ps
=ps+1:GOTO 354
GOTO 504
45 ku=1:IF (bd=0) AND (dL=2) THE
N Lh=1:GOTO 604
50 IF tp=4 THEN 704
IF (Lh=1) AND (bd<>0) THEN 604
IF bd=0 THEN GOSUB ULoneHand:GOT
O 704
GOSUB CGoALone4
IF Lh=0 THEN 704
60 LOCATE 1,1:PRINT "Lonehand"4
70 FOR de=1 TO 2000:NEXT4
GOSUB CLRMess:RETURN4
4
UPickCard: 4
f=0:WHILE c(0,f)=-1:f=f+1:WEND:g
=f4
PrintHand: x=(g*5+2)*8+1:PUT(x,1
67),eh,PSET:x=(f*5+2)*8+1:PUT(x,
167),hb,PSET4
GetKeyUPC: k$=INKEY$:IF k$="" TH
EN GetKeyUPC ELSE IF k$=CHR$(13)
THEN ExitUPC4
g=f:IF k$<>CHR$(31) THEN 1004
90 f=nf(f):IF c(0,f)<0 THEN 904
GOTO PrintHand4
100 IF k$<>CHR$(30) THEN GetKeyU
PC4
110 f=nf(f+2):IF c(0,f)<0 THEN 1
104
GOTO PrintHand4
GOTO GetKeyUPC4
ExitUPC: RETURN4
4
UDiscard:4
FOR i=0 TO 44
IF (s(p,i)=tp) AND (c(p,i)=2) TH
EN 4
c(p,i)=74
ELSE 4
IF ((s(p,i) AND 253)=(tp AND 253
)) AND (c(p,i)=2) THEN c(p,i)=6:s
(p,i)=tp4
END IF:NEXT 4
FOR i=0 TO 4:FOR j=0 TO 34
IF NOT(s(p,j)>s(p,j+1)) THEN4
IF s(p,j)=s(p,j+1) THEN IF NOT(c
(p,j)>c(p,j+1)) THEN4
t=c(p,j):c(p,j)=c(p,j+1):c(p,j+1
)=t4
t=s(p,j):s(p,j)=s(p,j+1):s(p,j+1
)=t4
END IF4
END IF:NEXT j,i4
FOR i=0 TO 4:pt(i)=04
IF s(p,i)=tp THEN 4
pt(i)=c(p,i)+104
ELSE4
IF c(p,i)=5 THEN4
pt(i)=94
ELSE4
IF (s(p,i)<>s(p,nf(i))) AND (s(p
,i)<>s(p,nf(i+2))) THEN pt(i)=-1
4
END IF4
END IF:NEXT 4
L=99:FOR i=0 TO 4:IF pt(i)<L THE

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N f=i:L=pt(i)4
NEXT:RETURN 4
4
ResetHand:4
FOR i=0 TO 3:FOR j=0 TO 3:ns(i,j
)=0:NEXT:FOR j=0 TO 44
IF c(i,j)=2 THEN 4
IF s(i,j)=tp THEN4
c(i,j)=74
ELSE4
IF ABS(s(i,j)-tp)=2 THEN c(i,j)=
6:s(i,j)=tp4
END IF4
END IF:ns(i,s(i,j))=ns(i,s(i,j))
+1:NEXT j,i4
RETURN 4
4
Players:4
LOCATE 2,2:PRINT "Partner?";:Lo=
9:hi=10:xp=2:yp=12:GOSUB SeLecti
on4
fc(0)=0:IF an=10 THEN fc(0)=24
LOCATE 2,2:PRINT "Opponents?";:L
o=9:hi=10:xp=2:yp=14:GOSUB SeLec
tion4
fc(1)=0:IF an=10 THEN fc(1)=24
LOCATE 2,2:PRINT " ";:R
ETURN4
4
PlayHand: 4
FOR i=0 TO 7:FOR j=0 TO 3:cL(i,j
)=0:NEXT j,i:cL(2,tp AND 253)=14
FOR i=0 TO 3:sL(i)=0:NEXT 4
Ld=FNnp(dL):dm=4:tr(0)=0:tr(1)=0
:IF Lh<>0 THEN4
IF bd=2 THEN x=20:FOR i=0 TO 4:y
=i*5+2:GOSUB EraseCard:NEXT 4
dm=FNnp(FNnp(bd))4
IF Lh=1 THEN IF Ld=dm THEN Ld=FN
np(Ld)4
END IF:FOR tk=0 TO 4:p=Ld:ps=0:t
L=0:IF dm=p THEN p=FNnp(p)4
GOSUB PlayCard:wp=p:IF Lh=1 THEN
ps=ps+14
sL(s(p,pc(p)))=14
IF s(p,pc(p))=tp THEN tL=14
FOR i=1 TO 3:p=FNnp(p):IF p=dm T
HEN 1304
ps=ps+1:GOSUB PlayCard:IF tL=0 T
HEN 1204
IF s(p,pc(p))=tp THEN IF c(p,pc(
p))>c(wp,pc(wp)) THEN wp=p4
GOTO 1304
120 IF s(p,pc(p))=tp THEN wp=p:t
L=1:GOTO 1304
IF s(p,pc(p))=s(wp,pc(wp)) THEN
IF c(p,pc(p))>c(wp,pc(wp)) THEN
wp=p4
130 NEXT:FOR de=1 TO 400:NEXT4
x=px(wp):y=py(wp):GOSUB Winner4
FOR de=1 TO 3000:NEXT:Ld=wp:wt=w
p AND 253:tr(wt)=tr(wt)+14
COLOR 2,3:x=21:y=31+6*wt:n=tr(wt
):GOSUB PrintScore4
FOR i=0 TO 3:x=px(i):y=py(i):GOS
UB EraseCard:c(i,pc(i))=-1:NEXT
i,tk4
COLOR ,0:LOCATE 1,1:PRINT "
";4
bt=bd AND 253:LOCATE 15,284
COLOR 2,3:IF NOT(tr(bt)<3) THEN4
IF NOT(tr(bt)<5) THEN 4
pw(bt)=pw(bt)+2+Lh*24
IF bt=0 THEN PRINT " YOU WON
":LOCATE 16,28:PRINT " ALL TRICK
S ":GOTO 1404
IF bt=1 THEN PRINT "COMPUTER WON
":LOCATE 16,28:PRINT " ALL TRICK
S ":GOTO 1404
END IF:pw(bt)=pw(bt)+14
IF tr(0)>2 THEN PRINT "YOU WON H
AND";:GOTO 1404
IF tr(1)>2 THEN PRINT " COMPUTE
R ":LOCATE 16,28:PRINT " WON H

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AND ":GOTO 1404
END IF:pw(1-bt)=pw(1-bt)+24
IF tr(0)<3 THEN PRINT "YOU'VE B
EEN":LOCATE 16,28:PRINT " EUCHR
ED! ":GOTO 1404
IF tr(1)<3 THEN PRINT " COMPUTE
R ":LOCATE 16,28:PRINT " EUCHR
ED! "4
140 FOR de=1 TO 4000:NEXT4
RETURN4
PlayCard: 4
IF p<=0 THEN 4
COLOR 11,2:LOCATE 15,28:PRINT "
YOUR PLAY ":GOSUB UPickCard4
150 Ls=s(Ld,pc(Ld))4
IF NOT((ps=0) OR (s(p,f)=Ls) OR
(ns(p,Ls)=0)) THEN4
GOSUB PrintHand:GOTO 1504
x=20:y=f*5+2:GOSUB EraseCard:GOT
O 1604
END IF:COLOR ,4:LOCATE 15,28:PRI
NT " "4
x=20:y=f*5+2:GOSUB EraseCard:GOT
O 1604
END IF:IF tk>=5 THEN 4
FOR k=0 TO 4:IF c(p,j)>-1 THEN f
=i4
NEXT:GOTO 1604
END IF:ON (ps+1) GOSUB 4000,4100
,4200,43004
160 pc(p)=f:y=py(p):x=px(p):c=c(
p,f):s=s(p,f):GOSUB PutCard4
ns(p,s(p,f))=ns(p,s(p,f))-1:cL(c
(p,f),s(p,f))=14
RETURN4
4
4000 IF ns(p,tp)<>5-tk THEN 4015
4
sp=tp:GOSUB 5200:IF f=1 THEN GOT
O 51504
GOTO 51604
4015 IF (Lh<>1) OR (bd<>p) THEN
40304
IF ns(p,tp)>0 THEN sp=tp:GOTO 51
504
GOTO 50504
4030 GOSUB 5000:IF (f=1) AND (AB
S(bd-p)=2) THEN sp=tp:GOTO 51504
GOSUB 5250:IF (f<1) OR (p<>bd)
THEN 50504
GOSUB 5200:IF i=1 THEN sp=tp:GOT
O 51504
IF ns(p,tp)>2 THEN sp=tp:GOTO 51
604
GOTO 50504
4100 IF ns(p,s(Ld,pc(Ld)))=0 THE
N 41154
GOSUB 5300:sp=s(Ld,pc(Ld)):IF f=
1 THEN 51504
GOTO 51604
4115 IF ns(p,tp)=5-tk THEN sp=tp
:GOTO 51604
IF ns(p,tp)=0 THEN 51004
IF c(Ld,pc(Ld))=5 THEN sp=tp:GOT
O 51604
IF bd<>p THEN sp=tp:GOTO 51604
GOSUB 5250:IF f=1 THEN sp=tp:GOT
O 51604
GOTO 51004
4200 IF ns(p,s(Ld,pc(Ld)))=0 THE
N 42354
sp=s(Ld,pc(Ld))4
IF (sp<>tp) AND (tL=1) THEN 5160
4
IF ABS(wp-p)<>2 THEN 42254
GOSUB 5300:IF f=1 THEN GOSUB 535
0:IF f=0 THEN 51504
GOTO 51604
4225 GOSUB 5300:IF f=1 THEN 5150
4
GOTO 51604
4235 IF ns(p,tp)<5-tk THEN 42704
sp=tp:IF ABS(wp-p)=2 THEN 51604

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IF tL=0 THEN 51604
GOSUB 5300:IF f=1 THEN 54004
GOTO 51604
4270 IF ns(p,tp)=0 THEN 51004
IF ABS(wp-p)<>2 THEN 43104
IF (tL=1) OR (ps=3) THEN 51004
IF c(wp,pc(wp))=5 THEN 51004
IF c(wp,pc(wp))<4 THEN sp=tp:GOT
O 51604
GOSUB 5250:IF f=1 THEN sp=tp:GOT
O 51604
GOTO 51004
4310 IF tL=0 THEN sp=tp:GOTO 516
04
GOSUB 5300:IF f=1 THEN sp=tp:GOT
O 54004
GOTO 51004
5000 f=0:FOR a=0 TO 4:IF c(p,a)>
5 THEN f=14
NEXT:RETURN 4
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=a4
NEXT:IF f>-1 THEN 50704
Lc=-1:FOR a=0 TO 4:IF s(p,a)<>tp
THEN IF c(p,a)>Lc THEN Lc=c(p,a)
:f=a4
NEXT4
5070 RETURN 4
5100 IF ns(p,tp)>0 THEN 51254
sp=-1:FOR a=0 TO 44
IF s(p,a)<>tp THEN IF (c(p,a)=5)
AND (ns(p,s(p,a)))>1 THEN sp=s(p
,a)4
NEXT:IF sp>-1 THEN 51604
GOTO 51804
5125 v=4:f=-1:FOR a=0 TO 44
IF s(p,a)=tp THEN 51354
IF (ns(p,s(p,a))<>1) OR (sL(s(p
,a))=1) THEN 51354
IF (c(p,a)>=0) AND (c(p,a)<v) TH
EN v=c(p,a):f=a4
5135 NEXT:IF f=-1 THEN 51804
RETURN 4
5150 IF ps=3 THEN 54004
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=
a4
NEXT:RETURN 4
5160 v=10:FOR a=0 TO 44
IF s(p,a)=sp THEN IF (c(p,a)>=0)
AND (c(p,a)<v) THEN v=c(p,a):f=a
4
NEXT:RETURN 4
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=a4
NEXT:RETURN 4
5200 ht=8:f=04
5205 ht=ht-1:IF ht>0 THEN IF cL(
ht,tp)=1 THEN 52054
IF ht<0 THEN 52404
FOR a=0 TO 4:IF s(p,a)=tp THEN I
F c(p,a)=ht THEN f=14
NEXT 4
5240 RETURN 4
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=04
NEXT:RETURN 4
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=14
NEXT:RETURN 4
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=14
NEXT:RETURN 4
5400 d=10:FOR a=0 TO 44
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=a4
NEXT:RETURN 4

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EraseCard: PUT((y-1)*8-2,(x-1)*8
-1),ec,PSET:RETURN4
4
Winner:4
xl=y-1:yl=x-1:x=(x+2)*8:y=(y+2
)*8+3:xl=x*8-3:yl=y*8-24
CIRCLE (x,y),8,0:PAINT (x,y),04
FOR i=1 TO 100:NEXT4
FOR i=1 TO 3:LINE (xl-i,yl-i)-(x
l+i+38,yl+i+42),i+5,b:NEXT4
FOR i=3 TO 1 STEP -1:CIRCLE (x,y
),i*2,i+5:PAINT (x,y),i+5:NEXT 4
r=1:FOR i=0 TO 5:r=r-.07:cy(i)=r
:NEXT4
FOR i=1 TO 50:FOR p=1 TO 200:NEX
T:j=i MOD 64
PALETTE (i MOD 3)+6,cy(j),cy(j),
0:NEXT4
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 4
CIRCLE (x,y),8,4:PAINT (x,y),44
RETURN4
4
InitShapes:4
RESTORE InitShapes4
FOR j=0 TO 3:FOR i=0 TO 30:4
READ a$:sb(i,j)=VAL("&H"+a$):NEX
T i,j4
RESTORE Hand:FOR i=0 TO 75:4
READ a$:hb(i)=VAL("&H"+a$):NEXT:
RETURN4
4
Diamond: DATA B,9,3,400,E00,1F00
,3F80,7FC04
DATA 3F80,1F00,E00,400,400,E00,1
F00,3F804
DATA 7FC0,3F80,1F00,E00,400,FBE0
,F1E0,E0E04
DATA C060,8020,C060,E0E0,F1E0,FB
E0,04
4
Club: DATA B,9,3,0,0,0,0,04
DATA 0,0,0,0,E00,1F00,1F00,7FC04
DATA FFE0,FFE0,75C0,E00,1F00,F1E
0,E0E0,E0E04
DATA 8020,0,0,8A20,F1E0,E0E0,04
4
Heart: DATA B,9,3,71C0,FBE0,FFE0
,FFE0,7FC04
DATA 3F80,1F00,E00,400,71C0,FBE0
,FFE0,FFE04
DATA 7FC0,3F80,1F00,E00,400,8E20
,400,04
DATA 0,8020,C060,E0E0,F1E0,FBE0,
04
4
Spade: DATA B,9,3,0,0,0,0,04
DATA 0,0,0,0,400,400,E00,1F004
DATA 3F80,7FC0,75C0,E00,1F00,FBE
0,FBE0,F1E04
DATA E0E0,C060,8020,8A20,F1E0,E0
E0,04
4
Hand: 4
DATA E,12,4,0,2C0,960,15A0,5884
DATA A3C,23C,20C,413C,2054,1168,
58,1204
DATA 40,140,2A0,540,AA0,600,340,
19604
DATA CA0,CAB,46AC,66A4,66A4,37EC
,1FFC,FF84
DATA FF8,FF0,FF0,17E0,7E0,F60,AA
0,FFFC4
DATA FFFC,FFFC,FFFC,FFFC,FFFC,FF
FC,FFFC,FFFC4
DATA FFFC,FFFC,FFFC,FFFC,FFFC,FF
FC,FFFC,FFFC4
DATA FFFC,600,FC0,3FE0,3FE0,1FF8
,DFFC,FFFC4
DATA EFCF,FFFC,7FFC,3FF8,1FF8,1F
F0,1FF0,1FE04
DATA FE0,F60,AA0,04

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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. Basically, all of your explanations are right. A complete system will work flawlessly with only a stepdown transformer. Beware of voltage converters, however; I have dam-

aged 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 curiosity, 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", Ddrive number, Bbank number, Pstart address TO Pend 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  $4 \times 8$ -pixel area, while the VDC chip's bitmapped display can use only two different colors within each  $8 \times 8$ -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 ( $640 \times 200$ ), 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  $8 \times 8$ -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 ( $80 \times 25$ ) 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 ( $640 \times 176$  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 ROM ROUTINES
RQ 110 WR=DEC("CDCC"):RR=DEC("CDDA")
PX 115 REM ** SET DEFAULT COLORS
MF 120 BC=2:FC=11:PC=9:SYS WR,PC,26
CC 125 REM ** SET SCREEN HEIGHT TO 22 ROWS
XB 130 SYS WR,22,6
```

```
PH 135 REM ** MOVE ATTRIBUTE MEMORY 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 BITMAPMODE DISPLAY
HE 150 SYS RR,25:RREG A:SYS WR,(A AND 63) OR 192,25
FD 155 REM ** CLEAR BITMAP AND ATTRIBUTES
MJ 160 SYS RR,24:RREG A:SYS WR,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,25,30: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 COORDINATES
EC 210 X=320:Y=88
GH 215 REM ** CHECK FOR KEYPRESS
JS 220 GET K$:ON INSTR("BFPC",K$) GOTO 230,240,250,160,210:GOTO 260
DC 230 BC=(BC+1) AND 15:GOTO 30
HS 240 FC=(FC+1) AND 15:GOTO 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 220:ELSE B=D AND 128:D=D\8:SPACE:AND 15
GG 265 REM ** CALCULATE NEW POSITION
RD 270 Y=Y+(D<3 OR D=8)-(D>3 AND D<7):IF Y<0 THEN Y=175: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\8) AND 7)),31
SJ 325 REM ** SET FOREGROUND AND 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-



## Liquidator

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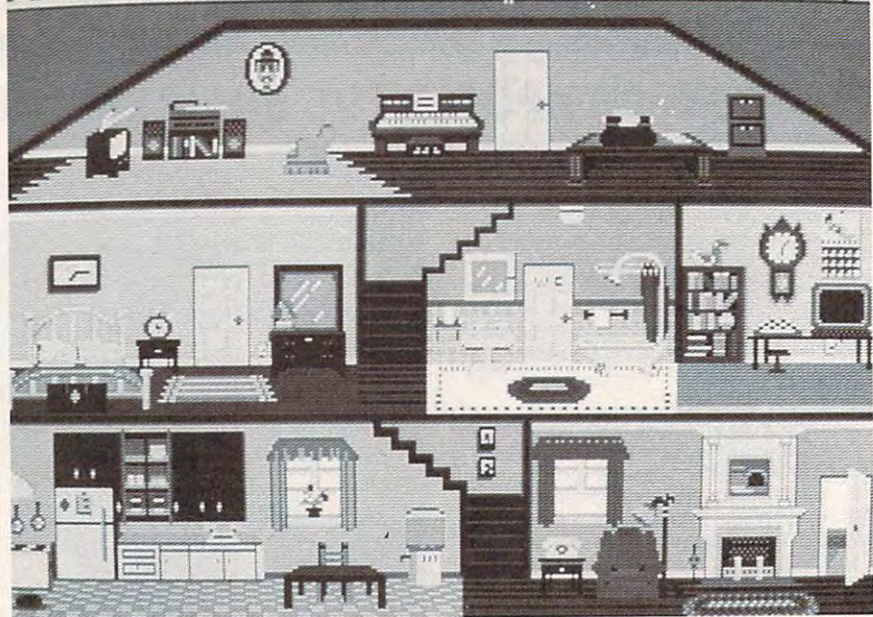


cause nothing is irrevocable. Activision, in a flurry of brilliance, decided not to let that happen. As a design decision it is unusual, but it is one worth considerable praise.

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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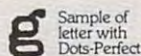
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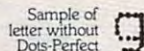
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## Certificate Maker And Walt Disney Card & Party Shop

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 tem-

plate, 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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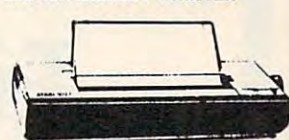
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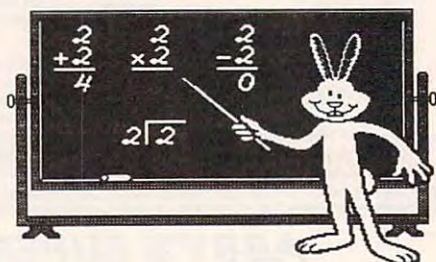


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*Certificate Maker* and *Walt Disney Card & Party Shop* were designed to fill specialized printing needs, creating certificates or making cards and party items for children. Both perform their designated functions well, and will no doubt be used regularly in schools and homes with small children. They're fun to use as well as practical.

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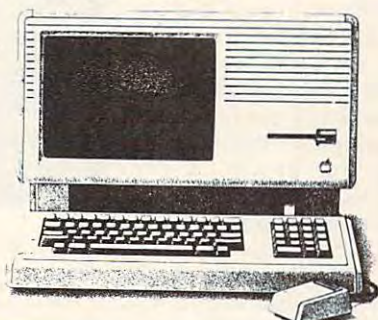
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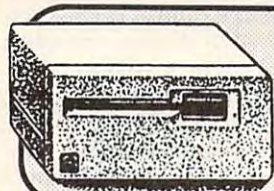
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# Roadwar 2000

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 cities.

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 com-



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

pares 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.

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  
Mountain View, CA 94043  
\$39.95







# 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 occurred 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 be-

tween 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 Janu-

ary, 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=nocoIs.pzL-1: rLast=n-rows.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. ©





# Telecomputing Today

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*

©





# The World Inside the Computer

Fred D'Ignazio, Associate Editor

## 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 (daisy-chained) 3½-inch drives. We had copies of lots of software, made at the dealers with an old IIC (Pro-Dos) utilities disk, but it turned out the software was uncopiable, 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 Apple-Color 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 hun-

dred 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  $\frac{1}{2}$  (base  $\times$  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 file-maker, 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 finish-

ing 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 DA
TA":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,AB
230 DATA 0,C,DC,AB,0,14,DC,AB
240 DATA 0,1C,42,A7,3F,3C,0,2
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,FB,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,4
1
330 DATA 48,E7,FE,FB,4A,79,0,0
340 DATA 2,3C,67,2,60,5E,4A,7
9
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,FB,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,F
F
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,F
F
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,D2,42,31,8
1
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,B0,7
C
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,FB,F,FB
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,FB,B,2B
900 DATA F,FB,D,D8,7,FB,6,2B
910 DATA 7,F0,7,D0,2F,F0,2E,1
0
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 ©
```





## 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 standalone 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 EDIT. 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. ©





## 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$="0123456789ABCDE
F"
DE 30 GRAPHICS 0
BI 40 PRINT "COMPLETE FILE N
AME"; INPUT FILE$
BH 50 OPEN #1,4,0,FILE$
OB 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
NB 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:

$$(x^2+5y^2)*EXP(1-x^2-y^2)/2-SIN(3x^2y^2)/(x^2+y^2)^4$$

$$-x^3/10-(SIN(1-x^2-y^2)+COS(1-x^2-y^2))/2^4$$

$$SIN(3x)*SIN(3y)/5+.7*SIN(2x^2+3y^2)/(x^2+y^2)^4$$

$$COS(3x)+2*SIN(x^2+y^2)/(x^2+y^2)^4-x/2^4$$

$$.3*(SIN(x^2+y)+COS(y^2+x))^4$$

$$(SIN(4x^2+y^2)+2*SIN(xy))/(4x^2+y^2)^4$$

$$SIN(3x)+SIN(3y)^4$$

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:

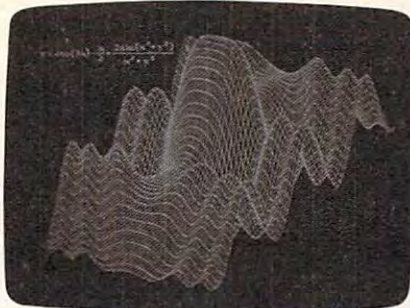
DEF FNz(x,y)=SIN(3x)+SIN(3y)

## 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 res-

olution, 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 counter-clockwise 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 perspec-

tive 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  $21 \times 21$  grid. But it lands on the point and tries to compute a

corresponding function value if the grid is  $20 \times 20$ .

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
res=1 resolution
n: l=640*200, 2=640*400*
gt=1 graph type
1=estimate, 2=real
asp=1 y/x ratio
of graph (only for gt=1)*
h=150 height factor
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)*

```



```

y1=yc(x,y):y2=yc(x,y+1):y3=yc(x+
1,y+1):y4=yc(x+1,y)
AREA (x1,y1):AREA (x2,y2):AREA (
x3,y3):AREA (x4,y4):AREAFILL
LINE (x1,y1)-(x2,y2),3:LINE (x2,
y2)-(x3,y3),3
LINE (x3,y3)-(x4,y4),3:LINE (x4,
y4)-(x1,y1),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:tl=111*rgb(col,n)+1
1
LINE (tl,c)-(tl+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:dx=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
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 AUTO-RUN.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"
HA 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 @

```

# 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 character sets
PS 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
IM 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
AB 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
OB 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 1978 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
OF 2040 DATA 0,0,60,96,124,9
6,60,0
BH 2050 DATA 24,24,126,219,2
19,126,24,24
OK 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
IN 2100 DATA 0,0,102,108,120
,108,102,0
EL 2110 DATA 0,192,96,48,24,
44,103,0
NI 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
BB 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
AM 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
HM 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
MN 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
AD 3210 DATA 0,119,18,22,12,
6,126,0
HK 3220 DATA 0,60,12,12,12,1
2,12,0
DN 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
```

©



# 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  $1 \times 10^{-38}$  to  $1 \times 10^{38}$ . (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 Applecode 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 Applecode 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, "File-maker," 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 Applecode 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.

Applecode 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 Applecode.

Of course, it's important to remember which key or keys you used to encode each file in the first place. And while Applecode 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": RETURN
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 pro-

gram; 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. Applecode, 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: Applecode

```
B1 100 RTN = 13: REM ASCII VALUE
    OF CHARACTER MEANING 'EN
    D OF LINE'
05 110 D$ = CHR$(4): BL$ = CHR$(7): REM DISK ACCESS : BE
    LL CHAR.
22 120 ZR = 0: PF = .5: WN = 1: EI
    = 8: TW = 20: TT = 32: NF =
    95: OH = 100: OTE = 128: SX
    = 160: TFF = 255: REM THE
    USE OF THESE VARIABLES SP
    EEDS UP THE 'ENCODE/DECO
    D' LOOP.
66 130 KY = 0: ONERR GOTO 590
F2 140 TEXT : HOME : HTAB (13):
    PRINT "APPLECODE": POKE
    34,1
DF 150 REM ** GET USER INPUT **
41 160 ED = FRE (0): HOME : PRIN
    T : HTAB (8): PRINT "<E>N
    CODE OR <D>ECODE ": GET
    A$: 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
```