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$2.95
October
1985
Issue 65
Vol. 7, No. 10
$3.75 Canada
02193
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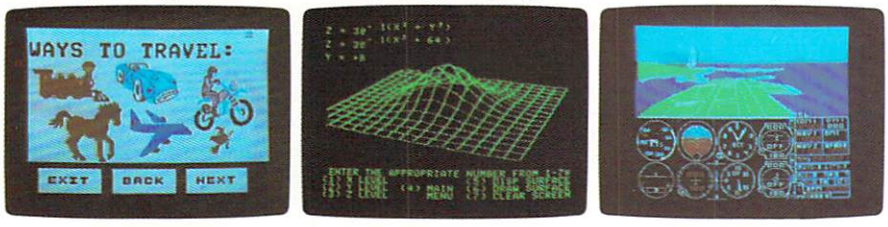

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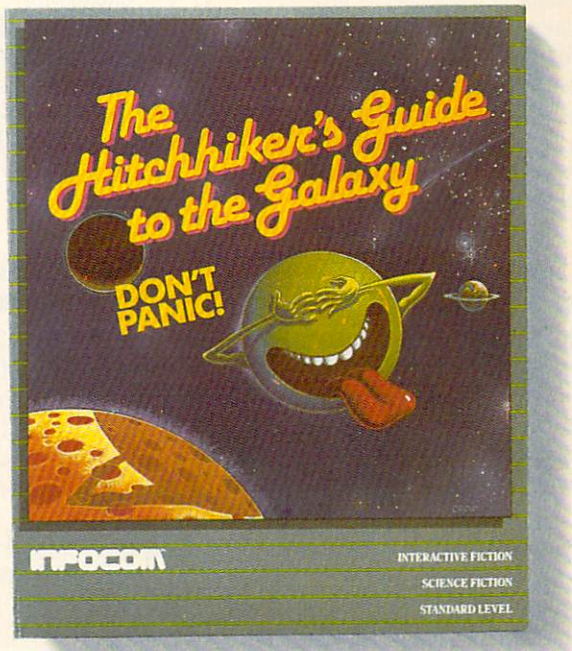

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COMPUTE! Publications, Inc.
One of the ABC Publishing Companies:
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Address all inquiries to:
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COMPUTE! The Journal for Progressive Computing (USPS: 537250) is published monthly by COMPUTE! Publications, Inc., P.O. Box 5406, Greensboro, NC 27403 USA. Phone: (919) 275-9809. Editorial Offices are located at 324 West Wendover Avenue, Greensboro, NC 27408. Domestic Subscriptions: 12 issues, $24. POSTMASTER: Send address changes to: **COMPUTE!** Magazine, P.O. Box 10955, Des Moines, IA 50950. Second class postage paid at Greensboro, NC 27403 and additional mailing offices. Entire contents copyright ©1985 by COMPUTE! Publications, Inc. All rights reserved. ISSN 0194-357X.

Editor's Notes

This month's Editor's Notes are written by Tom R. Halfhill, Editor of COMPUTE!.
—Robert C. Lock, Editor-In-Chief.

We received some interesting letters in response to our September 1985 Editor's Notes. As you may recall, it was argued that machine language (ML) will remain the dominant language for commercial software, even though many of the first programs appearing for the newest generation of personal computers—such as the Atari 520ST and Commodore Amiga—are written with compilers such as C. The argument was that ML is and always will be the computer's native language, and since higher-level languages run slower and consume more memory, they will always be superseded by ML for commercial software.

Here's a dissenting letter from reader Jeff O'Neil in Plano, Texas:

> I feel there will continue to be a migration away from assembly language with more use of higher-level languages, such as C, for application programs. The driving force is programmer productivity—being able to quickly bring good products to the market and also being able to quickly port the same program from one machine to another. Languages such as C can be effectively used on the newer micros because of better compilers and because of the larger memories available. No longer do you have to spend an inordinate amount of time trying to squeeze the code into 64K. Assembly language will continue to be used for operating systems and compilers, but less and less for application programs.

While last month's Editor's Notes presented one side of the higher-level language discussion, Mr. O'Neil presents a point of view also shared by some editors.

One of the lessons of industrialization is that a machine will always take over a task from a person if it can do the work faster, better, or less expensively. A compiler, in effect, is a device that generates object code from the programmer's high-level source code. Because high-level code is easier to write, compilers make it possible for programmers to finish a program faster than if they were writing in low-level ML to begin with. Certainly, none of the high-level compilers currently available can generate object code as good as that written by an experienced ML programmer using an assembler. But they don't have to. They need only be *good enough.*

For example, the vast majority of application programs announced to date for the 520ST and Amiga are written in compiled C. Potentially, they could be even better programs if written directly in ML. But it would take longer to write and debug the programs in ML, increasing development costs accordingly. To recover this larger investment in programmers' time, the software companies would be forced to charge a higher price or accept less profit. By transferring a task to a machine—in this case, using a compiler to generate the object code—they finished the job faster and still created good programs. That's the classic equation for greater productivity.

This principle has been demonstrated time and again for hundreds of years. In all probability, the clothes you wear, the car you drive, the furniture you own, the books you read, the TV set you watch, and so on were not painstakingly handmade by skilled craftsmen. Most of these things are manufactured largely by machines. Handmade versions are available, but top quality is not always the ultimate consideration. If it were, people would hire freelance programmers to write custom programs entirely in ML, no matter what the cost.

Furthermore, compilers are constantly being improved. Someday—especially if there are breakthroughs in the field of artificial intelligence—we may have compilers which generate object code that matches or even surpasses the code written by good ML programmers. At the very least, compiled languages will continue getting better, and the most time-critical routines can be rewritten in ML—just as many other products today are made partly by machine and partly by hand.

And don't forget another factor that affects programmer productivity—training time. The rapid pace of computer technology means that ML programmers have to master the instruction set of an entirely new chip every few years. But high-level languages can be implemented on any chip, so programmers only have to learn the language once.

The programmer productivity factor also is closely tied to marketability. If software companies invest the programmer time in writing all-ML programs, they risk missing a window of opportunity. And in the fast-moving world of personal computing, a few months can make or break a commercial program.

Portability, too, is related to productivity. If programmers can write a major program in a high-level language and translate it for noncompatible computers with a minimum of fuss, they can double or triple the potential market and reap a higher return on their time.

For a preview of what's to come, look at the world of minicomputers and mainframes. Application programming is increasingly done in high-level languages. As personal computers keep growing more powerful, we too will see more and more application software written in high-level languages instead of ML. The extra horsepower built into the machines will make it less necessary for people to spend tedious hours building extra horsepower into the programs.

Computers are boosting productivity and reducing sweatwork in hundreds of occupations; why should computer programming be any different?

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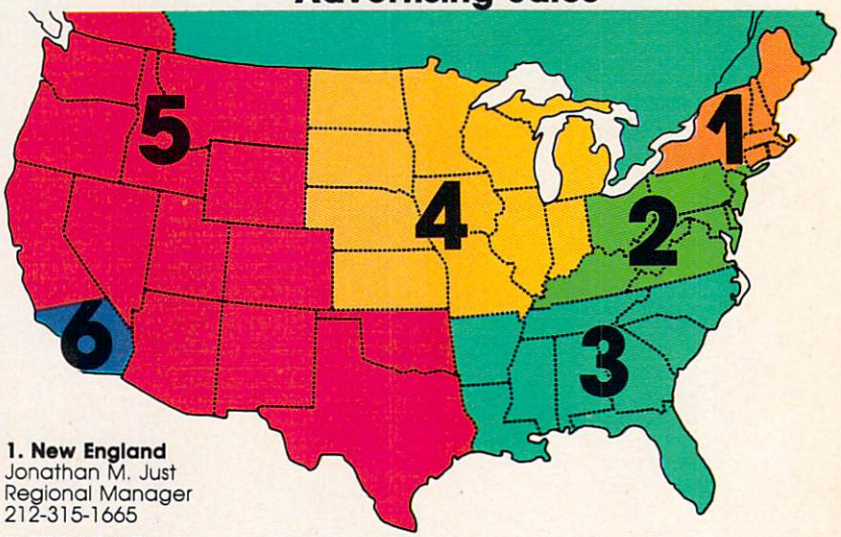

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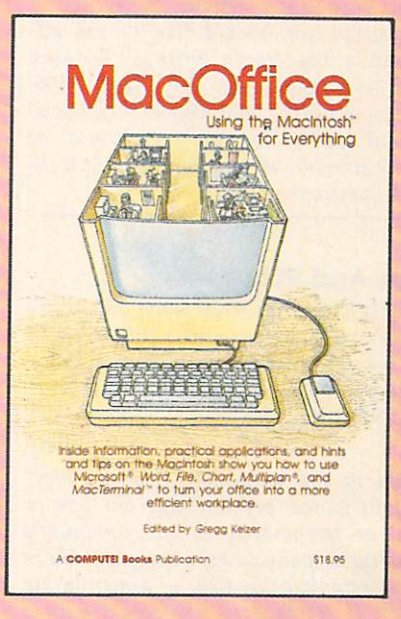

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Readers Feedback

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.

Files And Programs

What is a file, and what is the difference between a program and a file? When I try to erase a program on disk, my disk drive sometimes gives me a FILE NOT FOUND message.

Kevin Cullen

A file is any collection of data (information) stored permanently on disk or tape, or temporarily in the computer's memory. In many cases, a computer file is the electronic equivalent of a manila file folder: It stores data you create with a computer. Word processing programs store words in files, spreadsheets make files containing numbers, and so on. In that sense, a file may seem very different from a program, which is a set of instructions the computer can load into memory and run. But programs are just a special kind of data—letters, numbers, and other symbols arranged in a pattern the computer understands. Thus, a program stored on disk is a file containing computer instructions rather than some other kind of data. When the disk drive signals FILE NOT FOUND, file is used in a general sense that includes programs along with other kinds of data.

Although these broad definitions apply to all computers, be alert for additional, narrower meanings that apply only to your system or in specific situations. For instance, opening a file to a printer usually means you are opening a communications channel to that device. In Commodore disk parlance, a program file is any file with a certain format (different from sequential or relative format), and so on. When in doubt, consult the user's guide for your equipment and pay close attention to the context in which the word is used.

Apple ProDOS Conversions

I have an Apple IIe and would like to use the "Renumber" program on the DOS 3.3 System Master disk. However, I like ProDOS better for programming, and most of my files are on ProDOS disks. I can copy the program to ProDOS, but it won't run properly. How can I make this program work in ProDOS?

Bruce Bohm

The general rule for transporting programs between DOS 3.3 and ProDOS is that BASIC programs usually work and machine language (ML) programs usually don't. Since the "Renumber" program you mention is stored as an Applesoft BASIC file, you would expect it to work with ProDOS. The reason it doesn't is that Renumber is a hybrid program: In addition to BASIC instructions, it contains a substantial machine language routine. When you run Renumber, the BASIC portion prints instructions for using the program, then calls the ML routine to do the real work. Though the BASIC part would probably work with ProDOS, the ML section is incompatible.

In short, there's no way to make Renumber work in ProDOS without rewriting its machine language section. But you do have an alternative. On the example disk included with "BASIC Programming with ProDOS" (available from Apple dealers) is a program called "Applesoft Programmer's Assistant." One of its features is a renumber command that's very similar to the DOS 3.3 Renumber program. The instruction manual for this package is very helpful by itself—especially if you learned Applesoft BASIC with DOS 3.3 and want to learn what's different about ProDOS—and the programs on the example disk are quite useful as well.

Datassette Adapter

I have found an adapter that lets me use my old Commodore Datassette with the newer Plus/4 or 16 computers. It is available from the following company for less than $20:

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Gary Sawitzke

We appreciate the information. Incidentally, the C2N Datassette designed for the VIC-20 and 64 works just fine on the Commodore 128, in 128 mode as well as 64 mode.

Saving Atari Screens

I am currently working on an Atari program that lets me create high-resolution drawings in graphics mode 8. However, it lacks one important function. How do you save and reload a graphics screen? I have an 800XL and 1050 disk drive.

Albert Newball

The following program uses the computer's input/output routines to save a block of memory. To use it, put lines 1–2 at the start of your program. These lines create a short machine language routine in memory page 6. Line 10 shows how to save or load a screen. Set the variable NAME$ equal to the name of the file you want to save or load (include D: for disk or C: for cassette). Set the variable AUX to 4 when you want to load a graphics screen, or set AUX to 8 to save a screen. Once NAME$ and AUX are defined, GOSUB 1000 does the job.

```
EO 1  DIM NAME$(15):FOR A=153
      6 TO 1542:READ B:POKE A
      ,B:NEXT A
CC 2  DATA 104,104,104,170,76
      ,86,228
OL 10 NAME$="D:NAME":AUX=4:G
      OSUB 1000:END
CO 1000 OPEN #1,AUX,0,NAME$
KE 1010 POKE 852,PEEK(88):PO
        KE 853,PEEK(89):POKE
         856,220:POKE 857,30
        :POKE 850,AUX+3
PC 1015 A=USR(1536,16)
KH 1020 CLOSE #1:RETURN
```

You can use this routine in other graphics modes by changing the values POKEd into locations 856 and 857 in line 1010. Determine the total number of bytes used for the screen in that graphics mode, then break the number down into low byte/high byte format. POKE 856 with the low byte value and POKE 857 with the high byte. The following line shows how to convert the value of the variable VA into low byte (LO) and high byte (HI) values:

```
HI=INT(VA/256):LO=VA-(HI*256)
```

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Too Many Caesars

I own two Commodore computers and a 1541 disk drive. I would like to connect both computers to the drive at once (of course, I would only send disk commands from one computer at a time). Everything works fine when only one computer is turned on, but when I turn on the second one, the first computer does a cold start. When I try to send disk commands from either computer, the entire system seems to lock up. Is there any way to accomplish what I'm trying to do?

Charles Mitchell

Since you can connect more than one peripheral to a single computer, you might expect the reverse to be true. Why can't two computers share the same drive? The answer reveals a fundamental difference between a computer and peripheral devices such as disk drives and printers. The computer is designed to act as "absolute ruler" of the system. It not only sends and receives information (as peripherals can do), but also sends commands *that control the whole system. Plugging two computers into the same disk drive is like creating a Rome with two Caesars: Each computer acts like the only commander-giver in existence, and the system becomes confused.*

In the first case you describe, turning on the second computer sends a normal reset command to every device in the system—including the second computer, which responds as if it had reset itself. Sending a disk command (which goes to the other computer as well as the drive) makes things even worse. Serial communications require a complex exchange of "handshaking" signals between computer and peripheral to make sure one doesn't send data until the other is ready, and vice versa. Since the second computer isn't designed to respond as a peripheral, it can't complete the handshake and crashes the entire system.

One makeshift way to do what you want is to unplug the serial cable from one computer whenever you want to use the other. However, we definitely don't recommend this as a regular practice. The serial port connectors aren't designed for such heavy use, and you run the risk of sending garbage signals along the line. For long-term use you may want to buy a switching box which cleanly disconnects one computer from the serial bus before connecting the other.

ACCEPT On TI

I have a problem using ACCEPT on my TI-99/4A with Extended BASIC. When I try to enter numeric input with ACCEPT and accidentally press ENTER before any input, the screen scrolls and I get an error message. Is there any way I can avoid this without using the CALL KEY statement?

Jory Rannow

The following program illustrates one solution to your problem:

```
100 CALL CLEAR
110 DISPLAY AT(1,1):"ROW
    #1"
120 ACCEPT AT(2,1)VALIDAT
    E(NUMERIC):X$
130 IF X$="" THEN 120
140 X=VAL(X$)
150 PRINT X
```

After this program clears the screen, line 110 prints a message on line 1 so you can tell whether scrolling occurs. Line 120 takes in numeric input (numerals 0–9, period symbol, plus symbol, minus symbol, or E) and accepts the input as X$. If at this point you hit ENTER by mistake, line 130 sends you back for another try without scrolling the screen. Once you've entered a value, line 140 converts it from a string into the numeric variable X.

Unwanted Commodore Messages

I have written a machine language routine that loads several program modules into the Commodore 64 from disk. However, the computer prints the usual SEARCHING FOR and LOADING messages during every load. How can I prevent these messages from appearing on the screen?

Allen Kotomski

These messages are generated by the 64's operating system, which controls input/output functions. Since Commodore calls the operating system the Kernal, *they're known as Kernal control messages. One easy way to mask them is to change the character color to the same color as the screen background. The messages then print invisibly on the screen. However, since they may overprint an existing display or cause the screen to scroll, it's usually better to suppress them altogether.*

Location $9D (157 decimal) holds a flag that tells the 64 what type of messages to display. When the flag contains 128 (bit 7 is set to 1), the computer prints Kernal control messages to tell you when it's searching, loading, saving, or verifying. When bit 7 is set to 0, control messages are not displayed. Though you rarely see them when using BASIC, the Kernal also has its own set of error messages. For instance, the Kernal equivalent of BASIC's FILE NOT FOUND message is I/O ERROR #4. Location $9D controls Kernal error messages as well: They're displayed when the flag contains 64 (bit 6 is set to 1), and suppressed when bit 6 is clear.

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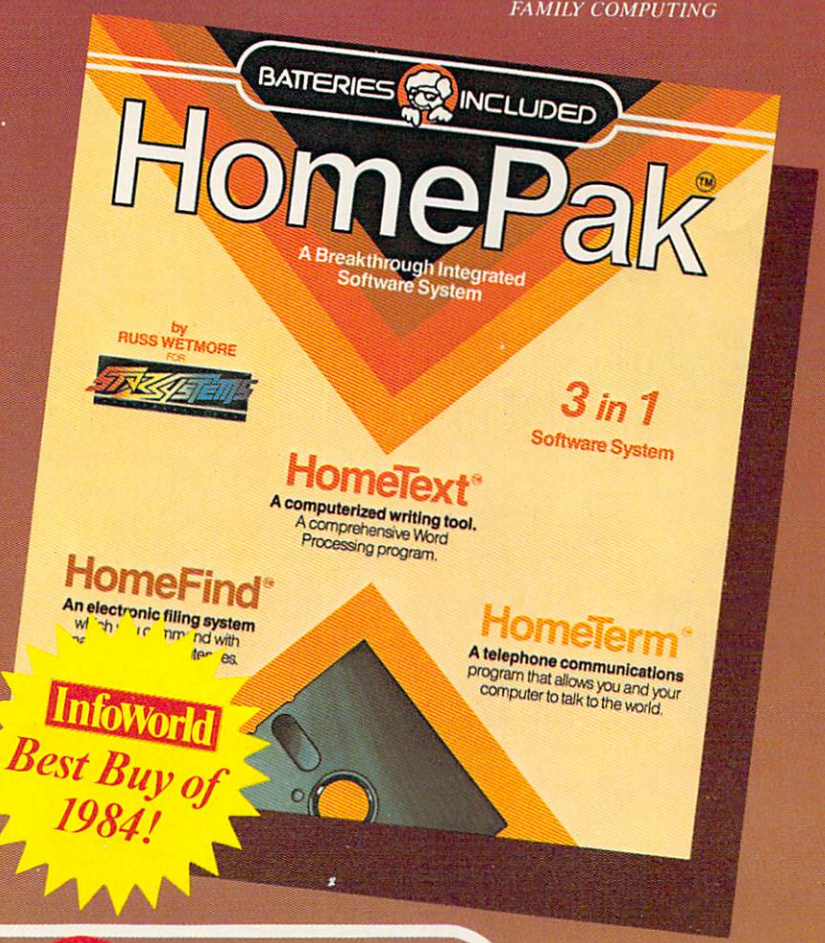

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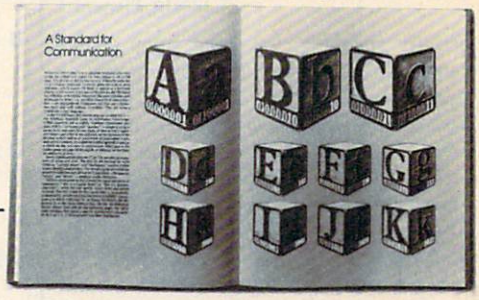

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Thus, the machine language statement LDA #$00:STA $9D suppresses all Kernal messages. This is the normal condition when a BASIC program is running. LDA #$80:STA $9D displays only the control messages (the normal condition when you're in BASIC direct mode), and LDA #$40:STA $9D displays only the special Kernal error messages. Note that Commodore computers also have a built-in routine (SETMSG, accessed at $FF90) to set the Kernal message control flag. To use it, load the accumulator with the value you want to put in location $9D, then JSR $FF90.

Atari Disk RAM?

I have an Atari 600XL and 1050 disk drive. My 600XL has 16K RAM. Does my disk drive add any RAM to the computer? If so, how much does it add?

Doug Howard

Strictly speaking, you lose *some usable computer memory when operating an Atari (or most other computers) with a disk drive. To use the drive, you must load DOS (the Disk Operating System) into memory. DOS is a machine language program that on the Atari is roughly 6K long. Therefore, when DOS is present, you lose memory that's otherwise available.*

However, in a broader sense the disk drive expands system memory tremendously. A disk drive lets you run much larger programs (and process much more data) than the computer could otherwise handle. For example, a program that's too big to fit into memory can be broken into two separate parts or modules. When the first program module is finished, it loads and runs the second module. The second module could in turn load a third, and so on. Since the program modules link themselves together as they go, this technique is often called chaining.

Though many BASIC programs store data within the program itself (usually in DATA statements), you can also store data outside the computer in a disk file. An Atari 1050 drive with DOS 2.5 or 3.0 stores about 126K of data on each disk. An 810 drive (or 1050 drive with DOS 2.0 or 2.5 formatted for single density) stores about 88K on a disk. Of course, the computer's memory can't hold that much data all at once. But it can access parts of it whenever it wants. When one disk fills up with data, you start filling another, and so on. In this sense, a disk drive extends system memory to infinity.

Multicolor Player/Missiles

I have written many simple games on my Atari 800XL using player/missile graphics and would like to start using different colors. How do I make multicolor P/M graphics?

Bob Rudis

Unfortunately, players can be only one color. However, you can simulate a multicolor player by overlapping two or more players. Define the players' shapes so that solid areas of underlying (lower priority) players show through holes (blank areas) in overlapping (higher priority) players. One player can be used for each color you need to define. Of course, to maintain the effect, you'll need to move the overlapped players in unison.

You can obtain additional colors by setting bit 5 of the player priority register (location 623 decimal). If you add 32 to the number in the priority register, then any area where two players overlap becomes a third color. The following program displays a red player and a blue player. The region where they overlap becomes green. You can find more information on multicolor players in COMPUTE!'s First Book of Atari Graphics.

```
DD 10 POKE 106,INT(PEEK(106)
      /8)*8-8:GRAPHICS 0:S=P
      EEK(106):REM PROTECT M
      EMORY ON A 2 K BOUNDAR
      Y
CC 20 POKE 559,62:POKE 704,5
      5:POKE 705,135:POKE 53
      256,1:POKE 53257,1:POK
      E 53277,3:SETCOLOR 2,0
      ,0
CB 30 POKE 623,33:POKE 54279
      ,S:PMBASE=256*S+1024:F
      OR A=PMBASE TO PMBASE+
      511:POKE A,0:NEXT A
LH 40 FOR A=0 TO 7:POKE PMBA
      SE+100+A,255:POKE PMBA
      SE+356+A,255:NEXT A
EB 50 FOR A=20 TO 245:POKE 5
      3248,A:POKE 53249,A+10
      :NEXT A:GOTO 50
```

Immortal PC Programs?

I have an IBM PC. Sometimes when I save a program and later try to erase it from my disk, the computer says "File not found." Yet when I load the program it is still there. How can I get rid of these unwanted programs?

Richard Bookal

You are evidently enclosing the filename in quotation marks when using the ERASE command from DOS. Although BASIC requires that you enclose or at least precede filenames with quotes, DOS does not—in fact it won't find an existing file when quotes are used. To delete a file from disk, use ERASE filename.ext *from DOS or* KILL "filename.ext" *from BASIC. When you're KILLing a program, the second pair of quotes is optional.*

Trackball Tricks

I purchased a trackball for my Atari 800 computer system and would like to use the device in my programs. I have looked in the hardware manual and elsewhere, but can't find any information about how this is done.

Wesley Wortman

Atari and Commodore computers (which can use the same trackball) read the device like a joystick. If you have an Atari computer, plug the trackball into joystick port 1, then type in and run the one-line program below. By moving the ball in various directions, you can see what numbers it generates.

```
10 PRINT STICK(0): GOTO 10
```

A trackball that fits an Atari joystick port will also work on a Commodore VIC-20 or 64, again returning the same values a joystick would. If you have a Commodore 64, run the following program after plugging the trackball into joystick port 2.

```
10 PRINT CHR$(19);PEEK(56320)AND15;
   CHR$(20);CHR$(32):GOTO10
```

After running either program with the trackball, you may find it interesting to rerun it with a joystick for comparison. As you'll see, the ball is very sensitive and tends to return rapidly changing values, whereas a joystick returns the same value as long as you push it in a particular direction. Of course, in either case the device just generates numbers. It's your job to write a program that uses those numbers in some meaningful way—to animate a figure, draw a picture, or whatever. You can learn more about using joysticks in COMPUTE!'s Second Book of Atari *and* COMPUTE!'s First Book of Commodore 64.

ML Disk Routine

I need a machine language routine that opens, writes, and properly closes a disk file on a Commodore disk drive.

Rick Elwell

Since we're asked this type of question often, here's a short example that writes a 20-character sequential file to disk, and works with any Commodore computer and disk drive except the 128 in CP/M mode. You'll need a machine language assembler to enter this program. The explanatory comments after the semicolons are, of course, optional:

```
LDA   #3        ;Set file number,
TAY             ;secondary address
LDX   #8        ;and device
                number,
JSR   $FFBA     ;call SETLFS
                routine.
LDA   #10       ;Set filename
                length,
LDX   #<NAME    ;low byte of
                filename
LDY   #>NAME    ;and its high byte,
JSR   $FFBD     ;call SETNAM
                routine.
JSR   $FFC0     ;Call OPEN
                routine.
LDX   #3        ;Set file number,
JSR   $FFC9     ;call CHKOUT
                routine.
```

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```
        LDX   #0        ;X is a counter.
WRITE   LDA   CHARS,X   ;Get a byte,
        CMP   #255      ;look for end
                        marker,
        BEQ   EXIT      ;quit when found.
        JSR   $FFD2     ;Call CHROUT
                        routine,
        INX             ;bump counter,
        JMP   WRITE     ;write entire text.
EXIT    LDA   #3        ;Set file number,
        JSR   $FFC3     ;call CLOSE
                        routine.
        JSR   $FFCC     ;Call CLRCHN
                        routine.
        RTS
NAME    .ASC "0:FILE,S,W"
CHARS   .ASC "THIS IS A TEST FILE."
        .BYT 255
```

Though there are other ways to get the job done, it's usually simplest and most reliable to use the computer's built-in routines. The SETLFS routine ($FFBA) sets the logical file number, device number, and secondary address,* and *SETNAM ($FFBD) sets the filename. The filename prefix 0: designates drive 0 and the suffix ,S,W designates a sequential file opened for writing. Different suffixes are used for other operations—for instance, the suffix ,S,R would prepare the program to read this file.

After OPEN ($FFC0) opens the file, CHKOUT ($FFC9) sets it for output (writing). CHKIN ($FFC6) would be used here if you wanted to set the file for input (reading). The file is written one byte at a time with CHROUT ($FFD2). Use CHRIN ($FFCF) or GETIN ($FFE4) to input bytes when reading a file. After the write is complete, CLOSE ($FFC3) closes the file and CLRCHN ($FFCC) restores the system to normal, reenabling keyboard input and screen output. You should always CLOSE every disk file individually. Don't try to use CLALL ($FFE7) as a shortcut: It may create a poison (unclosed) file on the disk.

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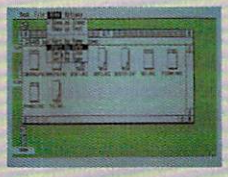

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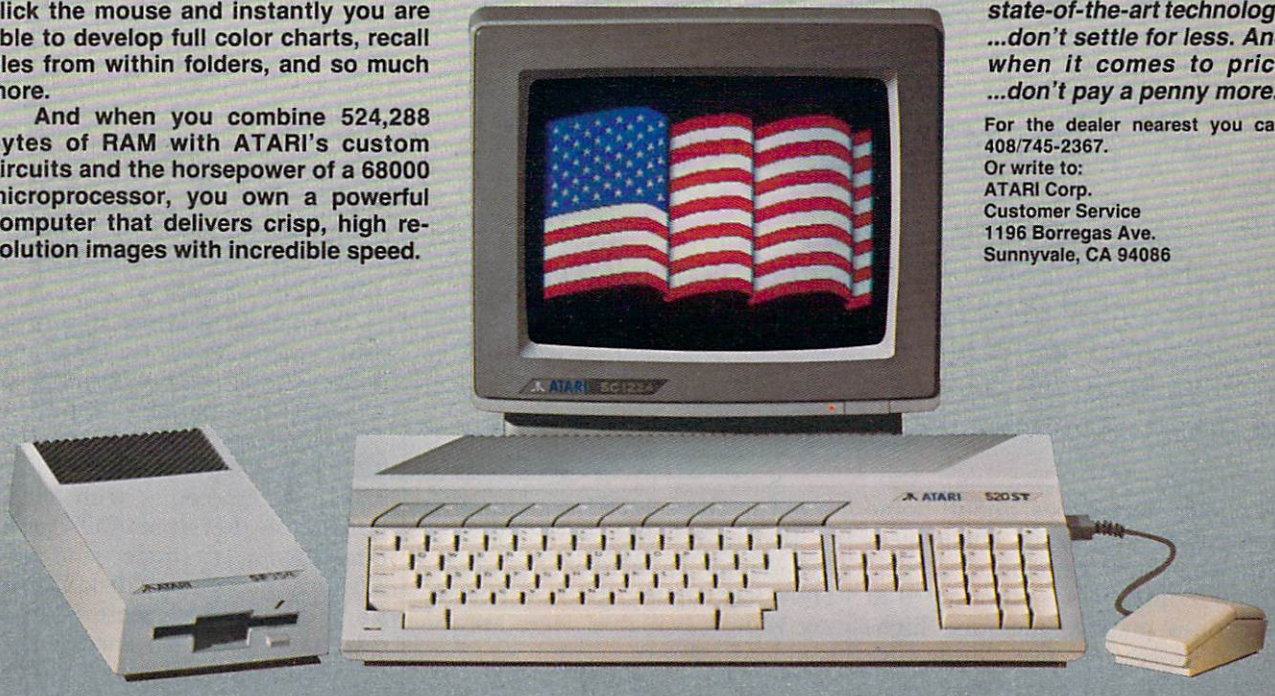

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A·T·A·R·I 520 ST

A Hands-On Report

Tom R. Halfhill, Editor

"We aren't selling home computers. We aren't selling business computers. We're selling personal computers. People can use them for whatever they want." With those words, Jack Tramiel launched the ST series and a new beginning for Atari. Here's a close look at the first computer in the ST series and the most powerful Atari ever.

The old stereotypes about home computers are being challenged. There's a new generation of personal computers emerging that combines massive memory, high-speed processing, fast floppy disk drives, hard disk interfaces, considerable expansion potential, stunning graphics, and sophisticated sound. These computers are powerful enough to run state-of-the-art business software and versatile enough to excel at running entertainment and educational programs.

The Atari 520ST was the first of this new breed. Announced at the Winter Consumer Electronics Show last January, it is now becoming widely available. Here are the standard features:

- 512K of Random Access Memory (RAM), half a megabyte.
- Motorola 68000 microprocessor. This 16/32-bit chip is clocked at 8 megahertz and can directly address up to 16 megabytes of memory without bank-switching. It's the same central processing unit found in the Apple Macintosh and Amiga from Commodore.
- One of the fastest floppy disk drive interfaces in personal computing. Although the interface bus is serial, not parallel, it transfers data at a megabit per second, faster than some hard disks. The basic 520ST system comes with one external drive that stores 400K (unformatted) on a single side of a 3½-inch microfloppy disk. Double-sided drives which store 800K per disk have also been announced.
- One of the fastest hard disk interfaces in personal computing. It transfers data at 1.33 megabytes per second, more than eight times faster than the floppy interface. Although hard disks aren't yet available for the ST, Atari plans to introduce a 10- to 15-megabyte

drive by early 1986, possibly for as low as $399. This price is feasible because the hard disk controller is already built into the computer. The hard disk interface can also be used for memory expansion or a CD-ROM (Compact Disc-Read Only Memory). Atari has shown a prototype CD-ROM that stores up to 550 megabytes of data on a single compact disc. (See "Monster Memory," August 1985.)

• Built-in Centronics-standard parallel port and RS-232 serial port for printers, modems, and other peripherals. These ports are compatible with IBM cables for printers and modems.

• Built-in Musical Instrument Digital Interface (MIDI) for attaching keyboard synthesizers, sequencers, drum boxes, and other electronic musical devices. Because the MIDI ports transfer data at a very high speed (31.25 kilobaud), they've also been considered for such future applications as extremely inexpensive local area networks (LANs).

• A slot for cartridges containing up to 128K of Read Only Memory (ROM).

• Intelligent video output port that recognizes whether a color or monochrome monitor is plugged into the computer and allows the operating system to adjust itself accordingly. This port also has pins for audio input/output.

• High-resolution monochrome monitor. With a screen refresh rate of 70 hertz—about 16 percent faster than normal monitors and TVs—this monitor is capable of unusually sharp displays. An analog RGB (red-green-blue) color monitor also is available.

• Screen modes with high resolution (640 × 400 pixels, monochrome), medium resolution (640 × 200, four onscreen colors), and low resolution (320 × 200, 16 onscreen colors).

• Palette of 512 possible colors. Any of the four colors in medium resolution or 16 colors in high resolution can be selected from this palette.

• Three-channel General Instruments sound chip, the same as found in the Texas Instruments TI-99/4A, IBM PCjr, and MSX-standard computers. Envelope registers allow the chip to simulate various types of waveforms.

• A disk-based operating system called TOS (Tramiel Operating System) which combines Digital Research's CP/M-68K and GEM (Graphics Environment Manager). CP/M-68K is the 68000 version of the popular Z80-based operating system, CP/M (Control Program/Microcomputers), similar to the MS-DOS used on the IBM PC and compatibles. CP/M-68K is vastly expanded, however, with provisions to support up to 16 disk drives with 512 megabytes per drive and 32 megabytes per file. To make this operating system easier to use, it is linked on the 520ST with GEM, a Macintosh-like user interface with icons, windows, and drop-down menus. GEM can be manipulated from the keyboard or with a mouse controller that comes with the 520ST. The two-button mouse plugs into one of the two controller ports built into the computer.

Turtle graphics in Logo: This geometric figure was created in the Atari 520ST's low-resolution mode (320 × 200 pixels, 16 colors).

• Digital Research Logo and Atari BASIC programming languages on disk. (At this writing, BASIC wasn't finished, and the 520ST was being shipped with Logo only. Atari has said that BASIC will be added to the package when it's done and offered as an upgrade to early ST buyers as well.)

• An 84-key keyboard with cursor keypad, numeric keypad, plus ten special function keys.

The price for the complete system (520ST, disk drive, monochrome monitor, mouse, and system software) is $799. A 520ST system with RGB monitor costs $999.

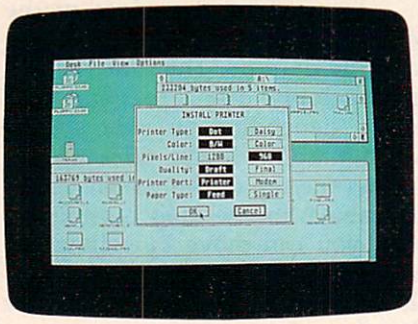
If you've never used a Macintosh, working with the Atari 520ST for the first time will be an unfamiliar experience. When you switch on most personal computers, you find yourself either in BASIC or some type of disk operating system (DOS). But the 520ST doesn't wake up with a READY prompt, command line, or DOS menu. Instead, the first thing you see is the GEM desktop.

Icons along the edges of the desktop screen show a trash can and file drawers. The drawers represent floppy disk drives and hard disks, depending on your system configuration. Menu titles appear across the top of the screen. Floating above the desktop is an arrow that you can move by rolling the mouse or by pressing certain keys. It represents an extension of your hand on the screen.

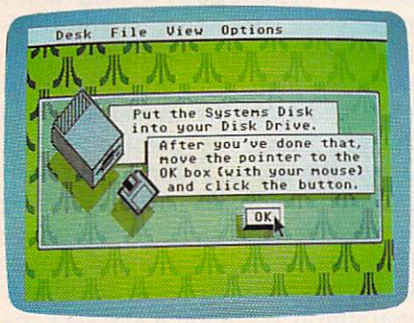
To view a menu, you move the pointer to the desired title. Instantly, the menu drops down over the screen. (The 520ST's *drop-down* menus are summoned slightly differently than the Macintosh's *pull-down* menus: You don't have to click and hold the mouse button.) As you move the pointer up and down the menu, it highlights various options. Some options may be invalid for a particular operation, so they appear in dim print and cannot be highlighted. To select an option, you simply highlight it and click the left button on the mouse.

To call a disk directory, you move the pointer atop the appropriate file drawer icon and do what's called a *double-click*—pressing the mouse button twice in rapid succession. The disk drive hums, and a window appears on the desktop. Various types of icons inside the window denote data files, executable program files, and subdirectories on the disk. If you prefer a more conventional disk directory, you can drop down the View menu and select View As Text. The file icons change into a list of filenames which includes such information as file lengths in bytes and the dates on which the files were last updated. Other options on the View menu let you sort the directory by filename (alphabetically), file type,

This low-res picture was created with Dr Doodle, *a simple drawing program written by Digital Research and included on an ST demo disk.*



In high resolution (640 × 400 pixels, monochrome), GEM closely resembles the Macintosh desktop.



Error messages on the 520ST are usually more helpful than the cryptic error codes of days past.

size, or date.

If you're working with a two-drive system, you can call the directory for drive B by double-clicking on its icon. When this window appears, it overlaps the window for drive A. But the drive A window isn't erased; by pointing to it and clicking the mouse button once, it moves atop the drive B window. A similar click on the drive B window brings it to the fore. You can flip back and forth between several windows in this manner, like shuffling papers on a real desktop. Options selected from menus, such as View As Text, affect the window which is currently on top of the pile.

All other functions in the GEM desktop work in similar ways: You point to a menu option or icon, then click the mouse button once or twice.

For instance, to run a program, you point to its icon or filename in the disk directory window and double-click. The desktop disappears and the program runs. When you exit the program, the desktop reappears.

Some operations, such as deleting a file, require a mouse maneuver known as *dragging*. First you select the icon—in this case, the file you want to delete—by pointing to it with the mouse and then clicking the mouse button. While still holding down the button, you can roll the mouse to drag an outline of the file icon along with the pointer. To delete the file, you would drag it to the trash can icon and release the mouse button. A window appears and asks "Are you sure?", warning that the file will be erased if you click on a marker labeled "OK." If you don't want to delete the file, you can click on a marker labeled "Cancel." The first choice irretrievably erases the selected file off the disk; the second choice restores everything to normal. (Unlike the Macintosh, you can't retrieve files from the trash can. As the 520ST manual points out, the 520ST trash can is more like an incinerator.)

This dragging technique is used for other operations as well. You can copy a file from one disk to another by dragging the file icon from the source disk's directory window to the destination disk's window; you can copy the contents of an entire disk by dragging its file cabinet icon atop another disk's icon; and you can organize files into subdirectories by dragging their icons into a folder icon.

You can also manipulate windows as easily as icons. The "active" window—that is, the one on top of the pile if several are displayed—has various control bars and squares along its edges. Pointing to the square in the upper-right corner and clicking the mouse button expands the active window to full-screen size. Clicking this corner again restores it as a window. Dragging the lower-right corner lets you adjust a window's size, making it larger or smaller. Dragging the top bar lets you move a window anywhere on the screen. Clicking on the small arrows displayed along the bottom and right bars will scroll the material displayed in the window, assuming some of it is hidden due to the window's size. And clicking on the upper-left corner removes the active window from the screen ("closes" the window).

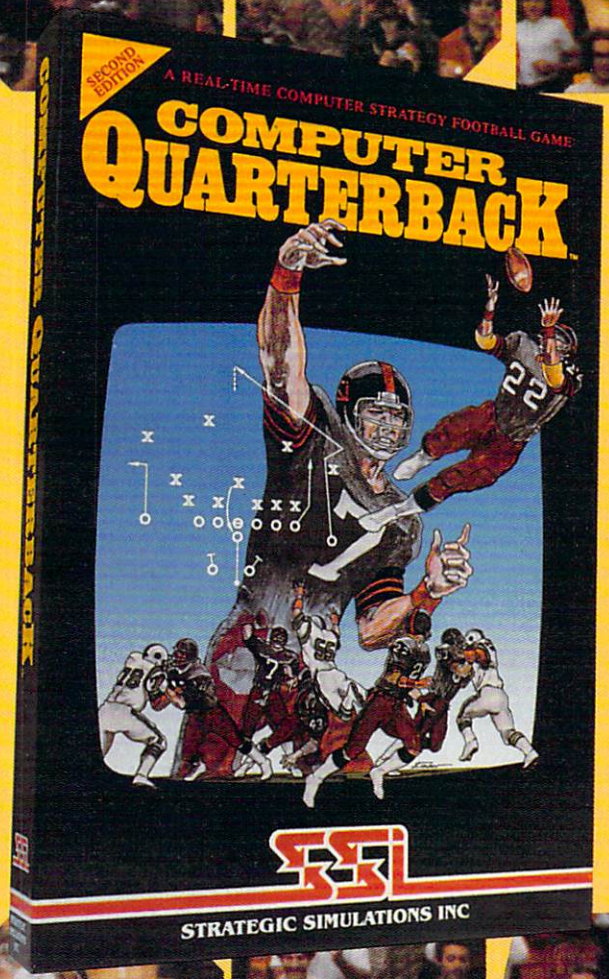
One unusual feature of the 520ST is its intelligent monitor interface. When you boot up, the operating system checks whether a monochrome or color monitor is attached to the computer and adjusts itself for one of three possible screen resolutions.

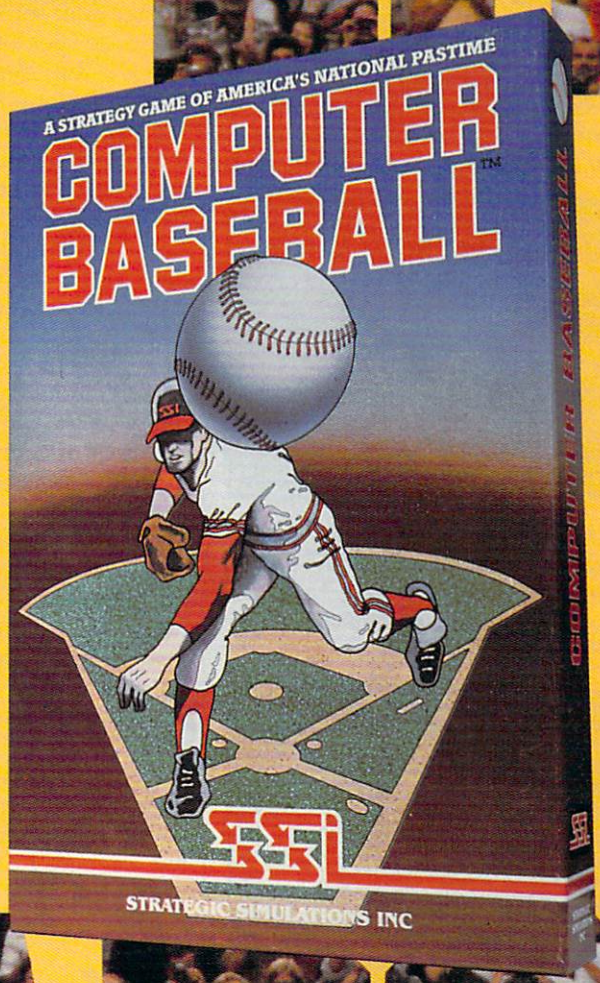
With the monochrome monitor, the operating system automatically configures the GEM desktop for high resolution—640 × 400 pixels, black and white. The display is extremely sharp and stable because of the monitor's 70 hertz refresh rate, which means it redraws the screen image 70 times per second rather than 60 times as on standard monitors and TVs. (This is possible because the monitor uses its own 70 hertz oscillator instead of synchronizing with the 60 hertz power line.) Furthermore, the display is paper-white, not blue-white, easier on the eyes. When the monochrome monitor is hooked up, the operating system won't let you enter the medium- or low-resolution modes, which have color.

If the 520ST is booted up when plugged into its RGB monitor, it defaults to medium resolution—640 × 200 with four simultaneous colors. Because this screen has the same horizontal resolution as the monochrome mode but only half the vertical resolution, the aspect ratio is slightly distorted. Icons appear tall and skinny, and characters are narrower.

The low-resolution mode—320 × 200 with 16 simultaneous colors—also requires the RGB monitor. (The RF modulator included in preproduction 520STs has been eliminated from production models, so it can't be attached to ordinary TVs. There's also no direct output for standard composite monitors, although one could probably be rigged from the RGB pins.)

SUPER STARS





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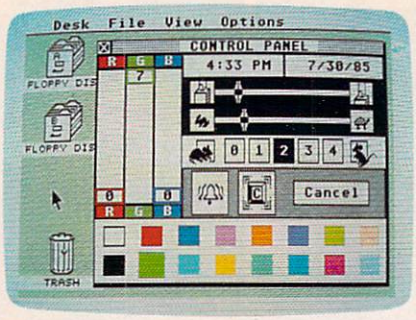
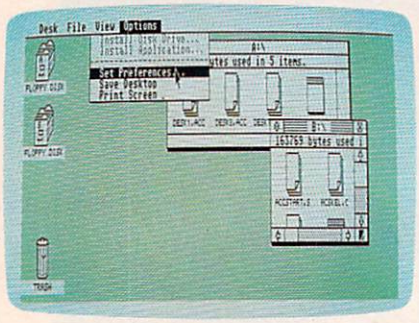
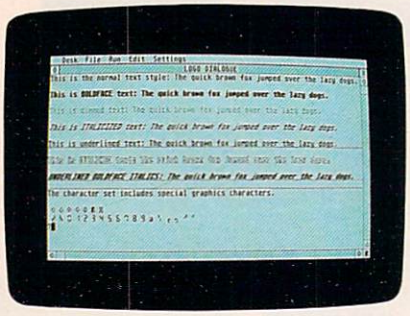


In low res, the GEM desktop has a 40-column screen. The Control Panel is a pop-up menu that lets you adjust various system functions.



In medium resolution (640 × 200 pixels, four colors), the GEM desktop has an 80-column screen. Note the two disk directory windows.



The 520ST is capable of displaying numerous type styles, as seen on this hi-res Logo screen.

To enter the low-res mode, you boot up in medium-res, then drop down the Options menu and select Set Preferences. A small window appears with markers for low-res, medium-res, and hi-res (the hi-res marker is dimmed to indicate it's not available with this configuration). To change modes, you click the mouse button while pointing to the appropriate marker.

If you want your 520ST to "wake up" in low-res instead of medium-res, you can drop down the Options menu and select Save Desktop. This selection saves all adjustments you've made to GEM onto the operating system boot disk. Other preferences can be saved this way, too. By dropping down various menus, you can specify whether warning windows should appear when copying or deleting files; turn the keyboard click and error beeps on or off; adjust the keyboard's auto-repeat delay and repeat rate; set the mouse button's response speed for double-clicking; choose the desktop's foreground and background screen colors from the 512 available hues; set the real-time clock's time and date, which is automatically stamped on disk directories whenever you save a file; and configure the RS-232 and parallel ports for certain peripherals.

The 520ST doesn't have sprites or player/missile graphics, but animation is possible in any of its screen modes by a technique called *bit-block transfer*. Like sprite graphics, it allows you to move objects around the screen without erasing the background. The mouse pointer and the bumblebee icon that appears when the disk drive is busy are examples of bit-block animation. Unfortunately, these capabilities are not supported in Logo, the only language shipped with the 520ST at launch. The Logo is actually a translation of Digital Research's Logo for the IBM PC, and it has no commands for animation or sound. Reportedly, the BASIC being prepared for the 520ST is a translation of Digital Research's BASIC for the PC.

When the 520ST made its first appearance at the Winter CES, it was hard to believe that anyone could design a system like the 520ST and throw together a prototype in only about six months—the time that had elapsed since ex-Commodore President Jack Tramiel had acquired Atari from its parent company, Warner Communications.

Forced to trim down from several thousand employees to several hundred, Atari accelerated development on the 520ST by taking advantage of some ready-made parts. The 520ST came along just in time for Digital Research's CP/M-68K and GEM. This is important in understanding the underlying structure of the 520ST, which has been nicknamed the "Jackintosh."

Although the Atari's desktop screens can easily be mistaken for the Macintosh's, the 520ST is actually quite different from the Mac. True, GEM has all the icons, windows, menus, and other Macintosh screen graphics. But GEM is really just a shell—a layer between the user and the real operating system, CP/M-68K. In fact, it's possible to leave GEM and enter this lower level. All the fancy graphics can be made to disappear and you see a screen prompt, A>. This prompt is familiar to users of CP/M and MS-DOS/PC-DOS (a descendant of CP/M). You can enter commands such as DIR to call a disk directory or TYPE to display a file. Like CP/M and PC-DOS, CP/M-68K allows programmers to perform various system functions by calling routines in the Basic Input/Output System, or BIOS. Digital Research even says that CP/M file structures are upwardly compatible with CP/M-68K.

GEM, too, is a module that has something in common with other systems. Digital Research sells a version of GEM for the IBM PC and compatibles, and publishes guidelines for writing application programs to work with GEM.

All this doesn't mean that the 520ST can run CP/M or PC-DOS programs, of course—the machine languages are completely incompatible. But it does mean that programs written in compiled languages such as C can be adapted for these various systems without complete rewriting. If software companies take advantage of this, it could significantly boost the amount of software available for the 520ST.

Another consequence of the 520ST's shell-like operating system structure is that the machine has not been designed around its user interface. The computer is functional without the mouse, and the keyboard includes such traditional features as cursor keys.

Combining ease of use with real power, speed, and the potential for future expansion, the Atari 520ST is an important addition to personal computing. It lends itself to users who prefer to buy their software off the shelf as well as to programmers—a versatile representative of the new generation. ©

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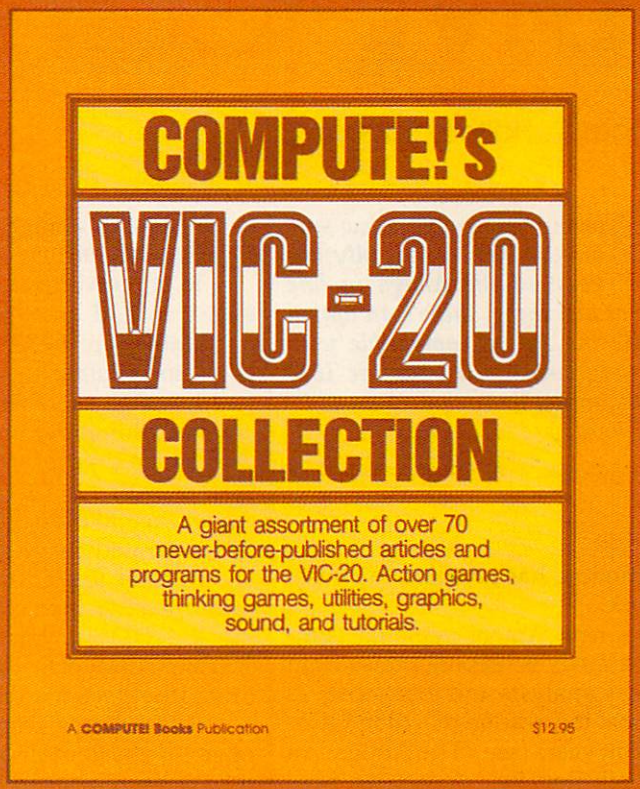

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Amiga Goes IBM-Compatible

Tom R. Halfhill, Editor

Commodore sprang a few surprises when it officially announced the Amiga in late July. For one thing, there's an option to make the Amiga compatible with most programs written for the IBM PC—an option that requires no additional hardware.

Commodore has revealed the missing link.

Its new Amiga personal computer already is reaping praise from industry analysts and journalists as the most innovative machine introduced in years (see "The Amiga: An In-Depth Review," COMPUTE!, September 1985). However, as with all new computers that break with existing technology, it could take a year or more before the Amiga accumulates an extensive software library.

But Commodore appears to have solved that problem with a single stroke. On July 23, when it formally unveiled the Amiga to a crowd of several hundred people at a gala media event in New York's Lincoln Center, Commodore announced that an option will make the Amiga software-compatible with the popular IBM PC and its huge base of commercial programs. Although this had been rumored for months, the method of achieving this compatibility was the real surprise—the Amiga will emulate the IBM PC *entirely in software.*

In other words, it won't be necessary to add an expansion board containing an 8088 and support chips to emulate the IBM PC. Instead, Amiga users will simply load an emulation program that replaces the Amiga's proprietary operating system with PC-DOS to make the Amiga act like an IBM. This was demonstrated in New York when an engineer loaded the PC emulator from a 3½-inch disk, then booted PC-DOS from a standard 5¼-inch IBM disk on an external drive (the 5¼-inch drive is optional). The Amiga's graphics-oriented operating system disappeared, and the screen displayed the usual PC-DOS startup message:

```
The IBM Personal Computer DOS
Version 2.10 (C)Copyright IBM Corp 1981,
  1982, 1983
A>
```

After inserting another 5¼-inch disk and typing "lotus" at the DOS prompt, the engineer demonstrated a *Lotus 1-2-3* spreadsheet. The Amiga screen even looked like an IBM monochrome screen.

The technical feat of emulating the IBM PC entirely in software is best appreciated by advanced programmers and engineers, but can be likened to playing a record on a tape deck. It seems almost impossible, and even some people who witnessed the demonstration have doubts that the Amiga can emulate the PC at a speed comparable to a real PC.

Nevertheless, Commodore's engineers maintain it has been done, and that the PC emulator will be available within a month after the Amiga's launch in September. No price for the emulator was announced, but Commodore says it chose the software method to keep costs down. The only hardware involved is the 5¼-inch drive, and one engineer told COMPUTE! that even that accessory might be unnecessary since some PC programs can be loaded from 3½-inch disks sold for the Data General One, a PC-compatible portable computer.

According to Commodore, the emulator isn't memory-hungry, either. It consumes about 40K of RAM, not counting video memory. Still, to run large PC programs such as *Lotus 1-2-3*, Commodore will probably advise users to expand the Amiga's standard 256K RAM to 512K (a $200 option).

Another surprise revealed July 23 was the Amiga's memory configuration. Commodore originally planned to locate the Amiga's large operating system, called Intuition, in 192K of ROM. Then, to make it easier to fix bugs and release the computer on time, Commodore said the first Amigas would load Intuition from disk, consuming

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It's not too early to get ready for 1988. With the right diet, proper training and hours of practice you just might make it. In the meantime, put on your sweatsuit, grab that joystick and let Summer Games II give you eight new ways to **Go For The Gold!**

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about half of the 256K user RAM. Now Commodore has a better solution: The standard Amiga will have 512K of RAM, but half will be dedicated to storing Intuition. Called the *Writeable Control Store*, this extra bank of 256K RAM is write-protected immediately after the operating system is loaded. Commodore says even a system reset won't interfere with it. In effect, the Writeable Control Store acts like 256K of ROM, except that Intuition must be loaded from disk again after the computer is powered off. As a result, the entire 256K of user RAM is available for programs.

The Writeable Control Store won't be counted as system RAM; the standard $1,295 Amiga will still be advertised as a 256K computer, even though it really contains 512K. Later, when Commodore is certain that Intuition is fully optimized (critical parts are being rewritten from compiled C into machine language), the Writeable Control Store will be eliminated and replaced with ROM. This will allow nearly instant startups, because Intuition won't have to be loaded from disk. Commodore hasn't yet said whether early Amiga owners will be able to upgrade to a ROM-based operating system later. ©

Amiga Software

Kathy Yakal, Feature Writer

Here is a list of software announced so far for the Amiga. Prices are included where available:

Entertainment

Archon: Unique chess game, using wizards and dragons instead of traditional pieces. Unusual game play is enhanced by 3-D effects. *(Electronic Arts, 2755 Campus Drive, San Mateo, CA 94403.)*

Déjà Vu: A Nightmare Come True: A graphics/text adventure in the genre of a 1940s movie mystery. The Amiga's windowing ability lets the player see several parts of the story simultaneously. *($54.95; Mindscape, Inc., 3444 Dundee Road, Northbrook, IL 60062.)*

Dr. J & Larry Bird Go One-on-One: Realistic graphics and sound highlight simulated basketball action between the two athletes. *(Electronic Arts.)*

Marble Madness: Translation of the arcade game. *(Electronic Arts.)*

Radar Raiders: A graphics- and sound-rich flight simulator that lets the player control a high-performance jet aircraft, both in test pilot and combat game modes. *(Developed by Sublogic Communications Corporation and marketed by Amiga.)*

Return to Atlantis: 3-D undersea adventure. *(Electronic Arts.)*

Sargon III: Chess game with nine levels of play and a library of 68,000 moves. *(Hayden Software Company, 600 Suffolk Street, Lowell, MA 01854.)*

Skyfox: Light combat simulation. *(Electronic Arts.)*

Zork I: The Underground Empire; Zork II: The Wizard of Frobozz; Zork III: The Dungeon Masters; Enchanter; Sorcerer; Suspect; The Witness; Cutthroats; Deadline; Seastalker; Infidel; Planetfall; Suspended; Starcross; The Hitchhiker's Guide to the Galaxy. The well-known series of all-text interactive fiction adventures. *($39.95–$49.95. Infocom, Inc., 125 Cambridge Park Drive, Cambridge, MA 02140.)*

Languages And Utilities

ABasiC: A powerful BASIC interpreter designed to take full advantage of the Amiga's capabilities. *(Developed by Metacomco, the British company that wrote AmigaDOS. Marketed by Amiga.)*

Amiga Assembler/Linker: A Motorola-standard 68000 macroassembler with linker. *(Developed by Metacomco and marketed by Amiga.)*

Amiga Tutor: A step-by-step look at the Amiga's graphics capabilities and other major features. *(Mindscape.)*

Cambridge LISP 68000: Programming language designed for work in artificial intelligence. *(Developed by Metacomco and marketed by Amiga.)*

Lattice C Compiler: Allows software developed for other PC operating systems to run on the Amiga. *(Lattice, Inc., P.O. Box 3072, Glen Ellyn, IL 60138.)*

Lattice C Cross Compiler/IBM MS-DOS: Allows software developed for Amiga to run on IBM personal computers. *(Lattice, Inc.)*

Lattice C Cross Compiler/Unix: Allows software designed for the Amiga to run on Unix-type machines. *(Lattice, Inc.)*

Lattice C Cross Compiler/VAX: Allows software developed for the Amiga to run on VAX minicomputers. *(Lattice, Inc.)*

LMK: Software development tool similar to *Unix-Make*. *(Lattice, Inc.)*

LSE: Screen editor; allows user to enter commands in several languages. *(Lattice, Inc.)*

MCC Pascal 68000: Single-pass compiler for software systems and utilities development. *(Developed by Metacomco and marketed by Amiga.)*

TMN: Software development tool for text management utilities. *(Lattice, Inc.)*

TLC-LOGO for the Amiga: A high-level programming language incorporating a LISP dialect. *(Developed by The LISP Company and marketed by Amiga.)*

Turbo PASCAL: High-speed compiler. *(Borland International, 4585 Scotts Valley Drive, Scotts Valley, CA 95066.)*

Business/Productivity

CalCraft: A spreadsheet for the Amiga, featuring pull-down menus and flexible formatting options. *(Developed by Synapse Software and marketed by Amiga.)*

Deluxe Video Construction Set: Creates animated video with sound effects; accepts data from other Electronic Arts software. *(Electronic Arts.)*

Enable/Calc: Spreadsheet program with over 50 math functions and up to eight simultaneously active spreadsheet files in RAM. *(The Software Group/Amiga, Northway Ten Executive Park, Ballston Lake, NY 12019.)*

Enable/File: Database manager capable of handling up to 256 fields per record. *(The Software Group/Amiga.)*

Enable/The Office Manager: Integrated business package, including word processor, database manager, telecommunications, and graphics modules. *(The Software Group/Amiga.)*

Enable/Write: Word processor. *(The Software Group/Amiga.)*

Graphicraft: Graphics/paint package using 32 medium-resolution colors. *(Developed by Island Graphics Corporation and marketed by Amiga.)*

Harmony: Creates musical accompaniment, either through Amiga's internal sound or MIDI (Musical Instrument Digital Interface) instruments. *(Developed by Cherry Lane Technologies and marketed by Amiga.)*

Moviecraft: Animation package; uses "tweening" technique to animate without reading from disk. *(Developed by Island Graphics and marketed by Amiga.)*

Musicraft: Turns the Amiga into a four-voice synthesizer and sequencer; teaches music composition. *(Developed by Everywhere, Inc. and marketed by Amiga.)*

Presentationcraft: Business graphics package for creating 3-D objects, exploded and expanded bar and pie graphs. *(Developed by Island Graphics Corporation and marketed by Amiga.)*

RAGS to RICHES Ledger: Double-entry general ledger software for small businesses. *(Developed by Chang Laboratories and marketed by Amiga.)*

RAGS to RICHES Payables: Accounts payable software for small businesses. *(Developed by Chang Laboratories and marketed by Amiga.)*

RAGS to RICHES Receivables: Accounts receivable software for small businesses. *(Developed by Chang Laboratories and marketed by Amiga.)*

RAGS to RICHES Sales: A sales register program for point-of-sale income accounting; makes the Amiga function as a cash register. *(Developed by Chang Laboratories and marketed by Amiga.)*

Scorewriter: Enables user to score and print music. *(Developed by Cherry Lane Technologies and marketed by Amiga.)*

The Print Shop: Specialized graphics software, allowing user to design and print personalized greeting cards, invitations, letterheads, stationery, signs, and banners. *(Brøderbund Software, Inc., 17 Paul Drive, San Rafael, CA 94903.)*

Telecraft: Telecommunications software for Amiga. *(Developed by Software 66.)*

Textcraft: A word-processing program incorporating online tutorials and screen help for ease of use. *(Developed by Arktronics and marketed by Amiga.)*

Education

The Halley Project: A realtime simulation of the solar system. Teaches about concepts like gravity, orbital motion, and navigation by the stars as players "travel" around the universe. *($49.95; Mindscape.)*

Keyboard Cadet: Teaches touch typing. *($39.95; Mindscape.)*

Seven Cities of Gold: An adventure game that helps teach geography and cartography; players are sixteenth-century conquistadors exploring the new world. *(Electronic Arts.)*

Peripherals

Penmouse Input Device: A cordless light pen with built-in power supply that functions as both a mouse and graphics tablet. *(Kurta Corporation, 4610 S. 35th Street, Phoenix, AZ 85040.)*

T-Card: Multifunction expansion card with up to one megabyte of memory; includes serial port, parallel printer port, and hard disk interface. *(Tecmar, 6225 Cochran Road, Solon, OH 44139.)*

T-Disk: 20-megabyte 3½-inch hard disk drive. *(Tecmar.)*

T-Tape: 20-megabyte tape backup for hard disk; can be linked to Amiga through floppy interface port. *(Tecmar.)*

T-Modem: Hayes-compatible modem, switchable 300, 1200, and 2400 bits per second. *(Tecmar.)*

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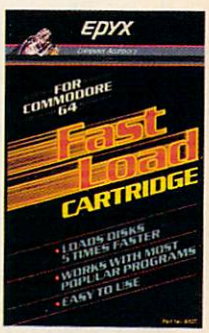

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The NEW Games

Selby Bateman,
Features Editor
Kathy Yakal,
Feature Writer

A game with no instructions. A program that seems to think for itself. Aircraft simulations edging closer to the real thing. And an "alternate reality" that's expandable. All this—plus the Goonies—are among the new computer game releases you'll be seeing this fall and during the holiday season.

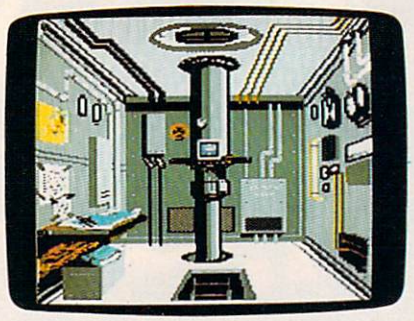
Jim Levy stepped back from the computer screen, a look of embarrassment crossing his face. As the president of Activision, Levy was *supposed* to be showing a roomful of reporters his company's newest computer game. But something had apparently gone wrong, and now he apologized and explained that he was trying to get online with a computer at company headquarters to demonstrate the program.

"Logon please..." appeared on the screen. After a few unsuccessful tries, suddenly Levy's computer was online—not with Activision, but with some unknown computer system. But whose?

"That, ladies and gentlemen, is the game," said Levy, flashing a sly smile at the crowd.

It's called *Hacker*, and it's a game with no instructions, no rules, no clues—just your simulated online connection with a mysterious computer system. Whose system have you stumbled into? What's going on? What does it take to win? What pitfalls make you lose? As the computer hacker, you must discover all these answers on your own as you play this intriguing adventure game, which will be available initially for the Commodore 64 and 128 (Apple and Atari soon after; price to be announced).

In addition to the engaging approach Activision has taken with *Hacker*, a number of companies are showing that there are plenty of fresh ideas for computer games. And these games reveal that experienced programmers are getting far more from today's computers than ever before. Several of the newest entries are sequels which equal or surpass the original hits. Here are some highlights:



A view through the periscope in Silent Service.

AcroJet, Gunship, and ***Silent Service*** (MicroProse Software)—Fans of MicroProse Software's earlier hits, *Solo Flight* and *F-15 Strike Eagle*, can look forward to more excitement from this trio of new simulations. *AcroJet* is an advanced flight simulator which starts where the earlier *Solo Flight* left off, allowing you to pilot a BD5-J jet. *Gunship* is a simulation of the AH-64 Apache attack helicopter, complete with electronic multiple weapons systems and realistic helicopter maneuverability. *Silent Service* is a World War II submarine combat simulation which lets you slowly increase the level of complexity as your skills develop. The emphasis in all three packages is on realistic simulations coupled with intriguing game scenarios. (*AcroJet*—Apple II, Atari, Commodore, IBM; *Gunship*—Apple II, Commodore, IBM; *Silent Service*—Apple II, Commodore; $34.95 each.)

Alternate Reality (Datasoft, Inc.)—This is the first game in a projected series of eight fantasy role-playing programs being released by Datasoft. Called *The City*, the original episode of *Alternate Reality* finds your character abducted by aliens to another time and place. As you move around the strange city, you learn basic survival skills. But this is an adventure game with a difference. Traits like patience, compassion, and honesty are valued every bit as much as the usual strength and proficiency with weapons. Day turns to night as you learn how to earn money, obtain food, avoid dangers, and explore the city. Later programs will tie in with this first game, letting you gain access to parts of the city which are not open to you in the original program. Following *The City*, Datasoft plans to produce *The Dungeon, The Arena, The Palace, The Wilderness, Revelation,* and *Destiny.* (Atari and Commodore versions, $39.95; Apple II family, $49.95.)

Beach-Head II (Access Software)—Two earlier fast-action games from Access, *Beach-Head* and *Raid Over Moscow*, have been among the most popular computer programs on the market. *Beach-Head II* may well join them. The theme is unabashedly arcade-style battle, with soldiers charging a machine gun bunker, rescuing prisoners, flying a helicopter through antiaircraft fire, and throwing knives in a one-on-one finale. Superb color graphics and eerily authentic speech synthesis add realism to the game's constant action. There are two options of game play: two players or one player versus the computer. (Commodore 64/128, Atari, Apple II, IBM PC/PCjr, $39.95.)

APBA Major League Players Baseball (Random House)—It's your strategic skills, not athletic abilities, which count in *APBA Major League Players Baseball*. Adapted from the popular board game invented 30 years ago, it's a simulation that lets you make the decisions of a major league manager, putting a baseball team together and then pitting it against other teams. The 1985 Master Edition contains actual records and ratings for 676 players from the 1984 professional baseball season. Updated records will be available

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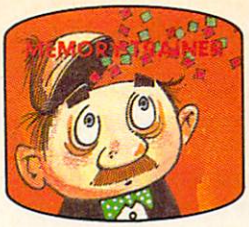

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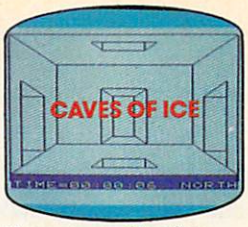

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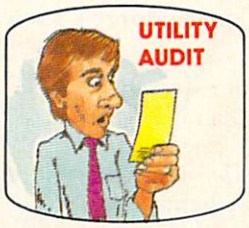
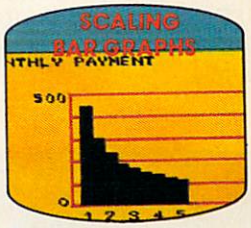


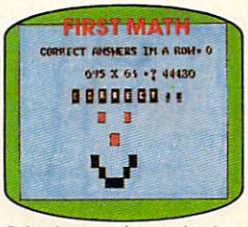
Cut your energy costs by monitoring your phone, electric and gas bills.

Computerize car maintenance to improve auto performance, economy and resale value.

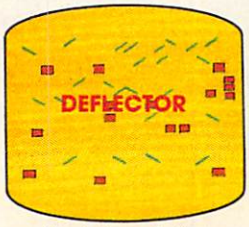


Create multi-colored bar graphs with a surprisingly small amount of memory.

A time-saving organizer for coupons, receipts and more.



School-age and pre-school children are rewarded for right answers, corrected on their wrong ones.



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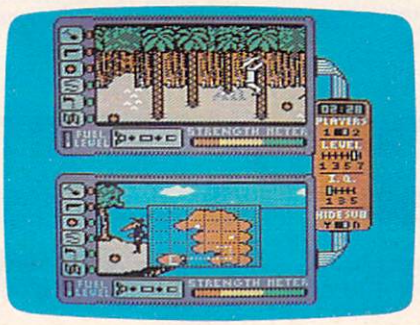
King Graham meets King Neptune in King's Quest II: Romancing the Throne.

King's Quest II: Romancing the Throne (Sierra)—The three-dimensional, double high-resolution graphics in the original *King's Quest* are back in this second all-graphics adventure featuring Sir Graham (now King Graham). King Graham's quest is a colorful, smoothly scrolling adventure which can be played by youngsters as well as adults. Sierra has again paid attention to all the details, making this a worthy successor to the original. (IBM PC and PC compatibles, $49.95.)

The Fourth Protocol (Bantam Electronic Publishing)—Frederick Forsyth's bestselling novel has been turned into a graphics and text adventure which is being released simultaneously with the paperback version of the book. You play the part of a British intelligence agent racing to uncover a plot to smuggle and detonate a nuclear device in England. The game employs easy-to-use Macintosh-style icons and windows to help you get around. And there are plenty of plot twists, even for those who may have read the book. (Commodore 64, $34.95; Apple version soon.)

The Goonies (Datasoft, Inc.)—A colorful series of eight mazes, filled with a collection of Rube Goldberg-style devices to trip you up, comprises this action-strategy game based on Steven Spielberg's movie. Coordinating your multiple characters and learning the intricacies of the mazes make this a demanding and absorbing game. You won't find the treasure easily, but you can have fun trying. (Apple II family, $39.95; Atari and Commodore, $29.95.)

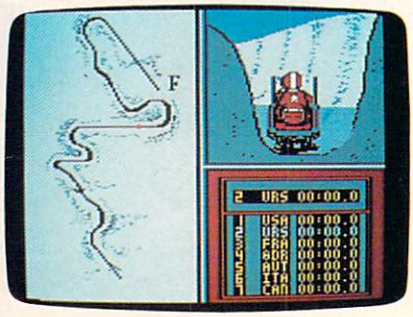
Jet (SubLogic)—The company that brought out the very popular *Flight Simulator II* has gone one better with its newest release, *Jet*, for IBM computers. This newest game is a very realistic simulation of two supersonic jet fighters, a land-based F-16 Fighting Falcon and a carrier-based F-18 Hornet. There is a free-flight mode, or you can try your hand at a variety of land or sea attacks or dogfight options to test your skill. (IBM PC or PC-compatible with minimum 128K memory, $49.95.)



Simultaneous play with split screens in Spy vs. Spy: The Island Caper.

Spy vs. Spy: The Island Caper (First Star Software)—First Star scored a big success with the original *Spy vs. Spy* game, and now the sequel is available. The same split-screen Simulvision/Simulplay techniques used in the original are employed here, allowing two players to see what's happening with each onscreen character and to act independently. Both games are based on *Mad Magazine's* long-running comic strip. In the latest edition, the spies are after a nuclear warhead on a tropical volcanic island. (Commodore 64/128, $29.95; Apple II, $34.95.)

Racter (Mindscape)—One of the most novel approaches to computer gaming this year may be *Racter*, a program with a mind of its own. *Racter* (short for *raconteur)* exists to converse with you. Type in a question, and the program not only responds from its 2,800-word vocabulary and knowledge of English grammar, but may also launch into a lengthy tale from the past, present, or future. The sentences are sophisticated—perhaps a bit schizophrenic—and all in fun. *Racter* is already the "author" of its own book (the first ever written by a computer), *The Policeman's Beard Is Half Constructed* (Warner Books), a collection of short poems, dialogues, limericks, and stories. (IBM PC, Apple IIe and IIc, Macintosh, $44.95. The book is available separately.)



The bobsled run in Winter Games.

Winter Games (Epyx, Inc.)—Last year, Epyx brought out a popular computer re-creation of the Summer Olympics called *Summer Games*. The package reportedly sold more than 200,000 copies thanks to its smooth, colorful graphics and solid game play. Now the company has produced two sequels, *Summer Games II*, and most recently, *Winter Games*, in anticipation of the 1988 Winter Olympics. Ski jumping, speed and freestyle events, a ski biathlon, and even a bobsled run are part of this latest Olympic exercise. (Apple II, Commodore 64, Macintosh, from $29–$35.)

Wishbringer (Infocom, Inc.)—This introductory level all-text fantasy is another of Infocom's computerized text adventures. *Wishbringer* is suitable for the beginning adventurer, yet offers the experienced player plenty of challenges. The game can be played on two levels—with the help of magic (for beginners) and through logic and puzzle-solving without magic (for experienced players). (Apple II family, IBM PC/AT, Macintosh, others, $39.95; Atari, Commodore, $34.95.) ©

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Expert Systems:
Shortcut To Artificial Intelligence?

Kathy Yakal, Feature Writer

The term expert system *is rapidly becoming a new catch-phrase, like* user-friendly. *Some people point to "smart" computers now being used for diagnosis and trouble-shooting in medicine and industry as proof that expert systems are possible and practical. Even some personal computer software publishers claim that their products possess artificial intelligence or expert system capabilities. But others maintain that few, if any, true expert systems really exist. Here's a look at what's happening.*

If an "expert" is defined as someone who knows more than most people about a given subject, then you probably seek advice from several experts every week. If you or someone in your family is ill, you probably go to a physician. After asking several questions and running some tests, the doctor arrives at a diagnosis and recommends treatment. If your car keeps stalling at intersections, you probably take it to a mechanic, who checks the car and recommends a repair. If you find yourself owing too much federal income tax on April 15, a tax consultant can offer ways to help. And if you think you've been wronged by someone, a lawyer can usually decide if it's worthwhile to bring a lawsuit.

All of these people you consult—these experts—are trusted to have a sufficient *database* of knowledge in certain areas so that their advice is worth following (and worth paying for).

You can also buy programs for your personal computer that have been designed to act as consultants in such areas as personal finance and health care. Are they replacements for real experts? Not according to their publishers, who stress that the programs are consultants *only*, and that you should almost always seek additional help from professionals.

But the day may not be too distant when a new type of computer program *will* replace experts—or at least, take over part of what experts do. These sophisticated programs, called *expert systems*, contain a database of knowledge that human experts can spend years acquiring. More significantly, the most advanced expert systems now under development also incorporate some of the rules of logic and analysis that experts combine with their storehouse of facts to solve real-life problems. Already, there are programs in everyday use that analyze geological data to find likely spots for new reservoirs of oil—a job which was formerly the exclusive domain of geologists and engineers.

Some people even believe that expert systems will become commonplace on the next generation of home computers, bringing the advice of family doctors and other professionals into the home at the touch of a key. But others warn that the premature application of expert systems could result in serious trouble, especially if they're based on an incomplete understanding of the decision-making process.

Though still in their infancy, expert systems are opening another chapter in the debate over artificial intelligence.

Several years ago, Joseph Weizenbaum, professor of computer science at the Massachusetts Institute of Technology (MIT), wrote a computer program called *Eliza*. His intention was to show how a computer could act like a psychologist. *Eliza* would ask the user questions about how he or she was feeling, then pick up on key words or phrases in the answer to guide its "therapy."

Some people are now calling *Eliza* an early expert system.

"I hadn't even heard that phrase used when I wrote it," says Weizenbaum today.

Part of the challenge of designing an expert system is deciding on the definition of what it's supposed to be and how it's supposed to work: Even the experts can't agree. For example, Weizenbaum thinks *Eliza* is being characterized as an early expert system because he consulted experts before writing it. Although *Eliza* may seem like it's really listening to you and responding, the program just follows a set of rules given it by Weizenbaum. If you say you're having a bad day, the program may ask you to talk about it. Then it may ask how certain events made you feel, or what you think you should do about it. *Eliza* is really more of an interactive diary than an expert.

Now the term expert system appears to be changing to apply to systems that perform expertly.

That's still too vague, says Weizenbaum. "If one were to characterize systems that perform expertly as expert systems, then huge libraries of scientific and business programs that have accumulated

over the years—many of which are doing a perfectly expert job at whatever they do—would all be expert systems. So it's not a very precise term.

"Here is an example of something that nobody considers to be an expert system: Today, almost all landings of wide-bodied airplanes are done automatically by onboard computers. I often wonder what the world would be like if that particular work had been done at the AI (artificial intelligence) lab at MIT or Stanford. I don't think we'd ever hear the end of it. But as a matter of fact, it was done, one might say, anonymously. I have no idea who did it, and certainly it does a job that it takes a lot of years to train a human being to do, but it's not considered an expert system. That's odd."

Yet, defining an expert system isn't as simple as pointing to a computer which replaces the performance of a human. Computers have been doing that for years. For instance, though they may not be labeled by some academics as expert systems, *process control* computers perform functions previously carried out by people with extensive training. "Today, for example, one can see a very large—I mean acres and acres—petroleum processing factory, and if you look very, very hard, you might find two people in these hundreds of acres," says Weizenbaum. "The whole thing is done under computer control.

"So there's this whole world of computerized process control which has been doing this for a long, long time, and it doesn't think of itself, or hasn't, as expert control."

Instead, true expert systems seem to be defined according to their evolution and architecture—such as a database of rules and inference mechanisms. Process control computers were developed by other means. "There are lots of process control applications that have been done very well that today might have been tackled differently in the light of expert systems," says Weizenbaum.

The point at which expert systems cross the border of artificial intelligence is hazier still. To some, there is a definite difference; to others, a perfectly functioning expert system *implies* artificial intelligence.

Part of the problem is that AI researchers diverge over how to approach the development of expert systems and artificial intelligence. A long time ago, says Weizenbaum, those in the field recognized two fundamentally different ways of doing business.

The first is to look at AI basically as a branch of psychology; that is, to use a computer to understand the operations of the human mind by programming it do high-level tasks as we think a human mind might do them. The other approach is to program a computer to do very clever things that ordinarily would require human intelligence, but to perform the tasks in ways that might not be considered by (or even possible for) a human being.

These two schools of thought are referred to as *theory mode* and *performance mode*. Weizenbaum gives an example of theory mode:

"Very early on, people got interested in the idea of computers playing chess. It was thought that if we could find out somehow what goes on in a chess player's mind and somehow program that into the computer, not only would we have a good chess-playing machine, but we'd also learn a lot about psychology, about human thought processes. People started trying to do that, but if nothing else, people got tempted to take shortcuts, to take advantage of some features that were built into the computer that no one thought were built into the human mind.

"So from the very beginning, the temptation couldn't be resisted, and people started designing chess-playing programs which took enormous advantage of all the peculiarities of computers but left behind any consideration of how the mind does it. And today we have powerful chess-playing computers, without the slightest claim that they teach us anything at all about human thinking.

"We've sort of drifted from theory into performance mode."

And due to a number of circumstances, including the military's interest in and funding of performance mode AI research, says Weizenbaum, there's very little theory work going on today.

One place where theory work is being pursued is at the University of California at San Diego, in a research center called the Institute for Cognitive Science. Paul Smolensky, one of the researchers there, has been primarily involved in research on neurally inspired mathematical models of learning, memory processes, and problem solving. Using what are currently believed to be some very general characterizations of the brain, Smolensky's work is focused on one primary area: to understand people, and how to educate them and advance knowledge in scientific fields.

An outgrowth of this research is that it suggests various kinds of novel computers that could be built—such as connecting lots of processors together and letting them work in parallel the same way neurons work in the brain. Only a few prototypes of such machines exist today.

"There's the platonic idea of what an expert system is, and then there's a whole bunch of actual systems that people have developed that they use the label for," says Smolensky. "I'm not aware of any that are actually in practice except the one that everyone in computer science is aware of, and that's the DEC [Digital Equipment Corporation] expert system for designing installations of their VAX computer systems."

This expert system, called R1/XCON, was developed by Dr. John McDermott, principal scientist and associate head of the computer science department at Carnegie-Mellon University. It configures a VAX minicomputer system to the customer's specifications, saving DEC more than $2.5 million annually in field costs. R1/XCON takes roughly a minute to execute the work it took its human predecessors an hour to complete.

McDermott and a number of other scientists, engineers, and programmers at Carnegie-Mellon have formed a corporation called the Carnegie Group to design and market AI-based systems for commercial applications. The Carnegie

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Group is looking into many areas that could benefit from expert systems, including engineering design, project management, production management, and sensor-based machine diagnosis and control.

One of the first steps in creating an expert system is to interview the experts the program is supposed to emulate. By asking a series of highly detailed questions, the designers try to figure out the decision-making process they'll attempt to reconstruct in the program. When this thinking process is coupled with a database of facts, the ideal expert system should have a similar capacity for analyzing information and arriving at the right decision.

A potential flaw has been cited in this approach, however: the difficulty of taking into account the role of human intuition, and even emotion, in decision-making.

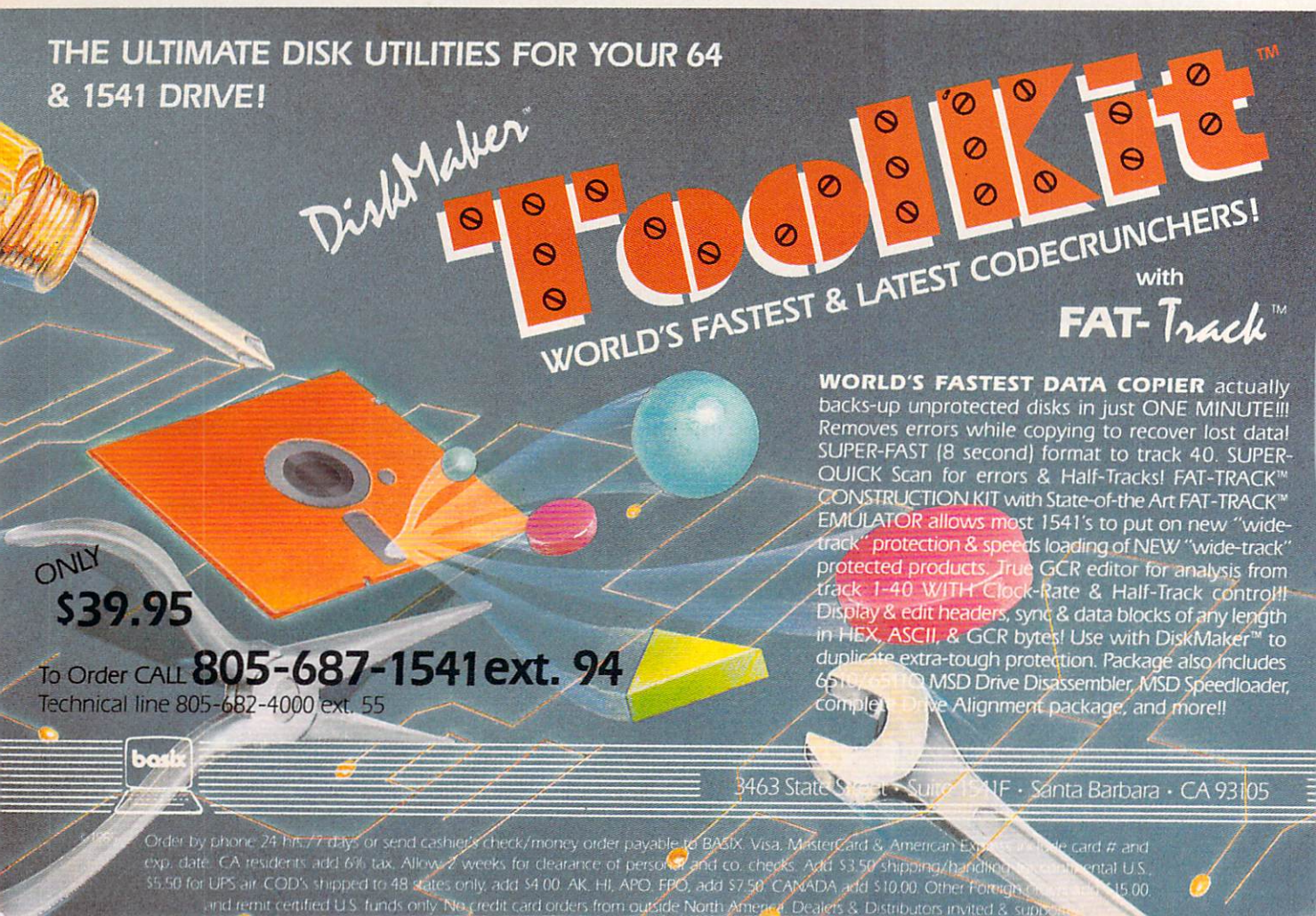
This is a vital point for some critics of expert systems and artificial intelligence. For instance, if you ask someone what the movie *War Games* was about, they'll probably say something like, "Oh, this kid broke into the national defense system with his home computer and almost started a nuclear war." But the defense system wasn't exposed to this vulnerability until after the government decided that human beings could not be trusted to enter the codes and push the buttons that would launch our nuclear weapons. So the weapons were placed under computer control, because computers would not falter for emotional reasons at the crucial moment.

"There's a tremendous amount of human judgment that has to go into a decision about whether to give a computer a certain role in a decision-making system," says Smolensky.

Computers may be able to take over jobs previously done by human beings, but that does not make them intelligent, let alone experts, he says. "Expertise derives in a very significant way from intuition and intuitive processes. Experts do not have any access to that when they introspect about how they do what they do, and no amount of asking an expert questions is going to get at the information and the knowledge that allows the expert to do what he or she does. And if we're going to understand expertise, we have to understand intuition."

Smolensky warns of the dangers of employing too much technology too fast, especially in areas that have a direct effect on human life. He points out that even when a relatively simple computer system is first installed in a business, there are inevitable last-minute bugs and problems that must be solved before it functions smoothly. "And it's only because these systems can make a lot of bad mistakes and people can go in and fix them afterward—basically putting Band-Aids on top of Band-Aids on top of Band-Aids—that we don't have a lot of permanent disaster stories.

"If you look at the problem of making decisions intelligently as something that we can only understand when we understand intuition, and if you realize that intuition is something that we're not going to understand for a long time, then you realize that we shouldn't be giving computers the power to make decisions that are important." ©



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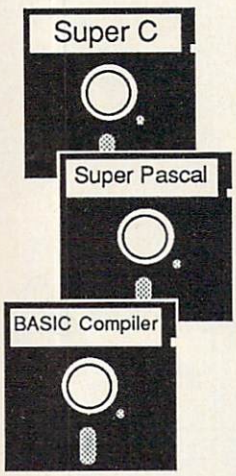

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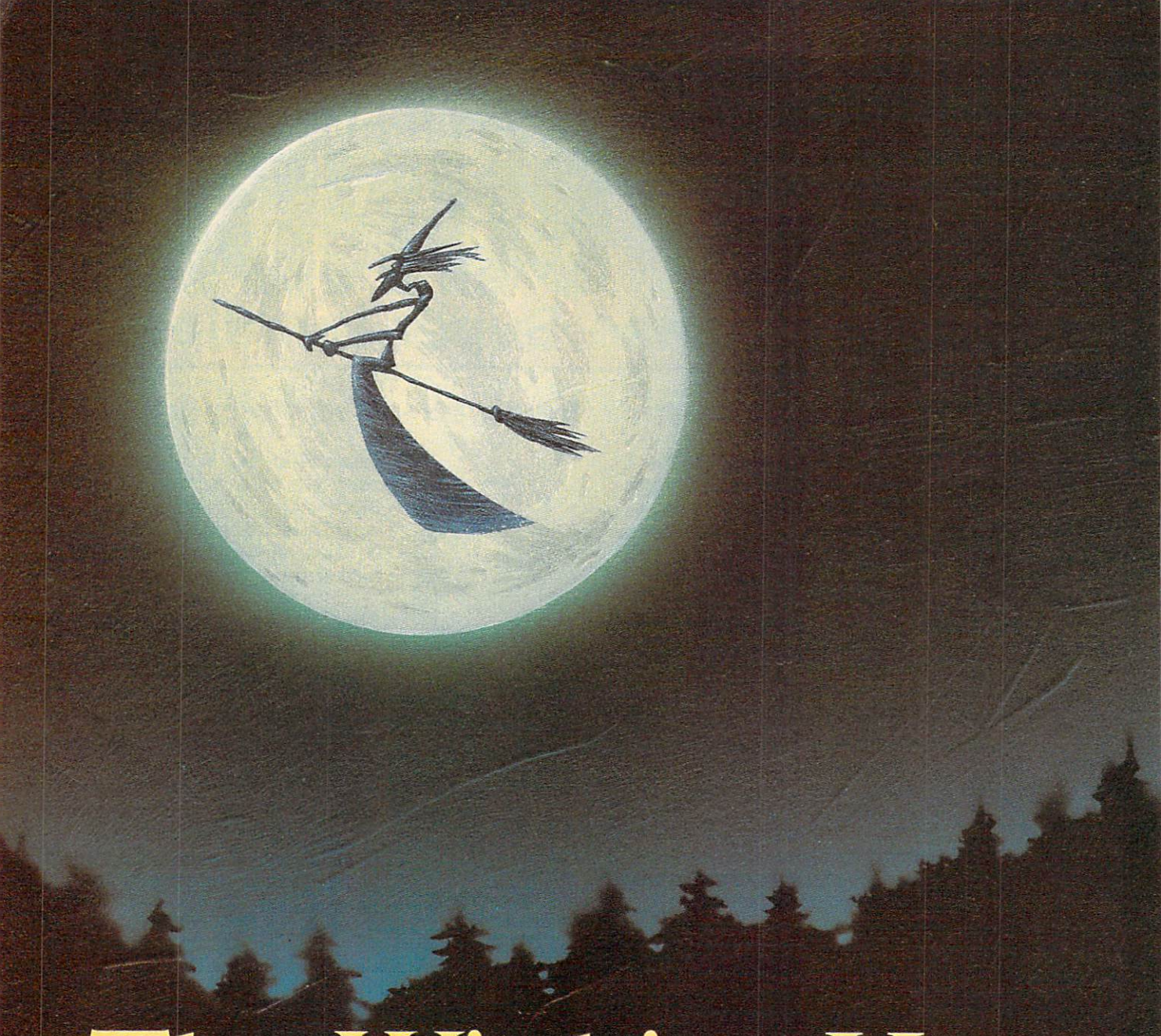

The Witching Hour

Brian Flynn

This game of skill and foresight is ideal for a bleak, stormy October night. Originally programmed for the IBM PC with color/graphics adapter and PCjr, versions have been added for the Commodore 64, expanded VIC-20, Atari 400/800, XL, and XE, TI-99/4A, and Apple II-series computers. The Commodore 64 and Atari versions require a joystick.

When autumn winds send a shiver down your spine and the witching hour draws near, there's no better entertainment than a good computer game. "The Witching Hour" is an absorbing contest of strategy based on Alquerque, a board game played in ancient Egypt and still popular in Spain today. Type in and save The Witching Hour, referring to the listing for your computer. Since every version is similar, read the general game rules below, then check the specific notes for your computer before running the program.

The Witching Hour pits broomstick-straddling witches against ethereal ghosts and is played on a board of 25 squares with 12 pieces to a side. After choosing sides, you attempt to take your opponent's players by jumping over them. You can move vertically, horizontally, or diagonally. However, certain diagonal moves are illegal (the lines between squares show where you can go) and only one square is vacant when the game begins.

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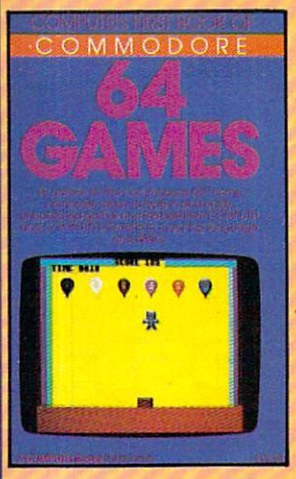

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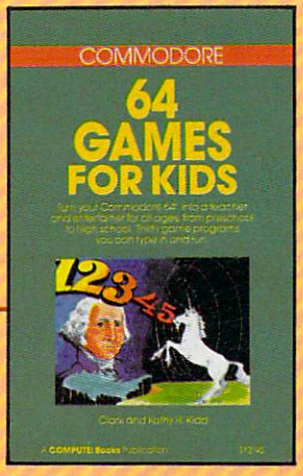

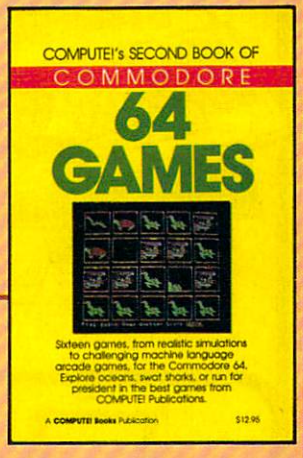

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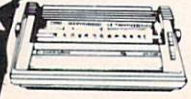

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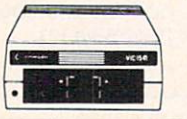

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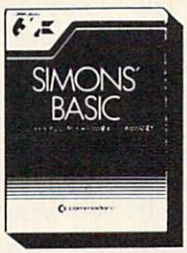

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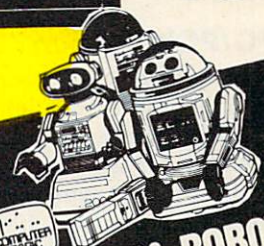

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piece removes that piece from the board. If no capture is possible, you may move any piece to an adjacent empty square. You may not pass up a capture—if it's possible to jump an opponent, you must always do so—and if the first capture puts you in position to make another, you must jump again (except in the Apple version). The computer won't let you make illegal moves.

Play ends when all the pieces from one side have been removed from the board. You can play against a friend or measure your skills against the computer (the IBM and TI versions also let you watch the computer play itself). Like other contests of strategy, The Witching Hour is simple to learn, but a challenge to master, and can be played at many different levels. Hint: It's sometimes smart to sacrifice a player to draw the opponent into a dangerous position.

IBM PC/PCjr Version

Each game square on the screen is marked with one of the letters of the alphabet. To move a piece, first type the letter for the square of the piece you want to move. Then type the letter of the square where you want to go. For instance, to move a witch from square L to square M, type L when the computer prompts you with FROM and type M when it prompts you with TO. If you press Enter without typing a letter, the computer takes that turn. Thus, to play alone against the computer, just press Enter every other turn. Press Enter on every turn to watch the computer play against itself.

Commodore 64 And VIC-20

Both Commodore versions of The Witching Hour offer a one- or two-player option when the game begins. The 64 version is played with a joystick. Plug the joystick into port 1 if you are playing alone (of course, two joysticks are needed for the two-player version). The colored box indicates which square you are on. Use the joystick to position the box on the piece you wish to move, then press the fire button: The box will change color. Now move the box to the square where you want the piece to go, and press the button again. If the move is legal, the piece appears in the new square (if not, you get to try again).

The VIC-20 game requires at least 8K memory expansion and uses keyboard controls exactly like the IBM version. Each square is marked with a letter. When the computer prompts you with FROM and TO, make your move by entering the appropriate letters. Before loading the VIC version, you must enter the following two lines in direct mode (don't add a line number, and hit RETURN after each line):

```
POKE 43,1:POKE 44,32:POKE 8192,0:NEW
POKE 36869,240:POKE 36866,150:POKE
  648,30:PRINT"{CLR}"
```

Atari Version

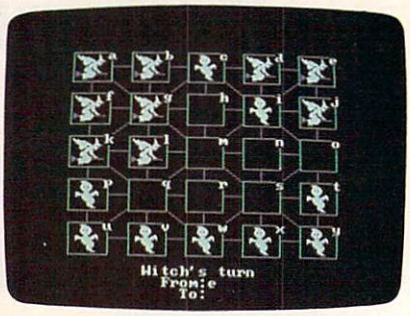
The Atari game requires a joystick (a pair for the two-player game) and is played like the Commodore 64 version. The joystick controls a colored box. Move the box over the piece you want to move, then press the fire button. After the box changes color, move it to the square where you want to put the piece, then press the button again. Player/missile graphics are used to form the witch and ghost figures, and a short machine language routine moves them quickly around the screen.

Apple Version

The Witching Hour runs on any Apple II-series computer with DOS 3.3 or ProDOS. When the program starts, you must choose between a one- or two-player game. Then the game board is drawn and play begins. The flashing box shows which square you are on, and is moved with keyboard controls. Press the I key to go up, J to go left, K for down, and L for right. Press RETURN when the box is on the piece you want to move, then move the box to the desired square and press RETURN again.

TI-99/4A Version

This program runs on any TI-99/4A computer with either console BASIC or TI Extended BASIC. Every game square is labeled with a letter, and the pieces are moved on the board with keyboard controls. The first letter you enter (when the computer prompts FROM:) designates the piece you wish to move. The second letter (entered when the computer prints TO:) designates the square you will move to. The computer signals with a beep when you try an illegal move. The game may be played by one or two players, or the computer can play both sides. Whenever you press ENTER without typing a letter, the computer takes that move.



"The Witching Hour" for IBM PC/PCjr forms ghost and witch shapes with PUT statements.

Program 1: The Witching Hour, PC/PCjr Version

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" published bimonthly in COMPUTE!.

```
NK 10 GOSUB 530:GOTO 280
OG 20 H=0:K=0:FOR A=7 TO 35:GOSU
      B 60:NEXT
GF 30 GOSUB 170:IF H<1 THEN 250
GE 40 H=0:K=0:A=T:GOSUB 60:IF H<
      1 THEN 250
HI 50 GOTO 30
DK 60 IF B(A)=0 OR B(A)=-S OR B(
      A)=2 THEN RETURN
BP 70 FOR B=0 TO D(A-7):C=A+M(B)
      :IF B(C)=S OR B(C)=2 THEN
      160
OC 80 IF B(C) THEN 120
ND 90 SC=RND(1)*.9:IF H<SC THEN
      H=SC:F=A:T=C
AE 100 IF CK=1 AND T1=C THEN L=1
      :B=7
EA 110 GOTO 160
NN 120 IF B(C+M(B)) THEN 160
JN 130 SC=1+RND(1)*.9:IF H<SC TH
      EN H=SC:F=A:T=C+M(B):K=C
MK 140 IF CK=0 THEN 160
GP 150 IF T1=C+M(B) THEN L=1:K1=
      C:B=7
GN 160 NEXT:RETURN
MD 170 B(T)=B(F):B(F)=0:A=F:GOSU
      B 760
IF 180 IF K THEN B(K)=0:A=K:GOSU
      B 760
DD 190 A=T:GOTO 760
HB 200 GOSUB 520:IF S=1 THEN PRI
      NT"The witches win!":GOTO
       220
BA 210 PRINT"The ghosts win!"
OF 220 LOCATE 23,10:PRINT"Hit a
      key to play again"
OE 230 K$=INKEY$:IF K$="" THEN 2
      30
GE 240 RUN
NI 250 S=-S:H=0:A=7
LP 260 IF A=36 THEN 200
ML 270 GOSUB 60:IF H=0 THEN A=A+
      1:GOTO 260
```

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```
GG 280 D=0:GOSUB 520:IF S=1 THEN
       PRINT"Ghost's turn":GOTO
       300
QF 290 PRINT"Witch's turn"
BM 300 PRINT TAB(16)"From:";
NJ 310 E=E+1:K$=INKEY$:IF K$=""
       THEN 310
OC 320 IF ASC(K$)=13 THEN GOSUB
       520:RANDOMIZE E:GOTO 20
GD 330 IF ASC(K$)<97 OR ASC(K$)>
       121 THEN 310
DM 340 PRINT K$:A=N(ASC(K$)-97):
       Z=A
DB 350 LOCATE 23,18:PRINT"To:";
GC 360 K$=INKEY$:IF K$="" THEN 3
       60
DD 370 IF ASC(K$)<97 OR ASC(K$)>
       121 THEN 360
JM 380 PRINT K$:T1=N(ASC(K$)-97)
GC 390 CK=1:L=0:K1=0:GOSUB 60:CK
       =0
KC 400 H=0:A=7
BH 410 IF A=36 THEN 440
MB 420 GOSUB 60:IF H>=1 THEN 440
FH 430 A=A+1:IF A<36 THEN 420
OL 440 IF D THEN 470
DN 450 IF L THEN 480
GF 460 SOUND 99,5:GOTO 280
PO 470 IF L=0 OR K1=0 THEN SOUND
       99,5:GOTO 510
DO 480 IF K1=0 AND H>=1 THEN 460
CD 490 F=Z:T=T1:K=K1:GOSUB 170:I
       F K1=0 THEN 250
AG 500 A=T:Z=A:H=0:GOSUB 60:IF H
       <1 THEN 250
JD 510 GOSUB 520:D=1:GOTO 350
MO 520 LOCATE 20,1:FOR B=1 TO 3:
       PRINT:PRINT"
                          ";:NEXT:
       LOCATE 21,14:RETURN
AE 530 KEY OFF:SCREEN 1:COLOR 0,
       1:CLS:DEFINT C,W
LI 540 DIM C1(98),W1(98),SQ(98),
       B(42),D(28),X(35),Y(35),L
       (35),XL(35),YL(35),N(28)
LP 550 LINE (50,80)-(81,103),1,B
IH 560 LOCATE 12,12: PRINT "The
       Witching Hour
DA 570 LINE (230,80)-(261,103),1
       ,B
NN 580 GET (50,80)-(81,103),SQ
II 590 FOR A=0 TO 52:READ C1(A):
       NEXT
QM 600 PUT (56,82),C1
MA 610 GET (50,80)-(81,103),C1
NC 620 FOR A=0 TO 69:READ W1(A):
       NEXT
OC 630 PUT (232,82),W1
MN 640 GET (230,80)-(261,103),W1
II 650 S=-1:FOR A=0 TO 7:READ M(
       A):NEXT
PN 660 FOR A=0 TO 28:READ D(A):N
       EXT
LD 670 B=48:C=32:D=59:E=12
QL 680 FOR A=0 TO 4:FOR F=0 TO 4
       :H=6*A+F+7:X(H)=B*F+D-15:
       Y(H)=C*A+E-11
BO 690 L(H)=G+97:N(G)=H:G=G+1:XL
       (H)=6*F+10:YL(H)=4*A+1:NE
       XT:NEXT
AF 700 CLS:FOR A=0 TO 4:LINE (D,
       C*A+E)-(B*4+D,C*A+E),2:NE
       XT
BH 710 FOR A=0 TO 4:LINE (B*A+D,
       E)-(B*A+D,C*4+E),2:NEXT
OE 720 A=0:F=0:GOSUB 740:A=B+B:G
       OSUB 740:F=C+C:GOSUB 740:
       A=0:GOSUB 740
EF 730 FOR A=0 TO 42:READ B(A):G
       OSUB 760:NEXT:RETURN
GP 740 LINE (D+A,E+F)-(2*B+D+A,2
       *C+E+F),2
FJ 750 LINE (D+A,2*C+E+F)-(2*B+D
       +A,E+F),2:RETURN
KG 760 IF B(A)=2 THEN RETURN
FP 770 IF B(A)<0 THEN PUT (X(A),
       Y(A)),W1,PSET
HN 780 IF B(A)=0 THEN PUT (X(A),
       Y(A)),SQ,PSET
KL 790 IF B(A)>0 THEN PUT (X(A),
       Y(A)),C1,PSET
JN 800 LOCATE YL(A),XL(A):PRINT
       CHR$(L(A)):RETURN
IJ 810 DATA 36,20,-256,192,0,-96
       1,0,16128,255,0,-1,192,-3
       328,-16177,0,-1,192
LN 820 DATA 16128,255,0,-1009,-1
       6381,1020,16368,-16,-1,-3
       841,-1,-769,-16336,-193
FC 830 DATA 192,16128,-3841,0,-2
       41,252,768,-769,0,16128,2
       52,0,-4033,0,16128,192,0
DJ 840 DATA -4081,0,0,255,0
QI 850 DATA 52,20,48,0,3,15360,2
       40,768,0,-241,252,-16381,
       768,-1,960,192,-256
CP 860 DATA -769,-4081,0,-241,16
       383,255,3840,4095,12543,0
       ,-1009,-1,192,768,-61
DG 870 DATA 207,0,3840,-16129,0,
       0,-12289,192,0,-253,-1636
       9,0,768,-15361,240
GP 880 DATA -32768,-253,15600,0,
       168,-193,-16369,-22016,-8
       1,-21761,-24406,16296
IL 890 DATA -1,0,-32768,-241,252
       ,0,3840,-3841,0,0,-16372
QL 900 DATA -6,1,6,-1,-5,7,5,-7
MN 910 DATA 7,3,7,3,7,0,3,7,3,7,
       3,0
DN 920 DATA 7,3,7,3,7,0,3,7,3,7,
       3,0,7,3,7,3,7
II 930 DATA 2,2,2,2,2,2,2,-1,-1,
       -1,-1,-1,2
CI 940 DATA -1,-1,-1,-1,-1,2,-1,
       -1,0,1,1,2
BJ 950 DATA 1,1,1,1,1,2,1,1,1,1,
       1,2,2,2,2,2,2,2
```

Program 2: The Witching Hour, Commodore 64 Version

Version by Kevin Mykytyn, Editorial Programmer

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" published bimonthly in COMPUTE!.

```
10 POKE 56,56:CLR:Z=1:U=53287
                          :rem 132
20 POKE53281,0:POKE53280,0:PRI
   NT"{CLR}{2 DOWN}"TAB(11)"
   {YEL}THE WITCHING HOUR
   {2 DOWN}{WHT}"         :rem 134
25 PRINTTAB(11)"JOYSTICK IN PO
   RT 1{2 DOWN}":PRINTTAB(6)"T
   WO JOYSTICKS FOR TWO PLAYER
   S                      :rem 102
30 PRINTTAB(8)"{3 DOWN}{CYN}PR
   ESS DOWN FOR ONE PLAYER":PR
   INTTAB(11)"{2 DOWN}UP FOR T
   WO PLAYERS             :rem 252
50 NP=PEEK(56321)AND3:IFNP=3TH
   EN50                    :rem 40
60 IFNP=2THEN110          :rem 195
70 PRINTTAB(9)"{3 DOWN}{GRN}PR
   ESS LEFT TO GO FIRST":PRINT
   TAB(11)"{2 DOWN}RIGHT TO GO
    SECOND"               :rem 141
80 IF(PEEK(56321)AND4)<>4THENF
   l=1:GOTO110            :rem 141
90 IF(PEEK(56321)AND8)<>8THENF
   l=-1:GOTO110           :rem 195
100 GOTO80                :rem 50
110 PRINT"{CLR}":GOSUB650:S$="
    {OFF}{HOME}{YEL}{13 RIGHT}
    ":GOTO350             :rem 68
120 H=0:K=0:FORA=7 TO 35:GOSUB
    160:NEXT              :rem 229
130 GOSUB270:IF H<1 THEN340
                          :rem 241
140 H=0:K=0:A=T:GOSUB160:IF H<
    1 THEN340             :rem 221
150 GOTO130               :rem 99
160 IF B(A)=0 OR B(A)=-S OR B(
    A)=2 THEN RETURN      :rem 140
170 FOR B=0 TO D(A-7):C=A+M(B)
    :IF B(C)=S OR B(C)=2 THEN2
    60                    :rem 237
180 IF B(C) THEN220       :rem 193
190 SC=RND(1)*.9:IF H<SC THEN
    {SPACE}H=SC:F=A:T=C
                          :rem 157
200 IF CK=1 AND T1=C THEN L=1:
    B=8                   :rem 207
210 GOTO260               :rem 100
220 IF B(C+M(B)) THEN260
                          :rem 203
230 SC=1+RND(1)*.9:IF H<SC THE
    N H=SC:F=A:T=C+M(B):K=C
                           :rem 4
240 IF CK=0 THEN260       :rem 231
250 IF T1=C+M(B) THEN L=1:K1=C
    :B=8                  :rem 70
260 NEXT:RETURN           :rem 241
270 A=F:B(T)=B(F):B(F)=0:GOSUB
    1130                  :rem 147
280 IFK THEN B(K)=0:A=K:GOSUB1
    130                   :rem 112
290 A=T:GOTO1130          :rem 165
300 GOSUB610:IF S=1 THEN PRINT
     LEFT$(S$,14)"{YEL}THE WIT
    CHES WIN!":GOTO320:rem 137
310 PRINT LEFT$(S$,15)"{YEL}TH
    E GHOSTS WIN!"        :rem 116
320 PRINT"{HOME}{DOWN}"SPC(12)
    "HIT FIREBUTTON"      :rem 79
330 WAIT56321,16,16:POKE53269,
    0:POKE53248,0:RUN     :rem 186
340 S=-S:Z=-(Z=0):H=0:A=7
                          :rem 155
345 IF A=36 THEN 300      :rem 212
347 GOSUB160:IFH=0THEN A=A+1:G
    OTO345                :rem 140
350 D=0:GOSUB610:IF NP=1 AND S
    =-1 THEN Z=1          :rem 39
360 IF F1=-1 THEN Z=1     :rem 49
370 IF NP=1 AND S=F1 THEN120
                          :rem 209
380 IF S=1 THEN PRINT S$"GHOST
    'S TURN":GOTO400      :rem 177
390 PRINT S$"WITCH'S TURN"
                          :rem 38
400 Q=3:R=3:FL=0:GOTO480
                          :rem 153
410 IF(PEEK(56320+Z)AND16)<>16
    ANDFL=0THENFL=1:GOSUB490:A
    =X:ZZ=A:POKEU,5:GOTO430
                          :rem 136
420 IF(PEEK(56320+Z)AND16)<>16
    ANDFL=1THENGOSUB490:T1=X:P
    OKEU,7:GOTO500        :rem 40
430 JX=15-(PEEK(56320+Z)AND15)
    :ONJXGOTO440,450,410,460,4
    10,410,410,470:GOTO410
                          :rem 54
440 Q=Q-1*-(Q>1):GOTO480
                          :rem 76
450 Q=Q+1*-(Q<5):GOTO480
                          :rem 77
460 R=R-1*-(R>1):GOTO480
                          :rem 81
470 R=R+1*-(R<5)          :rem 67
```

A SPECIAL APPLE-SPECIFIC PUBLICATION FROM THE PUBLISHERS OF *COMPUTE!*, *COMPUTE!'s Gazette*, AND BEST-SELLING COMPUTE! BOOKS.

The second semiannual edition of *COMPUTE!'s Apple Applications Special* goes on sale October 1, 1985.

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Editorial

COMPUTE!'s Apple Applications Special second issue features applications, purchasing decisions, tutorials, and in-depth feature articles for owners and users of Apple personal computers. There are exciting applications for business, school, and home. From software to hardware to the state of the industry, this special issue serves as a useful tool and a handy reference. The special issue includes:

Features

Apple at Ten, and What's Coming in the Next Decade: This in-depth look describes Apple's place in the industry and predicts what it will do in the future. Can the Macintosh Office concept succeed against IBM? How will Apple retain its position in the market when the newest round of computers—such as the Commodore Amiga and Atari ST—reaches homes and schools? This intriguing survey includes comments by computer industry analysts and software manufacturers.

Cruising MAUG: The Micronet Apple Users Group is probably the best connection any Apple owner can make. Available through CompuServe, MAUG lets Apple users communicate and exchange information and programs. This guide to MAUG describes just some of its features, and highlights programs from Macintosh desktop utilities to complete terminal software, all of which can be retrieved with a modem.

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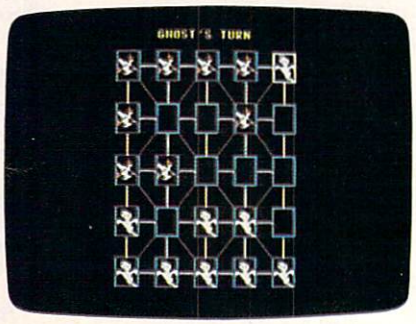
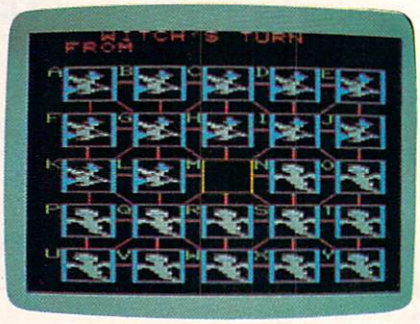
```
480 POKE 53248,R*40+47:POKE 53
    249,Q*40+26:FORTD=1TO100:N
    EXT:GOTO410          :rem 93
490 X=(Q-1)*6+(R-1)+7:WAIT5632
    0+Z,16,0:RETURN      :rem 29
500 CK=1:L=0:K1=0:GOSUB160:CK=
    0                    :rem 45
501 H=0:A=7              :rem 58
502 IFA=36THEN510        :rem 210
503 GOSUB160:IFH>=1THEN510
                         :rem 49
504 A=A+1:IFA<36THEN503:rem 42
510 IF D THEN540         :rem 49
520 IF L THEN545         :rem 63
530 GOSUB620:GOTO350     :rem 187
540 IF L=0 OR K1=0 THEN GOSUB6
    20:GOTO600           :rem 187
545 IFK1=0ANDH>=1THEN530
                         :rem 164
550 F=ZZ:T=T1:K=K1:GOSUB270:IF
     K1=0 THEN340        :rem 42
560 A=T:ZZ=A:H=0:GOSUB160:IFH<
    1 THEN340            :rem 93
600 D=1:Q=3:R=3:POKEU,5:GOTO48
    0                    :rem 109
610 PRINT"{HOME}{BLK}";:FORA1=
    1TO2:FORA2=1TO40:PRINT" ";
    :NEXTA2,A1:RETURN    :rem 15
620 POKE 54276,33:FOR TD=1 TO
    {SPACE}600:NEXT:POKE 54276
    ,32:RETURN           :rem 86
630 PRINT"{HOME}";:FORA=0TO23:
    PRINT"{7}{40 SPACES}";:NEX
    T                    :rem 232
640 RETURN               :rem 122
650 W$="{7}{RVS}@AB{DOWN}
    {3 LEFT}FGH{DOWN}{3 LEFT}L
    MN{2 UP}":G$="{7}{RVS}CDE
    {DOWN}{3 LEFT}IJK{DOWN}
    {3 LEFT}OPQ{2 UP}" :rem 18
660 BL$="{7}{OFF}O{Y}P{DOWN}
    {3 LEFT}{H} {N}{DOWN}
    {3 LEFT}L{P}@{2 UP}"
                         :rem 214
670 DIMD(28),B(42),X(35),Y(35)
                         :rem 22
680 S=-1:FORA=0TO7:READM(A):NE
    XT:FORA=0TO28:READD(A):NEX
    T                    :rem 100
690 FORA=0TO4:FORF=0TO4:H=6*A+
    F+7:X(H)=5*F+8:Y(H)=5*A+2:
    NEXTF,A:FORA=0TO42:rem 195
700 READB(A):NEXT:GOSUB770:GOS
    UB1190:FORA=0TO42:GOSUB113
    0:NEXT:RETURN        :rem 199
710 DATA -6,1,6,-1,-5,7,5,-7
                         :rem 64
720 DATA 7,3,7,3,7,0,3,7,3,7,3
    ,0                   :rem 9
730 DATA 7,3,7,3,7,0,3,7,3,7,3
    ,0,7,3,7,3,7         :rem 241
740 DATA 2,2,2,2,2,2,2,-1,-1,-
    1,-1,-1,2            :rem 43
750 DATA -1,-1,-1,-1,-1,2,-1,-
    1,0,1,1,2            :rem 34
760 DATA 1,1,1,1,1,2,1,1,1,1,1
    ,2,2,2,2,2,2,2       :rem 29
770 POKE56334,0:IFPEEK(15361)=
    192THEN830           :rem 16
780 PRINT"{CLR}{10 DOWN}"SPC(1
    5)"{YEL}PLEASE WAIT"
                         :rem 27
790 FOR A=15360 TO 15503:READ
    {SPACE}B:POKE A,B:NEXT
                         :rem 206
800 POKE 1,51:FORA=0TO1023:POK
    E14336+A,PEEK(A+53248):NEX
    T:POKE 1,55          :rem 85
810 FOR A=14952 TO 14967:READB
    :POKE A,B:NEXT       :rem 218
820 FOR A=832 TO 895:READB:POK
    EA,B:NEXT            :rem 14
830 POKE 53272,30:POKE 56334,1
    :POKE 53270,216      :rem 86
840 POKE2040,13:POKE53269,1:PO
    KE53275,0:POKE53271,1:POKE
    53287,7              :rem 88
850 FOR A=54272 TO 54295:POKE
    {SPACE}A,0:NEXT:POKE 54296
    ,15:POKE 54273,10    :rem 49
860 POKE 54277,21:RETURN
                         :rem 127
870 DATA255,192,192,192,192,19
    2,208,212            :rem 196
880 DATA255,0,0,8,8,10,42,5
                         :rem 86
890 DATA255,3,3,3,3,3,131,3
                         :rem 82
900 DATA255,192,192,193,192,19
    3,193,193            :rem 203
910 DATA255,0,0,80,84,85,153,8
    5                    :rem 43
920 DATA255,3,3,3,3,3,3,3
                         :rem 234
930 DATA213,197,197,192,193,22
    5,233,234            :rem 197
940 DATA69,84,20,84,81,80,80,8
    6                    :rem 59
950 DATA3,3,3,3,3,67,19,171
                         :rem 91
960 DATA192,192,212,213,213,20
    8,192,192            :rem 184
970 DATA85,20,20,85,85,85,85,2
    1                    :rem 54
980 DATA3,23,87,87,71,3,3,67
                         :rem 160
990 DATA232,224,193,192,192,19
    2,192,255            :rem 200
1000 DATA21,84,80,0,0,0,0,255
                         :rem 162
1010 DATA3,3,3,3,3,3,3,255
                         :rem 17
1020 DATA192,192,192,192,192,1
    92,192,255           :rem 241
1030 DATA21,5,5,5,1,0,0,255
                         :rem 65
1040 DATA67,67,3,67,83,23,3,25
    5,128,64,32,16,8,4,2,1,1,
    2,4,8,16,32,64,128:rem 44
1050 DATA255,255,255,192,0,3,1
    92,0                 :rem 179
1060 DATA3,192,0,3,192,0,3,192
                         :rem 226
1070 DATA0,3,192,0,3,192,0,3
                         :rem 119
1080 DATA192,0,3,192,0,3,192,0
                         :rem 225
1090 DATA3,255,255,255,0,0,0,0
                         :rem 223
1100 DATA0,0,0,0,0,0,0,0
                         :rem 144
1110 DATA0,0,0,0,0,0,0,0
                         :rem 145
1120 DATA0,0,0,0,0,0,0,0
                         :rem 146
1130 IFB(A)=2THENRETURN
                         :rem 166
1140 POKE781,Y(A):POKE782,X(A)
    :POKE783,0:SYS65520
                         :rem 110
1150 IFB(A)=0THENPRINTBL$;
                         :rem 64
1160 IFB(A)>0THENPRINTG$;
                         :rem 251
1170 IFB(A)<0THENPRINTW$;
                         :rem 10
1180 RETURN              :rem 170
1190 GOSUB630:PRINT"{HOME}
    {PUR}";:R$=CHR$(13):A$="
    {8 SPACES}{3 RIGHT}CC
    {3 RIGHT}CC{3 RIGHT}CC
    {3 RIGHT}CC"+R$+R$:rem 82
1200 B$="{8 SPACES}{RIGHT}-
    {RIGHT}M{2 RIGHT}-
    {2 RIGHT}N{RIGHT}B{RIGHT}
    M{2 RIGHT}B{2 RIGHT}N
    {RIGHT}B"            :rem 89
1210 B$=B$+R$+"{8 SPACES}
    {RIGHT}B{2 RIGHT}M{RIGHT}
    B{RIGHT}N{2 RIGHT}B
    {2 RIGHT}M{RIGHT}B{RIGHT}
    N{2 RIGHT}B"+R$+R$
                         :rem 152
1220 C$="{8 SPACES}{RIGHT}B
    {2 RIGHT}N{RIGHT}B{RIGHT}
    M{2 RIGHT}B{2 RIGHT}N
    {RIGHT}B{RIGHT}M{2 RIGHT}
    B"+R$                :rem 199
1230 C$=C$+"{8 SPACES}{RIGHT}B
    {RIGHT}N{2 RIGHT}B
    {2 RIGHT}M{RIGHT}B{RIGHT}
    N{2 RIGHT}B{2 RIGHT}M
    {RIGHT}B"+R$+R$      :rem 251
1240 PRINT"{CLR}{3 DOWN}"A$B$A
    $C$A$B$A$C$LEFT$(A$,28):R
    ETURN                :rem 65
```



The Commodore 64 version of "The Witching Hour" features sprite graphics.



Use keyboard controls to play "The Witching Hour" on the VIC-20.

Program 3: The Witching Hour, VIC-20 Version

Version by Kevin Martin, Editorial Programmer

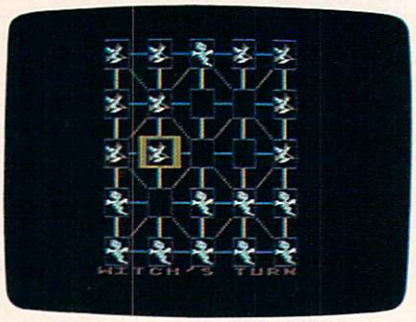
For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" published bimonthly in COMPUTE!.

```
10 Z=1:POKE36879,9:POKE36878,2
   39                    :rem 75
20 PRINT "{CLR}{YEL}{8 DOWN}
   {2 SPACES}THE WITCHING HOUR
   "                     :rem 104
30 PRINT "{2 DOWN}CHOOSE: '1'
```

```
   {SPACE}PLAYER"      :rem 157
40 PRINT SPC(8)"{2 DOWN}'2' PL
   AYERS"              :rem 102
50 GETA$:IFA$=""THEN50:rem 237
55 NP=ASC(A$)-48:IFNP<1ORNP>2T
   HEN50               :rem 130
60 IFNP=2THEN110       :rem 195
70 PRINT"{DOWN}PRESS:":PRINT"
   {2 SPACES}'1' TO GO FIRST":
   PRINT"{2 SPACES}'2' TO GO S
   ECOND"              :rem 219
75 GETA$:A=ASC(A$+CHR$(0))-48:
   IFA<1ORA>2THEN75    :rem 160
80 IFA=1THENF1=1       :rem 186
90 IFA=2THENF1=-1      :rem 233
110 PRINT"{CLR}":GOSUB650:S$="
   {OFF}{HOME}{4 RIGHT}":GOTO
   350                 :rem 161
120 H=0:K=0:FORA=7 TO 35:GOSUB
   160:NEXT            :rem 229
130 GOSUB270:IF H<1 THEN340
                       :rem 241
140 H=0:K=0:A=T:GOSUB160:IF H<
   1 THEN340           :rem 221
150 GOTO130            :rem 99
160 IF B(A)=0 OR B(A)=-S OR B(
   A)=2 THEN RETURN    :rem 140
170 FOR B=0 TO D(A-7):C=A+M(B)
   :IF B(C)=S OR B(C)=2 THEN2
   60                  :rem 237
180 IF B(C) THEN220    :rem 193
190 SC=RND(1)*.9:IF H<SC THEN
   {SPACE}H=SC:F=A:T=C
                       :rem 157
200 IF CK=1 AND T1=C THEN L=1:
   B=8                 :rem 207
210 GOTO260            :rem 100
220 IF B(C+M(B)) THEN260
                       :rem 203
230 SC=1+RND(1)*.9:IF H<SC THE
   N H=SC:F=A:T=C+M(B):K=C
                        :rem 4
240 IF CK=0 THEN260    :rem 231
250 IF T1=C+M(B) THEN L=1:K1=C
   :B=8                :rem 70
260 NEXT:RETURN        :rem 241
270 A=F:B(T)=B(F):B(F)=0:GOSUB
   1130                :rem 147
280 IFK THEN B(K)=0:A=K:GOSUB1
   130                 :rem 112
290 A=T:GOTO1130       :rem 165
300 GOSUB610:IF S=1 THEN PRINT
   "{HOME}{3 SPACES}THE WITCH
   ES WIN!":GOTO320    :rem 86
310 PRINT"{HOME}{3 SPACES}THE
   {SPACE}GHOSTS WIN!":rem 64
320 PRINT"{HOME}{DOWN}
   {5 SPACES}HIT SPACEBAR"
                       :rem 176
330 GETA$:IFA$<>" "THEN330
                       :rem 140
331 RUN                :rem 140
340 S=-S:Z=-(Z=0):H=0:A=7
                       :rem 155
345 IF A=36 THEN 300   :rem 212
347 GOSUB 160:IF H=0 THEN A=A+
   1:GOTO 345          :rem 140
350 D=0:GOSUB610:IF NP=1 AND S
   =-1 THEN Z=1        :rem 39
360 IF F1=-1 THEN Z=1  :rem 49
370 IF NP=1 AND S=F1 THEN120
                       :rem 209
380 IF S=1 THEN PRINT S$"GHOST
   'S TURN":GOTO400    :rem 177
390 PRINT S$"WITCH'S TURN"
                       :rem 38
400 PRINTS$"{DOWN}{2 LEFT}FROM
   : {LEFT}";          :rem 109
410 GETA$:A=ASC(A$+CHR$(0)):IF
   A<65ORA>89THEN410   :rem 210
420 PRINTA$;:A=N(A-65):Z=A
                        :rem 5
430 PRINT SPC(5)"TO: {LEFT}";
                       :rem 137
440 GETA$:T1=ASC(A$+CHR$(0)):I
   FT1<65ORT1>89THEN440
                       :rem 164
450 PRINTA$:T1=N(T1-65):rem 67
500 CK=1:L=0:K1=0:GOSUB160:CK=
   0                   :rem 45
501 H=0:A=7            :rem 58
502 IF A=36 THEN 510   :rem 210
503 GOSUB 160:IF H>=1 THEN 510
                       :rem 49
504 A=A+1:IF A<36 THEN 503
                       :rem 42
510 IF D THEN540       :rem 49
520 IF L THEN545       :rem 63
530 GOSUB620:GOTO350   :rem 187
540 IF L=0 OR K1=0 THEN GOSUB6
   20:GOTO570          :rem 193
545 IF K1=0 AND H>=1 THEN 530
                       :rem 164
550 F=Z:T=T1:K=K1:GOSUB270:IF
   {SPACE}K1=0 THEN340
                       :rem 208
560 A=T:Z=A:H=0:GOSUB160:IFH<1
    THEN340            :rem 3
570 GOSUB610:PRINT"{HOME}
   {2 SPACES}JUMP AGAIN (Y/N)
   ?"                  :rem 211
580 GETA$:IFA$<>"Y"ANDA$<>"N"T
   HEN580              :rem 55
590 GOSUB610:IFA$="N"THEN S=-S
   :GOTO350            :rem 252
600 D=1:PRINT"{HOME}";:GOTO430
                       :rem 171
610 PRINT"{HOME}{RED}{OFF}";:F
   ORA1=1TO3:FORA2=1TO22:PRIN
   T" ";:NEXTA2,A1:RETURN
                       :rem 46
620 POKE 36874,240:FOR TD=1 TO
    80:NEXT:POKE 36874,0:RETU
   RN                  :rem 43
630 PRINT"{HOME}";:FORA=0TO21:
   PRINT"{22 SPACES}";:NEXT
                       :rem 76
640 RETURN             :rem 122
650 W$="{BLK}{RVS}@AB{DOWN}
   {3 LEFT}FGH{DOWN}{3 LEFT}L
   MN{2 UP}":G$="{BLK}{RVS}CD
   E{DOWN}{3 LEFT}IJK{DOWN}
   {3 LEFT}OPQ{2 UP}":rem 254
660 BL$="{YEL}{OFF}O{ST}P{DOWN}
   {3 LEFT}{SG} {SM}{DOWN}
   {3 LEFT}L{S@}@{2 UP}"
                       :rem 169
670 DIMD(28),B(42),X(35),Y(35)
   ,N(28)              :rem 75
680 S=-1:FORA=0TO7:READM(A):NE
   XT:FORA=0TO28:READD(A):NEX
   T                   :rem 100
690 FORA=0TO4:FORF=0TO4:H=6*A+
   F+7:X(H)=4*F+2:Y(H)=4*A+3:
   N(G)=H:G=G+1        :rem 190
695 NEXTF,A:FORA=0TO42:rem 110
700 READB(A):NEXT:GOSUB770:GOS
   UB1190:FORA=0TO42:GOSUB113
   0:NEXT:RETURN       :rem 199
710 DATA -6,1,6,-1,-5,7,5,-7
                       :rem 64
720 DATA 7,3,7,3,7,0,3,7,3,7,3
   ,0                  :rem 9
730 DATA 7,3,7,3,7,0,3,7,3,7,3
   ,0,7,3,7,3,7        :rem 241
740 DATA 2,2,2,2,2,2,2,-1,-1,-
   1,-1,-1,2           :rem 43
750 DATA -1,-1,-1,-1,-1,2,-1,-
   1,0,1,1,2           :rem 34
760 DATA 1,1,1,1,1,2,1,1,1,1,1
   ,2,2,2,2,2,2,2      :rem 29
770 IFPEEK(7169)=192THEN830
                       :rem 29
780 PRINT"{CLR}{10 DOWN}"SPC(5
   )"{YEL}PLEASE WAIT"
                       :rem 234
790 FOR A=7168 TO 7311:READ B:
   POKE A,B:NEXT       :rem 115
800 FORA=0TO1023:POKE6144+A,PE
   EK(A+32768):NEXT    :rem 203
830 POKE 36869,254     :rem 161
860 RETURN             :rem 126
870 DATA255,192,192,192,192,19
   2,208,212           :rem 196
880 DATA255,0,0,8,8,10,42,5
                       :rem 86
890 DATA255,3,3,3,3,3,131,3
                       :rem 82
900 DATA255,192,192,193,192,19
   3,193,193           :rem 203
910 DATA255,0,0,80,84,85,153,8
   5                   :rem 43
920 DATA255,3,3,3,3,3,3,3
                       :rem 234
930 DATA213,197,197,192,193,22
   5,233,234           :rem 197
940 DATA69,84,20,84,81,80,80,8
   6                   :rem 59
950 DATA3,3,3,3,3,67,19,171
                       :rem 91
960 DATA192,192,212,213,213,20
   8,192,192           :rem 184
970 DATA85,20,20,85,85,85,85,2
   1                   :rem 54
980 DATA3,23,87,87,71,3,3,67
                       :rem 160
990 DATA232,224,193,192,192,19
   2,192,255           :rem 200
1000 DATA21,84,80,0,0,0,0,255
                       :rem 162
1010 DATA3,3,3,3,3,3,3,255
                        :rem 17
1020 DATA192,192,192,192,192,1
   92,192,255          :rem 241
1030 DATA21,5,5,5,1,0,0,255
                       :rem 65
1040 DATA67,67,3,67,83,23,3,25
   5                   :rem 44
1130 IFB(A)=2THENRETURN
                       :rem 166
1140 POKE781,Y(A):POKE782,X(A)
   :POKE783,0:SYS65520
                       :rem 110
1150 IFB(A)=0THENPRINTBL$;:RET
   URN                 :rem 90
1160 IFB(A)>0THENPRINTG$;
                       :rem 251
1170 IFB(A)<0THENPRINTW$;
                       :rem 10
1175 QS=X(A)+Y(A)*22+38400
                       :rem 103
1176 FORC1=0TO2:FORC2=0TO2:POK
   EQS+C1*22+C2,14:NEXTC2,C1
                       :rem 61
1180 RETURN            :rem 170

1190 GOSUB630:R$=CHR$(13):A$="
   {2 SPACES}{3 RIGHT}C
   {3 RIGHT}C{3 RIGHT}C
   {3 RIGHT}C"+R$+R$ :rem 81
1200 B$="{2 SPACES}{RIGHT}-
   {RIGHT}M{RIGHT}-{RIGHT}N
   {RIGHT}B{RIGHT}M{RIGHT}B
   {RIGHT}N{RIGHT}B"+R$+R$
                       :rem 39
1220 C$="{2 SPACES}{RIGHT}B
   {RIGHT}N{RIGHT}B{RIGHT}M
   {RIGHT}B{RIGHT}N{RIGHT}B
   {RIGHT}M{RIGHT}B"+R$+R$
                       :rem 244
1240 PRINT"{CLR}{PUR}{4 DOWN}"
   A$B$A$C$A$B$A$C$LEFT$(A$,
   18)                 :rem 211
1245 PRINT"{HOME}{GRN}{3 DOWN}
    ";:G=1:FORA=0TO4:IFA>0TH
```

```
     ENPRINT"{3 DOWN}":PRINT"
     {SPACE}";          :rem 194
1250 FORF=ØTO4:PRINTCHR$(G+64)
     "{3 RIGHT}";:G=G+1
                        :rem 101
1260 NEXTF,A:RETURN     :rem 213
```



The Atari version of "The Witching Hour" uses player/missile graphics and is played with a joystick.

Program 4: The Witching Hour, Atari Version

Version by Kevin Mykytyn, Editorial Programmer

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" published bimonthly in COMPUTE!.

```
BN Ø  A=PEEK(106)-16:TOP=A-16
      :CHBAS=TOP+12:DL=256*TO
      P:POKE 106,TOP:CH=CHBAS
      *256:POKE 756,CHBAS:SPR
      BAS=TOP+4
EF 1  FOR A=1536 TO 1567:READ
       B:POKE A,B:NEXT A
FL 2  DATA 160,127,169,Ø,145,
      206
IL 3  DATA 136,16,251,164,203
      ,162
IN 4  DATA 10,169,248,145,206
      ,200
LN 5  DATA 169,136,145,206,20
      Ø,202
KB 6  DATA 16,248,169,248,145
      ,206
IB 7  DATA 104,96
HP 10 FL=Ø:Z=Ø:U=704:POKE 82
      ,Ø:P1=2:P2=23
LG 20 GRAPHICS 17:POSITION 1
      ,5:PRINT #6;"THE WITCH
      ING HOUR":POSITION 7,1
      Ø:PRINT #6;"press"
IO 25 POSITION Ø,13:PRINT #6
      ;"down for one player"
      :PRINT #6:PRINT #6;" u
      p for two players"
OC 30 NP=STICK(Ø)-12:IF NP<1
       OR NP>2 THEN 30
MD 60 IF NP=2 THEN 110
NF 70 POSITION 7,17:PRINT #6
      ;"PRESS":POSITION 2,19
      :PRINT #6;"LEFT TO GO
      FIRST"
EE 75 PRINT #6;" RIGHT TO GO
       SECOND"
KO 80 IF STICK(Ø)=11 THEN F1
      =1:GOTO 110
LB 90 IF STICK(Ø)=7 THEN F1=
      -1:GOTO 110
DC 100 GOTO 80
BO 110 GRAPHICS Ø:POKE 752,1
      :IF RT=Ø THEN POSITIO
      N 3,10:PRINT "PLEASE
      WAIT, THE SCREEN WILL
       BLANK"
BN 111 FOR A=1 TO 700:NEXT A
NJ 112 GRAPHICS Ø:SL=PEEK(88
      ):SH=PEEK(89):FOR I=Ø
       TO 2:POKE DL+I,112:N
      EXT I:POKE DL+3,68:PO
      KE DL+4,SL:POKE DL+5,
      SH
FB 113 FOR I=DL+6 TO DL+27:P
      OKE I,4:NEXT I:POKE I
      ,6:I=I+1:POKE I,65:PO
      KE I+1,Ø:POKE I+2,DL/
      256
KJ 114 POKE 560,Ø:POKE 561,D
      L/256:GOSUB 650:GOTO
      350
DC 120 H=Ø:K=Ø:A=T:FOR A=7 T
      O 35:GOSUB 160:NEXT A
PB 130 GOSUB 270:IF H<1 THEN
       340
NN 140 H=Ø:K=Ø:A=T:GOSUB 160
      :IF H<1 THEN 340
GD 150 GOTO 130
IM 160 IF B(A)=Ø OR B(A)=-S
      OR B(A)=2 THEN RETURN
ON 170 FOR B=Ø TO D(A-7):C=A
      +M(B):IF B(C)=S OR B(
      C)=2 THEN 260
MB 180 IF B(C) THEN 220
MN 190 SC=RND(1)*Ø.9:IF H<SC
       THEN H=SC:F=A:T=C
MP 200 IF CK=1 AND T1=C THEN
       L=1:B=8
GE 210 GOTO 260
ML 220 IF B(C+M(B)) THEN 260
DE 230 SC=1+RND(1)*Ø.9:IF H<
      SC THEN H=SC:F=A:T=C+
      M(B):K=C
OH 240 IF CK=Ø THEN 260
EG 250 IF T1=C+M(B) THEN L=1
      :K1=C:B=8
DD 260 NEXT B:RETURN
JD 270 A=F:B(T)=B(F):B(F)=Ø:
      GOSUB 1130
HA 280 IF K THEN B(K)=Ø:A=K:
      GOSUB 1130
KF 290 A=T:GOTO 1130
JL 300 GOSUB 610:IF S=1 THEN
       POSITION P1,P2:PRINT
       " the witches win";:
      GOTO 320
OF 310 POSITION P1,P2:PRINT
       " the ghosts win";
MH 320 FOR TD=1 TO 1500:NEXT
       TD:POSITION P1,P2:PR
      INT "  hit firebutton
      ";
JO 330 IF STRIG(Ø)<>Ø THEN 3
      30
EO 335 POKE 53248,Ø:RT=1:GOT
      O 10
GO 340 S=-S:Z=(Z=Ø):H=Ø:A=7
NE 345 IF A=36 THEN 300
IM 347 GOSUB 160:IF H=Ø THEN
       A=A+1:GOTO 345
CG 350 D=Ø:GOSUB 610:IF NP=1
       AND S=-1 THEN Z=Ø
DA 360 IF F1=-1 THEN Z=Ø
NB 370 IF NP=1 AND S=F1 THEN
       120
AH 380 IF S=1 THEN POSITION
      P1,P2:PRINT "  ghosts
      {#} s turn ";:GOTO 400
HM 390 POSITION P1,P2:PRINT
       "  witch{#}s turn ";
JJ 400 Q=3:R=3:FL=Ø:GOTO 480
GC 410 IF STRIG(Z)=Ø AND FL=
      Ø THEN FL=1:GOSUB 490
      :A=X:ZZ=A:POKE U,198:
      POKE 77,Ø:GOTO 430
IF 420 IF STRIG(Z)=Ø AND FL=
      1 THEN GOSUB 490:T1=X
      :POKE U,40:GOTO 500
LJ 430 ON STICK(Z)-5 GOTO 43
      Ø,440,430,430,430,450
      ,430,460,470:GOTO 410
BP 440 Q=Q+1*(Q<5):GOTO 480
CA 450 Q=Q-1*(Q>1):GOTO 480
CE 460 R=R+1*(R<5):GOTO 480
BG 470 R=R-1*(R>1)
AC 480 POKE 203,R*20-5:POKE
      53248,Q*20+60:V=USR(1
      536):FOR TD=1 TO 30:N
      EXT TD:GOTO 410
AA 490 X=(R-1)*6+(Q-1)+7:IF
      STICK(Z)<>15 OR STRIG
      (Z)=Ø THEN 490
IC 495 RETURN
CN 500 CK=1:L=Ø:K1=Ø:GOSUB 1
      60:CK=Ø
DK 501 H=Ø:A=7
NC 502 IF A=36 THEN 510
DB 503 GOSUB 160:IF H>=1 THE
      N 510
CK 504 A=A+1:IF A<36 THEN 50
      3
DB 510 IF D THEN 540
DP 520 IF L THEN 545
LL 530 GOSUB 620:GOTO 350
IK 540 IF L=Ø OR K=Ø THEN GO
      SUB 620:GOTO 600
KE 545 IF K1=Ø AND H>=1 THEN
       530
CK 550 F=ZZ:T=T1:K=K1:GOSUB
      270:IF K1=Ø THEN 340
FN 560 A=T:ZZ=A:H=Ø:GOSUB 16
      Ø:IF H<1 THEN 340
MK 600 D=1:Q=3:R=3:POKE U,20
      Ø:GOTO 480
JD 610 POSITION P1,P2:FOR A1
      =1 TO 18:PRINT " ";:N
      EXT A1:RETURN
JF 620 SOUND 1,200,12,15:FOR
       TD=1 TO 70:NEXT TD:S
      OUND 1,Ø,Ø,Ø:RETURN
HJ 630 RETURN
FC 650 IF RT=Ø THEN DIM W$(3
      Ø),G$(30),BL$(30)
AB 655 W$="!":W$(2,2)=CHR$(3
      4):W$(3,17)="#{DOWN}
      {3 LEFT}'(){DOWN}
      {3 LEFT}-./":G$="$%&
      {DOWN}{3 LEFT}*+,
      {DOWN}{3 LEFT}Ø12":BL
      $="596{DOWN}{3 LEFT}
      {V} {B}{DOWN}{3 LEFT}
      8:7"
BC 670 IF RT=Ø THEN DIM D(28
      ),B(42),M(10),X(35),Y
      (35)
BK 680 RESTORE 710:S=-1:FOR
      A=Ø TO 7:READ T:M(A)=
      T:NEXT A:FOR A=Ø TO 2
      8:READ T:D(A)=T:NEXT
      A
LE 690 FOR A=Ø TO 4:FOR F=Ø
      TO 4:H=6*A+F+7:X(H)=5
      *F+9:Y(H)=5*A:NEXT F:
      NEXT A:FOR A=Ø TO 42
GI 700 READ T:B(A)=T:NEXT A:
      GOSUB 770:GOSUB 1190:
      FOR A=Ø TO 42:GOSUB 1
      130:NEXT A:RETURN
EA 710 DATA -6,1,6,-1,-5,7,5
      ,-7
AJ 720 DATA 7,3,7,3,7,Ø,3,7,
      3,7,3,Ø
PB 730 DATA 7,3,7,3,7,Ø,3,7,
      3,7,3,Ø,7,3,7,3,7
CL 740 DATA 2,2,2,2,2,2,2,-1
      ,-1,-1,-1,-1,2
CC 750 DATA -1,-1,-1,-1,-1,2
      ,-1,-1,Ø,1,1,2
BN 760 DATA 1,1,1,1,1,2,1,1,
      1,1,1,2,2,2,2,2,2,2
```

```
AO 770 POKE 756,CHBAS:POKE 5
       4279,SPRBAS:IF RT=1 T
       HEN 830
MM 780 FOR A=0 TO 1023:POKE
       CH+A,PEEK(57344+A):NE
       XT A
KE 790 RESTORE 870:FOR A=CH+
       8 TO CH+215:READ B:PO
       KE A,B:NEXT A:FOR A=C
       H+472 TO CH+479:READ
       B:POKE A,B:NEXT A
NI 800 FOR A=CH TO CH+7:POKE
        A,0:NEXT A
BI 810 A=SPRBAS*256+512:POKE
        207,A/256:POKE 206,A
       -256*PEEK(207)
OC 830 POKE 559,46:POKE 623,
       1:POKE 704,40:POKE 53
       256,3:POKE 53277,3:PO
       KE 708,15:POKE 709,40
       :RETURN
ME 870 DATA 255,192,192,192,
       192,192,208,212
FG 880 DATA 255,0,0,8,8,10,4
       2,5
FC 890 DATA 255,3,3,3,3,3,13
       1,3
ML 900 DATA 255,192,192,193,
       192,193,193,193
CL 910 DATA 255,0,0,80,84,85
       ,153,85
OK 920 DATA 255,3,3,3,3,3,3,
       3
MF 930 DATA 213,197,197,192,
       193,225,233,234
DL 940 DATA 69,84,20,84,81,8
       0,80,86
FL 950 DATA 3,3,3,3,3,67,19,
       171
LI 960 DATA 192,192,212,213,
       213,208,192,192
DG 970 DATA 85,20,20,85,85,8
       5,85,21
KA 980 DATA 3,23,87,87,71,3,
       3,67
MI 990 DATA 232,224,193,192,
       192,192,192,255
KC 1000 DATA 21,84,80,0,0,0,
       0,255
BB 1010 DATA 3,3,3,3,3,3,3,2
       55
PB 1020 DATA 192,192,192,192
       ,192,192,192,255
EB 1030 DATA 21,5,5,5,1,0,0,
       255
JE 1040 DATA 67,67,3,67,83,2
       3,3,255,128,128,32,3
       2,8,8,2,2,2,2,8,8,32
       ,32,128,128

PG 1041 DATA 255,192,192,192
       ,192,192,192,192,255
       ,3,3,3,3,3,3,3,3,3,3
       ,3,3,3,3,255,192,192
       ,192,192,192,192,192
       ,255
AF 1042 DATA 255,0,0,0,0,0,0,0
       ,0,0,0,0,0,0,0,0,0,255
       ,12,12,24,48,0,0,0,0
KG 1130 IF B(A)=2 THEN RETUR
       N
DM 1140 POSITION X(A),Y(A)
EA 1150 IF B(A)=0 THEN PRINT
        BL$;
PL 1160 IF B(A)>0 THEN PRINT
        G$;
AK 1170 IF B(A)<0 THEN PRINT
        W$;
KK 1180 RETURN
GO 1190 IF RT=0 THEN DIM R$(
       1)
BF 1200 R$=CHR$(155):POSITIO
       N 0,1:GOSUB 1300:GOS
       UB 1310:GOSUB 1300:G
       OSUB 1320:GOSUB 1300
       :GOSUB 1310:GOSUB 13
       00
ND 1210 GOSUB 1320:R$="":GOS
       UB 1300:RETURN
GE 1300 PRINT "{9 SPACES}
       {3 RIGHT}{2 R}
       {3 RIGHT}{2 R}
       {3 RIGHT}{2 R}
       {3 RIGHT}{2 R}";R$:R
       ETURN
CL 1310 PRINT "{9 SPACES}
       {RIGHT}{=}{RIGHT}3
       {2 RIGHT}{=}{2 RIGHT}
       4{RIGHT}{=}{RIGHT}3
       {2 RIGHT}{=}{2 RIGHT}
       4{RIGHT}{=}";R$;"
       {9 SPACES}{RIGHT}
       {=}{2 RIGHT}3{RIGHT}
       {=}{RIGHT}4{2 RIGHT}
       {=}{2 RIGHT}3{RIGHT}
       {=}{RIGHT}4{2 RIGHT}
       {=}";R$:RETURN
CM 1320 PRINT "{9 SPACES}
       {RIGHT}{=}{2 RIGHT}4
       {RIGHT}{=}{RIGHT}3
       {2 RIGHT}{=}{2 RIGHT}
       4{RIGHT}{=}{RIGHT}3
       {2 RIGHT}{=}";R$;"
       {9 SPACES}{RIGHT}
       {=}{RIGHT}4{2 RIGHT}
       {=}{2 RIGHT}3{RIGHT}
       {=}{RIGHT}4{2 RIGHT}
       {=}{2 RIGHT}3{RIGHT}
       {=}";R$:RETURN
```

Program 5: The Witching Hour, Apple II Version

Version by Kevin Martin, Editorial Programmer

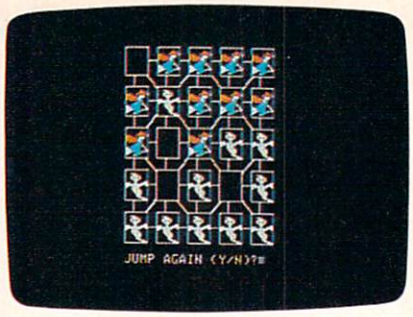
For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" published bimonthly in COMPUTE!

```
90 10 Z = 1: HOME : TEXT
6E 11 POKE 232,96: POKE 233,3: S
      CALE= 27: ROT= 0: HCOLOR=
      3
EA 20 VTAB 8: HTAB 11: PRINT "TH
      E WITCHING HOUR"
17 30 VTAB 12: HTAB 6: PRINT "PR
      ESS '1' FOR ONE PLAYER"
92 40 HTAB 12: PRINT "'2' FOR TW
      O PLAYERS"
D1 50 GET A$:NP = ASC (A$) - 48:
       IF NP < 1 OR NP > 2 THEN
      50
B6 60 IF NP = 2 THEN 110
EB 70 HTAB 5: PRINT "DO YOU WANT
       TO GO FIRST (Y/N)?";
2D 80 GET A$:F1 = 1: IF A$ < > "
      Y" AND A$ < > "N" THEN 80
3B 90 IF A$ = "N" THEN F1 = - 1
96 110 HOME : HGR : GOSUB 650: G
      OTO 350
D2 120 H = 0:K = 0: FOR A = 7 TO
       35: GOSUB 160: NEXT
BE 130 GOSUB 270: IF H < 1 THEN
       340
E5 140 H = 0:K = 0:A = T: GOSUB
       160: IF H < 1 THEN 340
97 150 GOTO 130
16 160 IF B(A) = 0 OR B(A) = - S
      OR B(A) = 2 THEN RETURN
E5 170 FOR B = 0 TO D(A - 7):C =
       A + M(B): IF B(C) = S OR
      B(C) = 2 THEN 260
F1 180 IF B(C) THEN 220
1C 190 SC = RND (0) * .9: IF H <
      SC THEN H = SC:F = A:T =
      C
A6 200 IF CK = 1 AND T1 = C THEN
      L = 1:B = 7
14 210 GOTO 260
52 220 IF B(C + M(B)) THEN 260
BF 230 SC = 1 + RND (0) * .9: IF
       H < SC THEN H = SC:F = A
      :T = C + M(B):K = C
D8 240 IF CK = 0 THEN 260
EF 250 IF T1 = C + M(B) THEN L =
       1:K1 = C:B = 7
CA 260 NEXT : RETURN
1A 270 A = F:B(T) = B(F):B(F) =
       0: GOSUB 1130
39 280 IF K THEN B(K) = 0:A = K:
       GOSUB 1130
04 290 A = T: GOTO 1130
5C 300 GOSUB 610: IF S = 1 THEN
      VTAB 21: HTAB 12: PRINT "
      THE WITCHES WIN!": GOTO 3
      20
0A 310 VTAB 21: HTAB 12: PRINT "
      THE GHOSTS WIN!"
5E 320 HTAB 10: PRINT "PRESS THE
       <SPACEBAR>"
76 330 GET A$: IF A$ < > " " THE
      N 330
AF 331 RUN
D7 340 S = - S:Z = - (Z = 0):H =
       0: FOR A = 7 TO 35: GOSU
      B 160: NEXT : IF H = 0 TH
      EN 300
44 350 D = 0: GOSUB 610: IF NP =
       1 AND S = - 1 THEN Z = 1
EA 360 IF F1 = - 1 THEN Z = 1
35 370 IF NP = 1 AND S = F1 THEN
       120
4F 380 IF S = 1 THEN VTAB 21: HT
      AB 12: PRINT "THE GHOST'S
       TURN": GOTO 400
66 390 VTAB 21: HTAB 12: PRINT "
      THE WITCH'S TURN"
E1 400 VTAB 22: HTAB 12: PRINT "
      FROM: "; CHR$ (8);
DA 410 GOSUB 1250
B7 420 PRINT A$;:A = N( ASC (A$)
      - 65):Z = A
DC 430 HTAB 25: PRINT "TO: "; CH
      R$ (8);
E0 440 GOSUB 1250
E9 450 PRINT A$;:T1 = N( ASC (A$
      ) - 65):CK = 1:L = 0:K1 =
      0: GOSUB 160:CK = 0
DB 451 H = 0:A = 7
62 452 IF A = 36 THEN 460
64 453 GOSUB 160: IF H > = 1 THE
      N 460
B1 454 A = A + 1: IF A < 36 THEN
       453
BC 460 IF D THEN 540
10 470 IF L THEN 545
96 530 GOSUB 620: GOTO 350
7D 540 IF L = 0 OR K1 = 0 THEN G
      OSUB 620: GOTO 570
A9 545 IF K1 = 0 AND H > = 1 THE
      N 530
45 550 F = Z:T = T1:K = K1: GOSU
      B 270: IF K1 = 0 THEN 340
97 560 A = T:Z = A:H = 0: GOSUB
      160: IF H < 1 THEN 340
18 570 GOSUB 610: VTAB 21: HTAB
      11: PRINT "JUMP AGAIN (Y/
      N)?";
62 580 GET A$: IF A$ < > "Y" AND
       A$ < > "N" THEN 580
31 590 GOSUB 610: IF A$ = "N" TH
      EN S = - S: GOTO 350
72 600 D = 1: VTAB 22: GOTO 430
4F 610 PRINT : VTAB 21: FOR J =
      1 TO 2: FOR I = 1 TO 40:
      PRINT " ";: NEXT I,J
1C 611 RETURN
03 620 PRINT CHR$ (7);: RETURN
14 630 HOME : RETURN
```

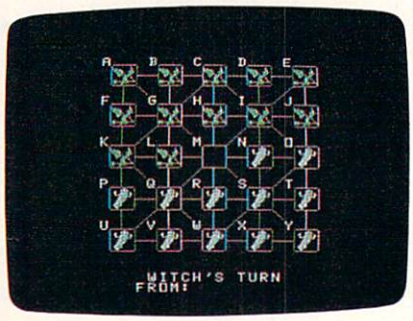
```
E7 650 DIM D(28),B(42),X(35),Y(3
      5),N(28)
DE 660 S = - 1: FOR A = 0 TO 7:
      READ M(A): NEXT : FOR A =
       0 TO 28: READ D(A): NEXT
53 670 FOR A = 0 TO 4: FOR F = 0
       TO 4:H = 6 * A + F + 7:X
      (H) = 4 * F + 11:Y(H) = 4
       * A:N(G) = H:G = G + 1:
      NEXT F,A
58 680 FOR A = 0 TO 42: READ B(A
      ): NEXT : FOR A = 0 TO 6:
       READ F: POKE 864 + A,F:
      NEXT : GOSUB 760: GOSUB 1
      190: FOR A = 0 TO 42: GOS
      UB 1130: NEXT : RETURN
C8 690 DATA -6,1,6,-1,-5,7,5,-7
44 700 DATA 7,3,7,3,7,0,3,7,3,7,
      3,0
1A 710 DATA 7,3,7,3,7,0,3,7,3,7,
      3,0,7,3,7,3,7
A9 720 DATA 2,2,2,2,2,2,2,-1,-1,
      -1,-1,-1,2
44 730 DATA -1,-1,-1,-1,-1,2,-1,
      -1,0,1,1,2
BE 740 DATA 1,1,1,1,1,2,1,1,1,1,
      1,2,2,2,2,2,2,2
38 750 DATA 1,0,4,0,44,62,0
A2 760 FOR A = 768 TO 855: READ
      F: POKE A,F: NEXT
7F 770 POKE 6,0: POKE 7,141: IF
      PEEK (191 * 256) = 76 THE
      N PRINT CHR$ (4);"PR#A$30
      0": GOTO 790
C8 780 POKE 54,0: POKE 55,3: CAL
      L 1002
E3 790 FOR A = 36352 TO 36567: R
      EAD F: POKE A,F: NEXT
18 800 RETURN
2C 1130 IF B(A) = 2 THEN RETURN
22 1140 VTAB Y(A) + 1: HTAB X(A)
45 1150 IF B(A) < 0 THEN PRINT "
      @AB": HTAB X(A): PRINT "
      FGH": HTAB X(A): PRINT "
      LMN"
30 1160 IF B(A) > 0 THEN PRINT "
      CDE": HTAB X(A): PRINT "
      IJK": HTAB X(A): PRINT "
      OPQ"
AB 1170 IF B(A) = 0 THEN PRINT "
      RST": HTAB X(A): PRINT "
      UVW": HTAB X(A): PRINT "
      XYZ"
F3 1180 RETURN
EA 1190 HCOLOR= 3
71 1200 FOR A = 11 TO 139 STEP 3
      2: HPLOT 78,A TO 190,A:
      NEXT
6A 1210 FOR A = 78 TO 190 STEP 2
      8: HPLOT A,11 TO A,139:
      NEXT
F8 1220 HPLOT 78,11 TO 194,140:
      HPLOT 194,11 TO 78,140
39 1230 HPLOT 78,76 TO 136,11 TO
       194,76 TO 136,140 TO 78
      ,76
2E 1249 RETURN
D2 1250 F = 2:T1 = 2:QS = 2
2B 1260 SCALE= QS
83 1270 XDRAW 1 AT (T1 * 4 + 10)
       * 7 - 3,(F * 4) * 8 + 25

3E 1275 PRINT CHR$ (F * 5 + T1 +
       65); CHR$ (8);
49 1280 A$ = "": IF PEEK ( - 163
      84) > 128 THEN GET A$
AF 1285 XDRAW 1 AT (T1 * 4 + 10)
       * 7 - 3,(F * 4) * 8 + 25

F8 1287 QS = QS + 5: IF QS > 27
      THEN QS = 2
EE 1290 IF A$ = "I" AND F > 0 TH
      EN F = F - 1
01 1291 IF A$ = "K" AND F < 4 TH
      EN F = F + 1
BB 1292 IF A$ = "J" AND T1 > 0 T
      HEN T1 = T1 - 1
B7 1293 IF A$ = "L" AND T1 < 4 T
      HEN T1 = T1 + 1
A2 1300 IF A$ < > CHR$ (13) THEN
       1260
40 1400 A$ = CHR$ (F * 5 + T1 +
      65): RETURN
D6 1500 DATA 216,120,133,69,134,
      70
2E 1510 DATA 132,71,166,7,10,10
44 1520 DATA 176,4,16,62,48,4
B8 1530 DATA 16,1,232,232,10,134
60 1540 DATA 27,24,101,6,133,26
A3 1550 DATA 144,2,230,27,165,40
95 1560 DATA 133,8,165,41,41,3
01 1570 DATA 5,230,133,9,162,8
3E 1580 DATA 160,0,177,26,36,50
B9 1590 DATA 48,2,73,127,164,36
47 1600 DATA 145,8,230,26,208,2
9F 1610 DATA 230,27,165,9,24,105
0F 1620 DATA 4,133,9,202,208,226
87 1630 DATA 165,69,166,70,164,7
      1
72 1640 DATA 88,76,240,253
71 1700 DATA 255,129,129,129,129
      ,129
F0 1710 DATA 139,171,255,128,128
      ,192
C8 1720 DATA 192,208,212,224,255
      ,192
6F 1730 DATA 192,192,194,202,234
      ,199
9F 1740 DATA 255,129,129,225,129
      ,225
60 1750 DATA 225,225,255,128,128
      ,135
8C 1760 DATA 159,255,238,255,255
      ,192
C9 1770 DATA 192,192,192,192,192
      ,192
8D 1780 DATA 171,171,171,169,129
      ,129
A0 1790 DATA 193,199,229,181,181
      ,165
90 1800 DATA 168,170,170,170,199
      ,193
48 1810 DATA 193,193,193,195,199
      ,204
D1 1820 DATA 129,129,159,255,255
      ,199
B9 1830 DATA 193,193,159,142,142
      ,255
C1 1840 DATA 255,191,191,255,192
      ,248
0C 1850 DATA 255,255,241,192,192
      ,192
55 1860 DATA 223,223,255,159,135
      ,129
72 1870 DATA 129,255,170,170,170
      ,168
0F 1880 DATA 170,139,128,255,216
      ,240
69 1890 DATA 255,193,192,192,192
      ,255
7E 1900 DATA 129,129,129,129,129
      ,129
13 1910 DATA 129,255,255,254,252
      ,248
17 1920 DATA 248,224,128,255,193
      ,193
47 1930 DATA 193,192,193,207,254
      ,255
39 1940 DATA 127,1,1,1,1,1
46 1950 DATA 1,1,127,0,0,0
D2 1960 DATA 0,0,0,0,127,64
25 1970 DATA 64,64,64,64,64,64
A4 1980 DATA 1,1,1,1,1,1
53 1990 DATA 1,1,0,0,0,0
20 2000 DATA 0,0,0,0,64,64
FB 2010 DATA 64,64,64,64,64,64
7B 2020 DATA 1,1,1,1,1,1
3B 2030 DATA 1,127,0,0,0,0
FF 2040 DATA 0,0,0,127,64,64
F6 2050 DATA 64,64,64,64,64,127
```



A ghost is about to be jumped in this game of "The Witching Hour" for Apple II computers.



"The Witching Hour" for the TI-99/4A works with console BASIC as well as TI Extended BASIC.

Program 6: The Witching Hour, TI-99/4A Version

Version by Patrick Parrish, Programming Supervisor

```
100 GOTO 150
110 FOR I=1 TO LEN(H$)
120 CALL HCHAR(R,C+I,ASC(
    SEG$(H$,I,1)))
130 NEXT I
140 RETURN
150 DIM B(42),D(28),N(28)
    ,X(35),Y(35)
160 GOSUB 1650
170 GOTO 930
180 H=0
190 K=0
200 FOR A=7 TO 35
210 GOSUB 310
220 NEXT A
230 GOSUB 600
240 IF H<1 THEN 860
250 H=0
260 K=0
270 A=T
280 GOSUB 310
290 IF H<1 THEN 860
300 GOTO 230
310 IF (B(A)<>0)*(B(A)<>-
    S)*(B(A)<>2)THEN 330
320 RETURN
330 FOR B5=0 TO D(A-7)
340 C=A+M(B5)
350 IF (B(C)=S)+(B(C)=2)T
    HEN 580
```

```
360 IF B(C)THEN 450
370 SC=RND#.9
380 IF H>=SC THEN 420
390 H=SC
400 F=A
410 T=C
420 IF (CK<>1)+(T1<>C)THE
    N 580
430 LL=1
440 GOTO 570
450 IF B(C+M(B5))THEN 580
460 SC=1+RND#.9
470 IF H>=SC THEN 520
480 H=SC
490 F=A
500 T=C+M(B5)
510 K=C
520 IF CK=0 THEN 580
530 K=0
540 IF T1<>C+M(B5)THEN 58
    0
550 LL=1
560 K1=C
570 B5=7
580 NEXT B5
590 RETURN
600 A=F
610 B(T)=B(F)
620 B(F)=0
630 GOSUB 2790
640 IF K=0 THEN 680
650 B(K)=0
660 A=K
670 GOSUB 2790
680 A=T
690 GOTO 2790
700 GOSUB 1630
710 IF S<>1 THEN 740
720 H$="THE WITCHES WIN!"
730 GOTO 750
740 H$="THE GHOSTS WIN!"
750 R=23
760 C=9
770 GOSUB 110
780 R=24
790 C=5
800 H$="HIT A KEY TO PLAY
    AGAIN"
810 GOSUB 110
820 CALL KEY(0,KK,SS)
830 IF SS=0 THEN 820
840 GOSUB 2190
850 GOTO 930
860 S=-S
870 H=0
880 A=7
890 IF A=36 THEN 700
900 GOSUB 310
910 A=A+1
920 IF H=0 THEN 890
930 DD=0
940 GOSUB 1630
950 IF S<>1 THEN 980
960 H$="GHOST'S TURN"
970 GOTO 990
980 H$="WITCH'S TURN"
990 R=22
1000 C=10
1010 GOSUB 110
1020 R=23
1030 C=9
1040 H$="FROM:"
1050 GOSUB 110
1060 RANDOMIZE
1070 CALL KEY(0,KK,SS)
1080 IF SS=0 THEN 1060
1090 IF KK<>13 THEN 1120
1100 GOSUB 1630
1110 GOTO 180
1120 IF (KK<65)+(KK>89)TH
    EN 1060
1130 H$=CHR$(KK)
1140 C=15
1150 GOSUB 110
1160 A=N(KK-65)
1170 Z=A
1180 H$="T0:"
1190 IF DD<>1 THEN 1210
1200 CALL HCHAR(23,10,32,
    7)
1210 R=23
1220 C=17
1230 GOSUB 110
1240 CALL KEY(0,KK,SS)
1250 IF SS=0 THEN 1240
1260 H$=CHR$(KK)
1270 C=21
1280 GOSUB 110
1290 T1=N(KK-65)
1300 CK=1
1310 LL=0
1320 K1=0
1330 GOSUB 310
1340 CK=0
1350 H=0
1360 A=7
1370 IF A=36 THEN 1420
1380 GOSUB 310
1390 IF H>=1 THEN 1420
1400 A=A+1
1410 IF A<36 THEN 1380
1420 IF DD THEN 1460
1430 IF LL THEN 1490
1440 CALL SOUND(50,220,5)
1450 GOTO 930
1460 IF (LL<>0)#(K1<>0)TH
    EN 1490
1470 CALL SOUND(50,220,5)
1480 GOTO 1600
1490 IF (K1=0)#(H>=1)THEN
     1440
1500 F=Z
1510 K=K1
1520 T=T1
1530 GOSUB 600
1540 IF K1=0 THEN 860
1550 A=T
1560 Z=A
1570 H=0
1580 GOSUB 310
1590 IF H<1 THEN 860
1600 DD=1
1610 CALL HCHAR(23,22,32)
1620 GOTO 1180
1630 CALL HCHAR(22,1,32,9
    6)
1640 RETURN
1650 FOR I=96 TO 104
1660 READ A$
1670 CALL CHAR(I,A$)
1680 NEXT I
1690 DATA 00000000000000F
    F,0101010101010101,F
    F8080808080808080
1700 DATA FF0101010101010
    1,8080808080808080,8
    040201008040201
1710 DATA 0102040810204080
    ,0101010101010101FF,F
    F0000000000000
1720 FOR I=112 TO 115
1730 READ A$
1740 CALL CHAR(I,A$)
1750 NEXT I
1760 DATA 0000A0FCFE7E3F1
    E,0000808C1C3E1CB8,1
    C0901101E1FFE302,F0E8
    C8C4E2FFE000
1770 FOR I=120 TO 123
1780 READ A$
1790 CALL CHAR(I,A$)
1800 NEXT I
1810 DATA 0001113113 1F030
    7,40F050F4F6F4FCE0,0
    70F0F1F3F3F1C08,E0C0
    8000000000000
1820 CALL CLEAR
1830 CALL COLOR(11,4,1)
1840 CALL COLOR(12,15,1)
1850 FOR I=1 TO 8
1860 CALL COLOR(I,16,1)
1870 NEXT I
1880 CALL SCREEN(2)
1890 PRINT TAB(6);"THE WI
    TCHING HOUR":::::::::
    :::::
1900 CALL HCHAR(14,8,112)
1910 CALL HCHAR(14,9,113)
1920 CALL HCHAR(15,8,114)
1930 CALL HCHAR(15,9,115)
1940 CALL HCHAR(14,23,120)
1950 CALL HCHAR(14,24,121)
1960 CALL HCHAR(15,23,122)
1970 CALL HCHAR(15,24,123)
1980 FOR A=0 TO 7
1990 READ M(A)
2000 NEXT A
2010 FOR A=0 TO 28
2020 READ D(A)
2030 NEXT A
2040 FOR A=0 TO 4
2050 FOR F=0 TO 4
2060 H=6#A+F+7
2070 X(H)=4#F+8
2080 Y(H)=4#A+2
2090 N(B)=H
2100 B=B+1
2110 NEXT F
2120 NEXT A
2130 DATA -6,1,6,-1,-5,7,
    5,-7
2140 DATA 7,3,7,3,7,0,3,7
    ,3,7,3,0
2150 DATA 7,3,7,3,7,0,3,7
    ,3,7,3,0,7,3,7,3,7
2160 DATA 2,2,2,2,2,2,2,-
    1,-1,-1,-1,-1,2
2170 DATA -1,-1,-1,-1,-1,
    2,-1,-1,0,1,1,2
2180 DATA 1,1,1,1,1,2,1,1
    ,1,1,1,2,2,2,2,2,2,2
2190 CALL COLOR(11,1,1)
2200 S=-1
2210 CALL COLOR(12,1,1)
2220 CALL COLOR(9,1,1)
2230 CALL COLOR(10,1,1)
2240 CALL CLEAR
2250 H$="...SETTING UP GA
    ME BOARD"
2260 R=23
2270 C=3
2280 GOSUB 110
2290 FOR ROW=5 TO 17 STEP
     4
2300 FOR COL=8 TO 24 STEP
     4
2310 CALL HCHAR(ROW,COL,1
    03)
2320 NEXT COL
2330 NEXT ROW
2340 FOR ROW=2 TO 18 STEP
     4
2350 FOR COL=7 TO 23 STEP
     4
2360 CALL HCHAR(ROW,COL+3
    ,100)
2370 CALL HCHAR(ROW+1,COL
    +4,99)
2380 CALL HCHAR(ROW,COL,9
    7)
2390 CALL HCHAR(ROW-1,COL
    +2,96)
2400 CALL HCHAR(ROW+1,COL
    +3,98)
2410 CALL HCHAR(ROW+2,COL
    +1,99)
```

```
2420 CALL HCHAR(ROW+2,COL
     +2,104)
2430 NEXT COL
2440 NEXT ROW
2450 FOR ROW=3 TO 19 STEP
     4
2460 CALL HCHAR(ROW,7,97)
2470 CALL HCHAR(ROW,26,10
     0)
2480 CALL HCHAR(ROW,27,32
     )
2490 NEXT ROW
2500 FOR COL=8 TO 24 STEP
     4
2510 CALL HCHAR(1,COL,96,
     2)
2520 CALL HCHAR(20,COL,10
     4)
2530 NEXT COL
2540 FOR ROW=4 TO 12 STEP
     8
2550 FOR COL=10 TO 18 STE
     P 8
2560 CALL HCHAR(ROW,COL,1
     01)
2570 CALL HCHAR(ROW,COL+5
     ,102)
2580 CALL HCHAR(ROW+1,COL
     +4,102)
2590 CALL HCHAR(ROW+4,COL
     +1,102)
2600 CALL HCHAR(ROW+5,COL
     ,102)
2610 CALL HCHAR(ROW+4,COL
     +4,101)
2620 NEXT COL
2630 NEXT ROW
2640 RESTORE 2160
2650 CALL HCHAR(23,3,32,2
     5)
2660 Q=0
2670 FOR A=0 TO 42
2680 READ B(A)
2690 GOSUB 2790
2700 IF B(A)=2 THEN 2730
2710 CALL HCHAR(Y(A)-1,X(
     A)-1,Q+65)
2720 Q=Q+1
2730 NEXT A
2740 CALL COLOR(9,14,1)
2750 CALL COLOR(10,14,1)
2760 CALL COLOR(11,4,1)
2770 CALL COLOR(12,15,1)
2780 RETURN
2790 IF B(A)<>2 THEN 2810
2800 RETURN
2810 IF B(A)<>0 THEN 2850
2820 CALL HCHAR(Y(A),X(A)
     ,32,2)
2830 CALL HCHAR(Y(A)+1,X(
     A),32,2)
2840 GOTO 2950
2850 IF B(A)>0 THEN 2910
2860 CALL HCHAR(Y(A),X(A)
     ,112)
2870 CALL HCHAR(Y(A),X(A)
     +1,113)
2880 CALL HCHAR(Y(A)+1,X(
     A),114)
2890 CALL HCHAR(Y(A)+1,X(
     A)+1,115)
2900 GOTO 2950
2910 CALL HCHAR(Y(A),X(A)
     ,120)
2920 CALL HCHAR(Y(A),X(A)
     +1,121)
2930 CALL HCHAR(Y(A)+1,X(
     A),122)
2940 CALL HCHAR(Y(A)+1,X(
     A)+1,123)
2950 RETURN                    ©
```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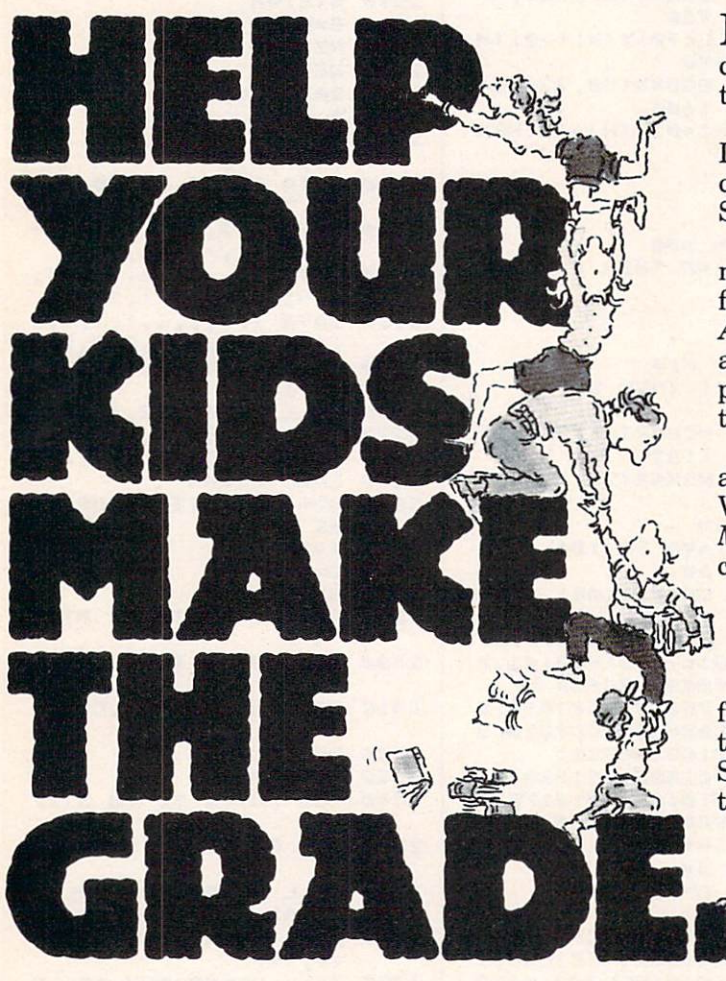

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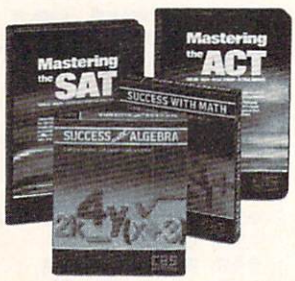

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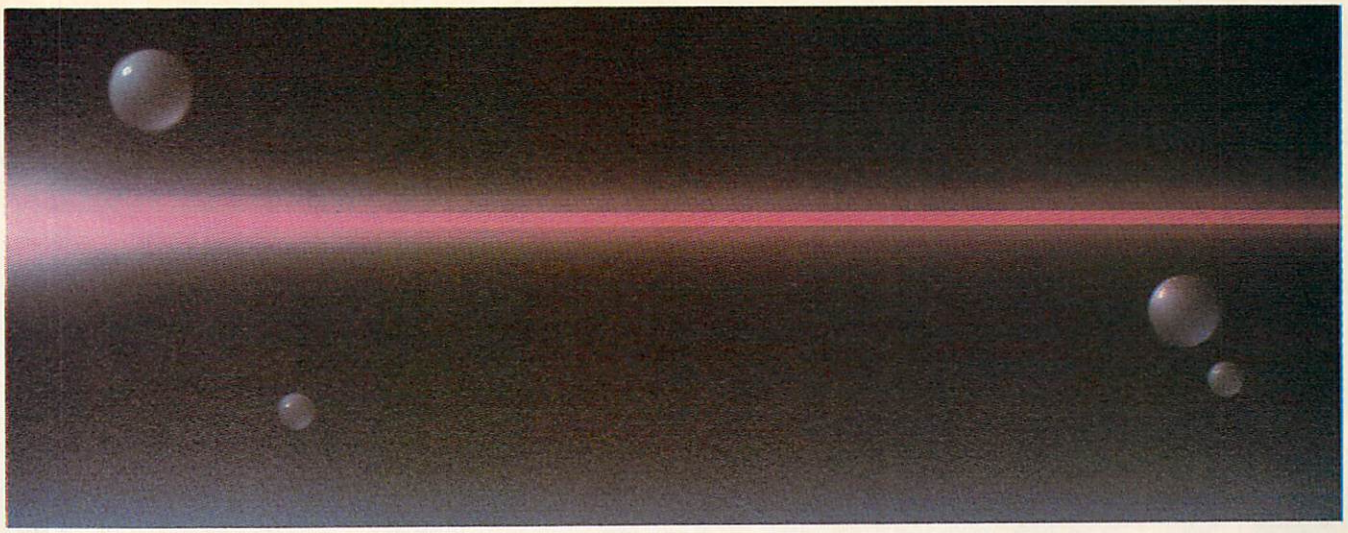

LASER BEAM

For Atari And Commodore 64

Mike Greenfield

This fast-paced arcade game is written entirely in machine language and challenges the quickest reflexes. Originally written for the Atari, the program has been adapted and enhanced for the Commodore 64. The Atari version runs on any 400, 800, XL, or XE with at least 16K RAM. Both versions require a joystick.

The Atari version of "Laser Beam" is a fast-action arcade-style game with a simple premise—you score by moving. The more you move, the more you score. You start off in an arena along with a bouncing ball. If you happen to run into the ball or the arena walls, the game ends.

But watch out! If you haven't collided with anything after half a minute or so, you advance to level 2 and a second bouncing ball appears. If you last a while longer, you reach level 3 and a *third* ball appears, and so on. Up to five balls can be bouncing around the arena simultaneously. Your score for each move depends on which level you're on. When there's one ball on the screen, you score one point per move; when there's five balls, you score five points.

In early stages of the game, you may not feel motivated to move unless you absolutely have to. So there's one additional challenge—the laser beams. Each side of the arena is guarded by a roving laser. You'll see a red indicator when the laser beam fire sequence has been activated, but the indicator tells you only where the beam will fire, not when. As the game progresses, it becomes more difficult to dodge the laser because the countdown before firing decreases.

Before starting the game, you can select one of ten difficulty options. The program automatically selects option 5. To change this, press the OPTION button. Option 9 is the slowest, and therefore the easiest; option 0 is the fastest.

To freeze the action, press the SELECT button. To continue, press SELECT and START together. After each round, press the START button to start another game. To return to the title screen, press START, SELECT, and OPTION simultaneously.

Entering The Atari Version

Programs 1 and 2 work together to load Laser Beam from BASIC. To fit the game into 16K of RAM, a single BASIC program can't hold all the DATA statements necessary for the machine language and also POKE them into memory.

Therefore, the DATA statements in Program 1 create a machine language file on disk or tape called LASERBEM.OBJ. (If LASERBEM.OBJ already exists on a disk, Program 1 recognizes this and won't create a new file.) After Program 1 runs, it automatically loads and runs Program 2, assuming you

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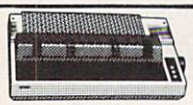

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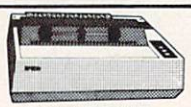

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Four bouncing balls fly wildly about the screen as the player runs for his life in the Atari version of "Laser Beam."

have saved Program 2 with the filename shown in line 220. Program 2 reads the file LASERBEM.OBJ, POKEs the machine language into memory, and then jumps to the starting address to automatically run the game.

Tape users need to make a few modifications to the programs. In Program 1, delete lines 10–90, replace the statements in line 220 with END, and change D: to C: in line 100. In Program 2, change D: to C: in line 100.

After these changes, Program 1 creates a file on tape which Program 2 can load. That means the file created by Program 1 should immediately follow Program 2 on the tape. As Program 2 reads this file, it is normal for the cassette recorder to stop and start and it reads each block.

Commodore 64 Version

Laser Beam on the Commodore 64 is considerably different from the original Atari version. The object is not just to avoid the bouncing balls, but also to grab them at certain times and stuff them into a basket.

Written entirely in machine language, Program 3 must be entered with COMPUTE!'s "MLX" utility found elsewhere in this issue. Here is the information you'll need:

Starting address: 49152
Ending address: 52699

After you've saved Laser Beam on disk or tape according to the MLX instructions, plug a joystick into port 2 and type LOAD"LASER BEAM",8,1 for disk or LOAD-"LASER BEAM",1,1 for tape (assuming you saved the program with the filename LASER BEAM, of course). Then type SYS 49152 and press RETURN.

The Highlight Zone

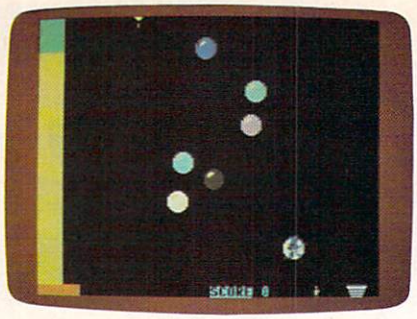
Move the joystick up or down to select the difficulty level from 0 to 9. Unlike the Atari version, 0 is the slowest and 9 is the fastest (in fact, 9 is so fast that it's almost unplayable!). The game starts when you press the fire button.

Immediately you'll see seven colored balls bouncing around the screen. At the left is a highlighted "safe zone" occupied by a small stick figure—that's you. By moving the joystick, you can maneuver your figure around the screen. But if you venture out of the safe zone and bump into a bouncing ball, you're zapped. (You get three lives per game, as indicated by the figures at the bottom of the screen.)

Your goal is to render the balls harmless, grab them one by one, and drop them into the basket in the lower-right corner. To make a ball safe to touch, you have to shoot it with the laser gun. The laser is visible along the edge of the screen. To control it, first you must move your figure into the uppermost corner of the safe zone. *The laser gun is under your control only when your figure is at this spot.* Pushing the joystick to the right moves the laser clockwise around the edge of the screen, and pushing the joystick to the left moves the laser counterclockwise around the screen. Press the fire button to activate the beam. If you push the joystick in any other direction, you'll move your figure away from the top of the safe zone, and the laser gun will no longer be under your control.

Now, you can't shoot just *any* bouncing ball with the laser to make it safe to grab. You have to shoot the ball which matches the border color of the screen. As soon as you hit the ball, it turns white. Then you can maneuver your figure out of the safe zone, grab the white ball by touching it, carry it to the basket, and drop it in by pressing the fire button. Afterward you must scurry back to the safe zone before a collision with another ball.

For example, let's say the border color is red. First you move your figure to the top of the safe zone to take control of the laser gun. Next you push the joystick right or left to



In this Commodore 64 version of "Laser Beam," the player has rendered a bouncing ball harmless by shooting it with the laser. Now he's carrying it to the basket.

aim the laser at the red ball. When you have a clear shot, press the fire button to shoot the beam. If you score a hit, the red ball turns white. Then you can push the joystick in another direction to move your figure out of the safe zone. Grab the ball, stuff it into the basket by pressing the fire button, and make your escape—all while avoiding the other bouncing balls, of course. If you succeed, the border color changes to correspond to one of the remaining balls.

You continue with the process until all the balls are safely dropped into the basket. Then another round begins.

Bouncing Chaos

Sounds simple, right? Well, it's not. There are a few complications. Suppose you fire the laser and hit a bouncing ball that *doesn't* match the border color. It turns white, too. But it *isn't* safe to grab. If you touch it, you're zapped. This becomes a real problem when you accidentally shoot several of the balls and turn them white. Only one of them is safe, and you have to remember which one. It's not easy when three or more white balls are bopping all over the place.

There is an incentive for creating this chaos, however. The number of points you get for dropping a ball in the basket doubles for each white ball on the screen. If the only white ball is the one you're grabbing, you get only 5 points. If a second ball is white, you get 10 points; if a third ball is white, you get 20 points; and so on. If all seven balls are white when you drop the first one into the basket, you score 320 points.

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Another complication is that your safe zone doesn't always stay safe for very long. After you shoot the ball that matches the border color, it begins shrinking from the bottom up. If you don't hurry out, you'll get zapped.

And there's yet another reason to move quickly: If you finish a round by dropping every ball into the basket before the horizontal bar at the bottom of the screen disappears, you get a 50-point bonus.

If all this action causes your brain to momentarily suffer a system crash, you can freeze everything by pressing and holding the SHIFT key. Press SHIFT LOCK to freeze the game for extended periods. Release SHIFT to resume play.

For instructions on entering these listings, please refer to "COMPUTE!'s Guide to Typing In Programs" published bimonthly in COMPUTE!.

Program 1: Atari Laser Beam, Main Program

```
AB 10  TRAP 90
DG 20  OPEN #1,4,0,"D:LASERBE
       M.OBJ"
CN 30  CLOSE #1
DB 40  GOTO 220
DD 90  CLOSE #1
BJ 100  OPEN #1,8,0,"D:LASERB
        EM.OBJ"
JD 110  READ NUMBEROFBYTES
ME 115  READ SUMOFBYTES
EL 120  N=0:S=0:TRAP 200
PB 130  READ A
EP 140  PUT #1,A
FE 150  N=N+1:S=S+A
GE 160  GOTO 130
FM 200  CLOSE #1
FF 210  IF N<>NUMBEROFBYTES T
        HEN PRINT "ERROR IN N
        UMBER OF BYTES ":STOP

LH 215  IF S<>SUMOFBYTES THEN
         PRINT "ERROR IN SUM
        OF BYTES ":STOP
GA 220  RUN "D:LOADLSR.BAS"
EC 10005 DATA 2440,265870
NI 10010 DATA 255,255,0,40,1
         19,45,255,255,255,2
         55
AB 10020 DATA 255,255,255,25
         5,0,0,0,255,255,0
CK 10030 DATA 0,0,24,24,24,2
         4,24,24,24,24
MM 10040 DATA 16,124,84,84,4
         0,40,40,108,0,24
GF 10050 DATA 60,126,126,60,
         24,0,83,46,0,0
HN 10060 DATA 0,0,0,0,0,0,0,
         0,0,0
DG 10070 DATA 5,15,13,169,0,
         133,203,169,51,133
DJ 10080 DATA 204,165,190,13
         3,195,165,195,201,0
         ,208
DJ 10090 DATA 1,96,162,0,160
         ,0,177,203,149,214
FF 10100 DATA 232,200,224,6,
         208,246,160,0,162,0
II 10110 DATA 134,240,134,24
         1,165,214,133,220,1
         65,215
IM 10120 DATA 133,221,165,21
         6,133,222,165,217,1
         41,116
DC 10130 DATA 40,32,0,50,169
         ,129,193,220,240,6
KF 10140 DATA 169,133,193,22
         0,208,9,32,71,41,22
         8
CG 10150 DATA 216,240,2,133,
         241,165,214,133,220
         ,165
JE 10160 DATA 215,133,221,16
         5,218,133,222,165,2
         19,141
JN 10170 DATA 157,40,32,0,50
         ,169,129,193,220,24
         0
EI 10180 DATA 6,169,133,193,
         220,208,9,32,85,41
CM 10190 DATA 228,218,240,2,
         133,241,165,214,133
         ,220
JB 10200 DATA 165,215,133,22
         1,165,216,133,222,1
         65,217
JE 10210 DATA 141,198,40,32,
         0,50,165,218,133,22
         2
JB 10220 DATA 165,219,141,21
         0,40,32,0,50,169,12
         9
AF 10230 DATA 193,220,240,6,
         169,133,193,220,208
         ,19
AF 10240 DATA 32,71,41,32,85
         ,41,133,241,169,1
NO 10250 DATA 197,240,240,40
         ,133,240,76,98,40,1
         69
CL 10260 DATA 133,145,220,16
         9,0,145,214,165,241
         ,201
CL 10270 DATA 0,240,3,32,37,
         41,165,220,133,214
IK 10280 DATA 165,221,133,21
         5,181,214,145,203,2
         32,200
BH 10290 DATA 224,6,208,246,
         32,56,41,24,169,6
AO 10300 DATA 101,203,133,20
         3,198,195,76,69,40,
         169
IL 10310 DATA 0,141,31,208,1
         62,51,160,51,136,14
         1
MM 10320 DATA 31,208,208,250
         ,202,208,245,96,162
         ,0
LP 10330 DATA 160,0,200,192,
         40,208,251,232,224,
         80
BD 10340 DATA 208,244,96,169
         ,160,197,217,240,3,
         133
FO 10350 DATA 217,96,169,176
         ,133,217,96,169,160
         ,197
BI 10360 DATA 219,240,3,133,
         219,96,169,176,133,
         219
CF 10370 DATA 96,72,162,96,1
         69,12,157,66,3,32
GD 10380 DATA 86,228,162,96,
         169,3,157,66,3,169
BN 10390 DATA 40,157,68,3,16
         9,40,157,69,3,104
NM 10400 DATA 157,75,3,41,24
         0,73,16,9,12,157
BJ 10410 DATA 74,3,32,86,228
         ,96,162,0,169,224
KH 10420 DATA 141,158,41,169
         ,48,141,161,41,189,
         0
GJ 10430 DATA 224,157,0,48,2
         32,224,0,208,245,24
MK 10440 DATA 173,161,41,105
         ,1,141,161,41,173,1
         58
ME 10450 DATA 41,105,1,141,1
         58,41,201,226,208,2
         24
EF 10460 DATA 169,48,141,244
         ,2,162,8,160,0,185
DF 10470 DATA 0,40,157,0,48,
         232,200,224,47,208
NM 10480 DATA 244,96,169,0,1
         33,203,169,52,133,2
         04
MN 10490 DATA 216,162,0,160,
         0,177,203,149,214,2
         32
CO 10500 DATA 200,224,6,208,
         246,165,214,201,255
         ,208
JG 10510 DATA 6,165,215,201,
         255,240,64,162,0,16
         0
BC 10520 DATA 0,196,217,240,
         5,177,216,76,4,42
DE 10530 DATA 165,216,145,21
         4,232,228,218,240,3
         2,24

CJ 10540 DATA 165,219,101,21
         4,133,214,169,0,101
         ,215
DB 10550 DATA 133,215,196,21
         7,240,221,169,1,101
         ,216
AL 10560 DATA 133,216,169,0,
         101,217,133,217,76,
         249
KA 10570 DATA 41,24,169,6,10
         1,203,133,203,76,21
         9
GH 10580 DATA 41,96,162,0,16
         0,0,165,206,133,220
PE 10590 DATA 165,207,133,22
         1,173,120,2,201,14,
         240
IA 10600 DATA 21,201,13,240,
         29,201,11,240,37,20
         1
HM 10610 DATA 7,240,45,169,0
         ,133,222,169,176,76
HB 10620 DATA 142,42,169,20,
         133,222,32,9,44,169
GO 10630 DATA 160,76,142,42,
         169,20,133,222,32,9
KP 10640 DATA 44,169,176,76,
         142,42,169,1,133,22
         2
BK 10650 DATA 32,9,44,169,16
         0,76,142,42,169,1
HO 10660 DATA 133,222,32,9,4
         4,169,176,76,142,42
MF 10670 DATA 141,146,42,32,
         0,50,162,0,160,0
HJ 10680 DATA 169,129,193,22
         0,240,27,169,133,19
         3,220
KD 10690 DATA 240,21,169,0,1
         45,206,169,4,145,22
         0
CO 10700 DATA 165,220,133,20
         6,165,221,133,207,1
         69,0
OD 10710 DATA 133,240,96,169
         ,255,133,240,96,169
         ,0
```

```
MP 10720 DATA 133,240,197,18
         1,240,5,198,181,76,
         12
JD 10730 DATA 43,173,10,210,
         141,45,40,24,101,18
         8
AL 10740 DATA 144,3,76,143,4
         3,173,45,40,41,31
GN 10750 DATA 201,17,16,233,
         173,45,40,41,31,168
HE 10760 DATA 165,177,133,22
         0,165,178,133,221,1
         69,20
JH 10770 DATA 192,0,240,10,1
         33,222,32,176,50,13
         6
ED 10780 DATA 192,0,208,248,
         165,220,133,179,165
         ,221
EK 10790 DATA 133,180,165,18
         9,133,181,169,193,1
         60,0
EF 10800 DATA 145,179,165,18
         1,201,0,208,119,165
         ,179
CL 10810 DATA 133,220,165,18
         0,133,221,169,2,133
         ,222
MN 10820 DATA 32,0,50,169,1,
         133,222,160,0,76
AC 10830 DATA 51,43,32,0,50,
         169,4,209,220,240
ED 10840 DATA 22,169,129,209
         ,220,240,27,169,133
         ,209
PN 10850 DATA 220,240,21,165
         ,183,145,220,32,216
         ,44
LF 10860 DATA 76,48,43,169,2
         55,133,240,169,0,13
         3
LF 10870 DATA 181,76,143,43,
         32,56,41,165,179,13
         3
AA 10880 DATA 220,165,180,13
         3,221,169,2,133,222
         ,32
AC 10890 DATA 0,50,169,1,133
         ,222,160,0,76,120
GB 10900 DATA 43,32,0,50,169
         ,129,209,220,240,13
NC 10910 DATA 169,133,209,22
         0,240,7,169,0,145,2
         20
DA 10920 DATA 76,117,43,169,
         129,145,179,96,169,
         128
AF 10930 DATA 133,203,169,51
         ,133,204,164,176,16
         2,1
GO 10940 DATA 177,203,149,17
         6,232,200,224,12,20
         8,246
EB 10950 DATA 96,165,182,141
         ,223,42,165,186,141
         ,241
NJ 10960 DATA 42,165,184,141
         ,40,43,141,109,43,1
         65
AK 10970 DATA 185,141,33,43,
         141,102,43,165,187,
         141
KH 10980 DATA 37,43,141,106,
         43,141,49,43,141,11
         8
BJ 10990 DATA 43,96,169,128,
         133,203,169,51,133,
         204
CL 11000 DATA 164,176,162,1,
         181,176,145,203,232
         ,200
MP 11010 DATA 224,12,208,246
         ,96,165,197,201,0,2
         40
BO 11020 DATA 13,201,1,240,1
         4,201,2,240,15,169
IH 11030 DATA 33,76,6,44,169
         ,0,76,6,44,169
BH 11040 DATA 11,76,6,44,169
         ,22,133,176,96,24
GB 11050 DATA 248,173,43,40,
         109,51,40,141,43,40
CP 11060 DATA 173,44,40,105,
         0,141,44,40,173,43
KD 11070 DATA 40,141,45,40,1
         69,84,141,152,44,17
         3
DM 11080 DATA 55,40,141,153,
         44,32,70,44,173,44
KD 11090 DATA 40,141,45,40,1
         69,82,141,152,44,17
         3
DK 11100 DATA 55,40,141,153,
         44,32,70,44,216,96
DE 11110 DATA 160,0,248,169,
         0,141,46,40,141,47
MC 11120 DATA 40,14,45,40,12
         1,46,40,10,14,45
PD 11130 DATA 40,121,46,40,1
         0,14,45,40,121,46
PJ 11140 DATA 40,10,14,45,40
         ,121,46,40,153,46
LB 11150 DATA 40,78,45,40,78
         ,45,40,78,45,40
DM 11160 DATA 78,45,40,200,1
         73,45,40,153,46,40
BD 11170 DATA 173,46,40,9,16
         ,141,46,40,173,47
NJ 11180 DATA 40,9,16,141,47
         ,40,160,0,185,46
AD 11190 DATA 40,153,0,0,200
         ,192,2,208,245,96
MM 11200 DATA 169,160,141,1,
         210,166,194,32,207,
         44
MM 11210 DATA 24,105,1,201,1
         76,208,241,169,14,1
         66
KL 11220 DATA 195,32,207,44,
         56,233,1,208,246,16
         9
KC 11230 DATA 175,141,1,210,
         166,196,32,207,44,5
         6
NE 11240 DATA 233,1,201,159,
         208,241,96,160,19,1
         36
8E 11250 DATA 208,253,202,20
         8,248,96,169,1,133,
         194
KC 11260 DATA 141,163,44,141
         ,192,44,169,64,141,
         0
NL 11270 DATA 210,169,4,133,
         195,169,1,133,196,1
         40
EP 11280 DATA 48,40,32,160,4
         4,172,48,40,96,169
OA 11290 DATA 2,133,194,133,
         195,133,196,169,3,1
         41
MK 11300 DATA 163,44,141,192
         ,44,165,192,141,2,2
         10
DO 11310 DATA 140,48,40,32,1
         60,44,172,48,40,96
KD 11320 DATA 173,54,40,141,
         45,40,169,94,141,15
         2
DK 11330 DATA 44,173,55,40,1
         41,153,44,32,70,44
LB 11340 DATA 216,96,169,24,
         141,196,2,169,15,14
         1
LF 11350 DATA 197,2,169,114,
         141,198,2,169,48,14
         1
HP 11360 DATA 199,2,96,165,8
         9,41,240,141,111,45
DI 11370 DATA 162,0,160,0,16
         9,0,133,203,169,55
GB 11380 DATA 133,204,177,20
         3,201,255,240,27,14
         1,108
AA 11390 DATA 45,141,113,45,
         200,177,203,141,109
         ,45
JP 11400 DATA 141,114,45,173
         ,255,255,9,0,141,25
         5
HL 11410 DATA 255,200,76,86,
         45,96,160,50,174,50
GB 11420 DATA 216,56,165,220
         ,229,222,133,220,16
         5,221
AJ 11430 DATA 229,223,133,22
         1,96,176,50,190,50,
         216
EM 11440 DATA 24,165,220,101
         ,222,133,220,165,22
         1,101
FJ 11450 DATA 223,133,221,96
         ,0,51,101,51,220,13
OL 11460 DATA 1,160,0,160,22
         1,13,1,160,20,160
AI 11470 DATA 198,14,0,160,2
         0,160,89,14,1,160
PJ 11480 DATA 20,160,16,14,0
         ,160,20,160,28,15
MI 11490 DATA 1,160,0,160,95
         ,14,1,160,20,160
ON 11500 DATA 243,13,1,160,2
         0,160,22,15,1,160
CM 11510 DATA 20,160,194,14,
         1,160,0,160,195,13
MC 11520 DATA 1,160,0,160,69
         ,14,0,160,20,160
PE 11530 DATA 39,14,1,160,20
         ,160,140,14,1,160
FH 11540 DATA 20,160,203,14,
         1,160,20,160,247,14
AL 11550 DATA 1,160,20,160,2
         55,255,255,255,255,
         255
KC 11560 DATA 128,51,182,51,
         188,13,0,0,0,17
PN 11570 DATA 66,1,2,20,176,
         150,13,0,0,0
GK 11580 DATA 15,67,20,40,1,
         176.207,13,0,0
AJ 11590 DATA 0,17,66,1,2,20
         ,160,58,15,0
FK 11600 DATA 0,0,15,67,20,4
         0,1,160,213,14
GE 11610 DATA 0,0,0,6,66,1,2
         ,20,176,0
NK 11620 DATA 52,89,52,128,1
         3,129,0,20,1,148
JF 11630 DATA 13,129,0,20,1,
         168,13,129,0,20
3B 11640 DATA 1,188,13,129,0
         ,18,20,189,13,129
MK 11650 DATA 0,18,20,206,13
         ,129,0,18,20,207
JM 11660 DATA 13,129,0,18,20
         ,36,15,129,0,20
HF 11670 DATA 1,56,15,129,0,
         20,1,76,15,129
ND 11680 DATA 0,20,1,128,13,
         0,53,5,1,76
AO 11690 DATA 15,5,53,5,1,13
         6,13,10,53,7
LC 11700 DATA 1,88,15,27,53,
         6,1,255,255,255
```

```
BE 11710 DATA 255,255,255,0,
         53,32,53,44,37,54
KK 11720 DATA 37,44,51,35,47
         ,50,37,40,41,51
HH 11730 DATA 35,47,50,37,44
         ,33,51,37,50,0
LL 11740 DATA 34,37,33,45,47
         ,48,52,41,47,46
GP 11750 DATA 0,54,41,54,157
         ,14,17,53,10,1
MM 11760 DATA 213,14,129,0,6
         ,20,214,14,129,0
KF 11770 DATA 6,20,228,14,12
         9,0,6,20,229,14
MN 11780 DATA 129,0,6,20,250
         ,14,4,0,1,1
MF 11790 DATA 255,255,255,25
         5,255,255,0,55,89,5
         5
DL 11800 DATA 1,51,7,51,13,5
         1,19,51,25,51
KL 11810 DATA 31,51,37,51,43
         ,51,49,51,55,51
LL 11820 DATA 61,51,67,51,73
         ,51,79,51,85,51
GM 11830 DATA 91,51,129,51,1
         40,51,151,51,162,51
HH 11840 DATA 173,51,1,52,7,
         52,13,52,19,52
LB 11850 DATA 25,52,31,52,37
         ,52,43,52,49,52
MB 11860 DATA 55,52,61,52,67
         ,52,73,52,79,52
FB 11870 DATA 1,54,7,54,13,5
         4,19,54,25,54
BN 11880 DATA 31,54,37,54,55
         ,40,56,40,255,255
PH 11890 DATA 0,56,167,57,16
         9,17,32,99,41,32
PP 11900 DATA 144,41,32,46,4
         5,32,210,41,32,24
BL 11910 DATA 45,56,173,44,4
         0,237,53,40,48,28
MK 11920 DATA 201,0,240,3,76
         ,42,56,56,173,52
DF 11930 DATA 40,237,43,40,1
         6,12,173,43,40,141
DL 11940 DATA 52,40,173,44,4
         0,141,53,40,173,52
NJ 11950 DATA 40,141,45,40,1
         69,146,141,152,44,1
         73
EE 11960 DATA 56,40,141,153,
         44,32,70,44,173,53
NJ 11970 DATA 40,141,45,40,1
         69,144,141,152,44,1
         73
HM 11980 DATA 56,40,141,153,
         44,32,70,44,216,169
HK 11990 DATA 0,133,197,165,
         197,201,4,240,18,32
GB 12000 DATA 231,43,32,144,
         43,169,0,133,181,32
DI 12010 DATA 208,43,230,197
         ,76,99,56,169,240,1
         33
EB 12020 DATA 206,173,56,40,
         133,207,169,255,133
         ,188
NI 12030 DATA 169,32,133,189
         ,169,1,133,190,141,
         51
AG 12040 DATA 40,169,0,133,1
         97,133,192,133,193,
         141
AE 12050 DATA 43,40,141,44,4
         0,32,28,44,24,165
AG 12060 DATA 197,105,1,201,
         4,208,7,169,0,133
LD 12070 DATA 197,76,182,56,
         133,197,32,231,43,3
         2
KM 12080 DATA 144,43,32,167,
         43,32,190,42,169,25
         5
ML 12090 DATA 197,240,240,12
         5,169,0,133,77,32,2
         08
NJ 12100 DATA 43,32,57,40,16
         9,255,197,240,240,1
         09
MO 12110 DATA 32,54,42,169,2
         55,197,240,240,100,
         32
HO 12120 DATA 249,44,169,5,2
         05,31,208,208,7,169
AC 12130 DATA 4,205,31,208,2
         08,249,165,192,133,
         220
AE 12140 DATA 165,193,133,22
         1,169,1,133,222,32,
         176
GI 12150 DATA 50,165,220,133
         ,192,165,221,133,19
         3,165
MH 12160 DATA 192,201,0,208,
         39,230,190,24,165,1
         88
BL 12170 DATA 233,10,133,188
         ,198,189,24,248,173
         ,51
DA 12180 DATA 40,105,1,141,5
         1,40,141,45,40,169
NB 12190 DATA 133,141,152,44
         ,173,56,40,141,153,
         44
DD 12200 DATA 32,70,44,216,1
         65,192,201,0,208,6
KL 12210 DATA 165,193,201,16
         ,240,3,76,164,56,16
         9
OB 12220 DATA 6,205,31,208,2
         40,3,76,82,57,76
NI 12230 DATA 0,56,169,0,205
         ,31,208,208,3,76
EB 12240 DATA 3,58,169,3,205
         ,31,208,208,226,24
GJ 12250 DATA 248,173,54,40,
         105,1,216,141,54,40
DI 12260 DATA 201,16,208,5,1
         69,0,141,54,40,173
AK 12270 DATA 54,40,141,45,4
         0,32,24,45,173,54
NM 12280 DATA 40,201,0,208,5
         ,169,1,76,144,57
CL 12290 DATA 10,10,10,10,14
         1,67,41,24,162,255
HA 12300 DATA 160,255,192,0,
         240,4,136,76,152,57
AP 12310 DATA 202,224,0,208,
         241,76,69,57,0,58
EL 12320 DATA 126,58,32,67,4
         5,32,144,41,169,18
BG 12330 DATA 32,99,41,32,14
         4,41,32,46,45,169
JH 12340 DATA 0,133,203,169,
         54,133,204,32,218,4
         1
FM 12350 DATA 169,246,133,18
         8,169,60,133,189,16
         9,44
GP 12360 DATA 133,176,169,0,
         162,0,160,0,192,255
HE 12370 DATA 240,4,200,76,4
         6,58,224,255,240,34
GH 12380 DATA 232,141,50,40,
         142,49,40,140,48,40
DO 12390 DATA 32,144,43,32,1
         67,43,32,190,42,32
HF 12400 DATA 208,43,173,50,
         40,174,49,40,172,48
JO 12410 DATA 40,76,44,58,20
         1,5,240,5,105,1
CB 12420 DATA 76,42,58,169,1
         7,32,99,41,32,144
AC 12430 DATA 41,32,46,45,32
         ,210,41,173,54,40
LA 12440 DATA 141,45,40,32,2
         4,45,76,69,57,0
```

Program 2: Atari Laser Beam, Loader Program

```
BF 100 OPEN #1,4,0,"D:LASERB
       EM.OBJ"
DM 110 GET #1,X:GET #1,X
FN 120 TRAP 210
JO 130 GET #1,STARTLO:GET #1
       ,STARTHI:GET #1,LASTL
       O:GET #1,LASTHI
JK 140 START=STARTLO+256*STA
       RTHI
IN 150 LAST=LASTLO+256*LASTH
       I
GJ 160 FOR I=START TO LAST
FA 170 GET #1,X
JF 180 POKE I,X
CC 190 NEXT I
FP 200 GOTO 130
IA 210 CLOSE #1:X=USR(14848)
GL 220 END
```

Program 3: Commodore 64 Laser Beam

Version by Kevin Mykytyn, Editorial Programmer

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

```
49152 :169,004,141,181,002,032,017
49158 :058,197,032,204,196,169,094
49164 :000,141,021,208,169,147,186
49170 :032,210,255,169,000,141,057
49176 :033,208,141,032,208,169,047
49182 :046,141,160,206,133,010,214
49188 :032,202,204,162,009,160,037
49194 :017,024,032,240,255,169,011
49200 :221,160,204,032,030,171,098
49206 :169,109,141,160,206,133,204
49212 :010,032,202,204,162,012,170
49218 :160,018,024,032,240,255,027
49224 :169,233,160,204,032,030,132
49230 :171,162,011,165,162,197,178
49236 :162,240,252,202,208,247,115
49242 :173,181,002,009,048,141,132
49248 :112,006,173,000,220,074,169
49254 :176,010,174,181,002,224,101
49260 :009,240,003,238,181,002,013
49266 :074,176,008,174,181,002,217
49272 :240,248,206,181,002,074,047
49278 :074,074,176,205,173,181,241
49284 :002,041,015,141,181,002,002
49290 :169,003,141,179,002,169,033
49296 :000,141,185,002,141,186,031
49302 :002,169,010,056,237,181,037
49308 :002,010,133,079,133,078,079
49314 :169,007,141,178,002,032,179
49320 :226,202,032,025,199,032,116
49326 :204,196,032,070,195,169,016
49332 :020,141,183,002,032,123,169
49338 :199,172,179,002,200,169,083
49344 :032,153,223,007,136,169,144
49350 :040,153,223,007,169,007,029
49356 :153,223,219,136,208,243,106
49362 :032,169,197,165,162,197,108
49368 :162,240,252,173,030,208,001
49374 :173,031,208,032,169,197,008
49380 :198,065,208,021,165,066,183
49386 :133,065,032,231,197,032,156
49392 :133,204,032,069,205,169,028
49398 :000,141,180,002,032,072,161
49404 :193,198,078,208,007,165,077
49410 :079,133,078,032,194,195,201
49416 :234,032,031,193,032,095,113
49422 :203,032,055,204,173,141,054
49428 :002,240,202,173,141,002,012
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49434 :208,251,076,225,192,162,116
49440 :002,173,031,208,074,074,082
49446 :144,026,072,189,038,208,203
49452 :041,015,201,001,240,015,045
49458 :169,001,157,038,208,202,057
49464 :228,167,208,004,169,024,088
49470 :133,169,232,104,232,224,132
49476 :009,208,222,096,165,010,010
49482 :208,003,076,022,194,173,238
49488 :180,002,208,008,032,236,234
49494 :198,144,003,076,026,194,215
49500 :165,083,208,045,174,160,159
49506 :206,189,000,207,133,170,235
49512 :133,251,189,128,207,133,121
49518 :171,133,252,189,000,206,037
49524 :133,084,074,144,008,169,216
49530 :064,133,149,169,036,208,113
49536 :006,169,066,133,149,169,052
49542 :022,133,147,133,148,133,082
49548 :083,165,084,201,035,176,116
49554 :023,201,033,208,004,169,016
49560 :001,208,002,169,040,024,084
49566 :101,170,133,170,165,171,044
49572 :105,000,133,171,208,025,038
49578 :201,036,240,004,169,001,053
49584 :208,002,169,040,133,016,232
49590 :165,170,056,229,016,133,183
49596 :170,165,171,233,000,133,036
49602 :171,165,149,160,000,145,216
49608 :170,165,170,024,105,000,066
49614 :133,253,165,171,105,212,221
49620 :133,254,169,010,160,000,170
49626 :145,253,169,128,141,011,041
49632 :212,169,008,141,012,212,210
49638 :165,147,024,105,010,010,179
49644 :141,008,212,169,129,141,012
49650 :011,212,198,147,208,030,024
49656 :165,149,201,032,240,018,029
49662 :169,032,133,149,165,251,129
49668 :133,170,165,252,133,171,004
49674 :165,148,133,147,208,006,049
49680 :169,000,133,010,133,083,032
49686 :096,076,212,194,169,000,001
49692 :133,010,166,166,189,150,074
49698 :003,201,002,144,240,173,029
49704 :080,003,240,235,173,060,063
49710 :003,201,055,208,228,173,146
49716 :070,003,201,214,144,221,137
49722 :138,072,032,023,195,104,110
49728 :170,169,026,133,169,134,097
49734 :016,162,000,160,006,185,087
49740 :040,208,041,015,201,001,070
49746 :208,001,232,136,016,243,150
49752 :189,050,197,024,109,185,074
49758 :002,141,185,002,173,186,015
49764 :002,105,000,141,186,002,024
49770 :032,120,205,166,016,169,046
49776 :255,157,070,003,206,178,213
49782 :002,208,080,169,000,141,206
49788 :021,208,169,147,032,210,143
49794 :255,162,010,160,015,024,244
49800 :032,240,255,032,213,194,078
49806 :169,032,160,205,032,030,002
49812 :171,173,183,002,010,133,052
49818 :016,010,010,024,101,016,075
49824 :170,072,169,000,032,205,040
49830 :189,104,024,109,185,002,011
49836 :141,185,002,173,186,002,093
49842 :105,000,141,186,002,169,013
49848 :000,133,162,165,162,201,239
49854 :120,208,250,104,104,238,190
49860 :181,002,076,151,192,032,062
49866 :035,195,169,001,157,150,141
49872 :003,032,255,194,096,169,189
49878 :020,141,004,212,141,011,231
49884 :212,169,010,141,005,212,201
49890 :141,012,212,173,181,002,179
49896 :010,024,105,005,141,001,006
49902 :212,169,035,141,008,212,247
49908 :169,017,141,004,212,169,188
49914 :021,141,011,212,096,230,193
49920 :168,166,168,189,249,199,115
49926 :134,167,141,032,208,160,080
49932 :007,185,249,199,153,039,076
49938 :208,136,016,247,096,162,115
49944 :024,160,005,138,032,165,036
49950 :204,202,208,247,096,169,132
49956 :020,141,011,212,173,178,003
49962 :002,024,105,004,141,001,063
49968 :212,173,179,002,010,010,122
49974 :010,010,141,008,212,169,092
49980 :012,141,012,212,169,021,115
49986 :141,011,212,096,238,160,156
49992 :206,173,160,206,201,122,116
49998 :208,017,169,000,141,160,005
50004 :206,240,010,206,160,206,088
50010 :016,005,169,121,141,160,190
50016 :206,173,160,206,168,032,017
50022 :111,195,185,000,206,032,063
50028 :156,195,096,173,155,195,054
50034 :201,025,176,005,238,155,146
50040 :195,208,005,169,005,141,075
50046 :155,195,169,020,141,011,049
50052 :212,169,007,141,001,212,106
50058 :173,155,195,141,008,212,254
50064 :169,038,141,012,212,169,117
50070 :021,141,011,212,096,005,124
50076 :072,173,160,206,168,185,096
50082 :000,207,133,004,185,128,051
50088 :207,133,005,104,160,000,009
50094 :145,004,165,004,024,105,109
50100 :000,133,004,165,005,105,080
50106 :212,133,005,169,007,145,089
50112 :004,096,162,007,189,150,032
50118 :003,240,003,076,131,196,079
50124 :189,070,003,201,055,208,162
50130 :005,254,070,003,208,007,245
50136 :201,215,208,017,222,070,125
50142 :003,189,100,003,073,001,079
50148 :157,100,003,032,138,196,086
50154 :032,183,196,189,060,003,129
50160 :201,055,208,010,189,080,215
50166 :003,208,005,254,060,003,011
50172 :208,015,189,060,003,201,160
50178 :055,208,022,189,080,003,047
50184 :240,017,222,060,003,189,227
50190 :090,003,073,001,157,090,172
50196 :003,032,138,196,032,183,092
50202 :196,189,090,003,208,029,229
50208 :189,130,003,024,125,110,101
50214 :003,157,130,003,189,060,068
50220 :003,105,000,157,060,003,116
50226 :189,080,003,105,000,157,072
50232 :080,003,076,087,196,189,175
50238 :130,003,056,253,110,003,105
50244 :157,130,003,189,060,003,098
50250 :233,000,157,060,003,189,204
50256 :080,003,233,000,157,080,121
50262 :003,189,100,003,208,021,098
50268 :189,140,003,024,125,120,181
50274 :003,157,140,003,189,070,148
50280 :003,105,000,157,070,003,186
50286 :076,131,196,189,140,003,077
50292 :056,253,120,003,157,140,077
50298 :003,189,070,003,233,000,108
50304 :157,070,003,202,240,003,035
50310 :076,196,195,096,032,167,128
50316 :196,024,125,110,003,201,031
50322 :100,144,003,157,110,003,151
50328 :032,167,196,024,125,120,048
50334 :003,201,150,144,003,157,048
50340 :120,003,096,173,027,212,027
50346 :041,031,172,027,212,016,157
50352 :005,073,255,024,105,001,127
50358 :096,169,128,141,004,212,164
50364 :169,064,141,005,212,169,180
50370 :020,141,001,212,169,129,098
50376 :141,004,212,096,032,084,001
50382 :204,169,000,133,012,133,089
50388 :010,133,083,169,009,133,237
50394 :064,141,170,002,169,128,124
50400 :141,015,212,141,018,212,195
50406 :169,008,133,065,133,066,036
50412 :169,003,141,184,002,169,136
50418 :007,141,167,002,141,168,100
50424 :002,160,007,032,042,197,176
50430 :153,110,003,032,042,197,023
50436 :153,120,003,173,027,212,180
50442 :041,001,153,090,003,173,215
50448 :027,212,041,001,153,100,038
50454 :003,136,208,225,169,009,004
50460 :133,164,169,000,133,168,027
50466 :032,255,194,169,001,133,050
50472 :063,096,173,027,212,201,044
50478 :150,144,249,096,000,005,178
50484 :010,020,040,080,120,160,226
50490 :162,255,169,003,133,002,014
50496 :169,004,133,003,169,034,064
50502 :032,154,197,230,002,165,082
50508 :002,201,040,208,243,198,200
50514 :002,169,035,032,154,197,159
50520 :165,002,024,105,040,133,045
50526 :002,165,003,105,000,133,246
50532 :003,165,002,201,231,208,142
50538 :232,169,191,133,002,169,234
50544 :036,032,154,197,198,002,219
50550 :165,002,201,154,208,243,067
50556 :230,002,169,033,032,154,232
50562 :197,165,002,056,233,040,055
50568 :133,002,165,003,233,000,160
50574 :133,003,201,003,208,234,156
50580 :169,020,141,160,206,096,172
50586 :232,157,000,206,165,002,148
50592 :157,000,207,165,003,157,081
50598 :128,207,096,169,000,133,131
50604 :016,162,007,160,014,189,208
50610 :150,003,201,002,208,018,248
50616 :173,060,003,157,060,003,128
50622 :173,070,003,157,070,003,154
50628 :173,080,003,157,080,003,180
50634 :189,080,003,074,038,016,090
50640 :189,060,003,153,000,208,053
50646 :189,070,003,153,001,208,070
50652 :136,136,202,016,208,165,059
50658 :016,141,016,208,096,169,104
50664 :000,133,006,160,000,165,184
50670 :083,240,001,096,173,000,063
50676 :220,074,176,015,174,070,205
50682 :003,224,055,240,008,206,218
50688 :070,003,162,001,134,006,120
50694 :200,074,176,015,174,070,203
50700 :003,224,215,240,008,238,172
50706 :070,003,162,002,134,006,139
50712 :200,074,176,059,032,236,033
50718 :198,176,015,208,052,072,239
50724 :169,032,032,156,195,032,140
50730 :087,195,104,076,087,198,021
50736 :174,080,003,208,007,174,182
50742 :060,003,224,025,240,027,121
50748 :072,173,060,003,056,233,145
50754 :001,141,060,003,173,080,012
50760 :003,233,000,141,080,003,020
50766 :192,000,208,004,169,003,142
50772 :133,006,104,074,176,059,124
50778 :032,236,198,176,015,208,187
50784 :052,072,169,032,032,156,097
50790 :195,032,070,195,104,076,006
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50802 :007,174,060,003,224,055,125
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52698 :000,013,013,013,013,013,027
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The Original Boston Computer Diet

Tony Roberts, Production Director

Requirements: IBM PC, PCjr, or XT with at least 128K RAM; Apple II-series computer with at least 64K RAM; or a Commodore 64/128. All versions also require a disk drive.

Discipline is a key ingredient in any weight-loss program, and that remains true with *The Original Boston Computer Diet*, a software package from Scarborough Systems.

While the program takes a conservative, balanced-diet approach to weight loss, its strengths are in the ways it helps dieters gather information about their eating habits and how it takes the drudgery out of counting calories. Before embarking on the diet, you choose one of three "counselors" who engages you in a question-and-answer session. Based on this information, the counselor sets up goals and procedures for the diet and assigns readings on nutrition and health.

The program requires about an hour a day for the first week or so, after which the daily meal planning and reporting routine takes only about 15 minutes. The program maintains seven days' worth of data for meals, and a series of charts are available to help you amass and assess information about your eating habits. The information includes statistics on the intake of various vitamins and minerals, as well as data about how your mood—from depression to elation—affects the number of calories consumed.

The heart of the program is the food planning and reporting section. Counting calories is practically effortless. As you plan future meals, the screen shows how each selection affects the number of calories in the scheduled meal as well as the balance of the weekly diet. With the touch of a key, you can tell the computer how much you ate during your last meal, and it adjusts the calorie count accordingly.

As the program builds its database of information about how you eat, it watches for and warns you of possible problems. Should your diet fall out of balance, the program might warn that your intake of calcium has been low recently, bolstering its comment with a graph or two. Another possible problem is undereating, which is as unacceptable to your counselor as pigging out.

The program can't guarantee you'll lose all the weight you hope to, but its evaluation of your eating habits, its insistence on planning and setting goals, and its readings on health and nutrition in the manual do give you the tools to help you maintain interest in your diet and develop the willpower to carry it off.

It's worth noting that the program is set up to handle the data for only one dieter at a time. A second family member who plans to take the treatment would have to obtain another copy of the program or wait until dieter No. 1 has had his fill.

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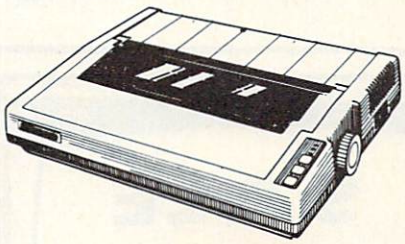

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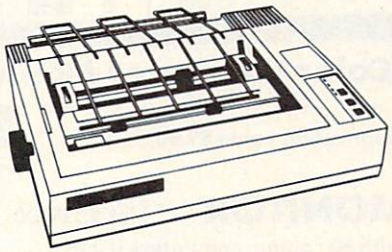

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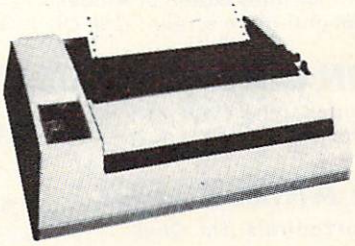

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The Writer's Tool For Atari

Robert L. Riggs

Requirements: Atari 400/800, XL, or XE computer with at least 48K RAM, a disk drive, and a printer.

Those of us who can't afford the super-expensive computers—and still need to do extensive computing—try to get multiple duty from our inexpensive machines. Games are nice. But we also want programming languages, spreadsheets, database managers, and quality word processors. As a high school teacher, I use my Atari 800XL for all kinds of time- and labor-saving jobs. Still, word processing is my primary concern and, until now, I've not found a program that was sophisticated enough for all my needs.

But *The Writer's Tool* is an extrapolation of all the other Atari word processors I've tried. Anything they can do, *The Writer's Tool* does better. Even the documentation is superior. The 166-page manual is clear and concise, and it includes an 89-page tutorial especially designed for those who are completely new to word processing, plus a 56-page reference section.

If you've tried other word processors for Atari computers, you'll find the transition to *The Writer's Tool* quite painless—and exciting. A quick once-over to note the new capabilities gets you started. Just pull out the quick reference card from the front of the manual and start typing. Then, after getting comfortable with *The Writer's Tool*, read the entire manual and try out each new feature. The tutorial section leads you, step by step, through each function. The reference section provides detail. Optimized Systems Software makes this word processor very easy to learn and use.

This doesn't mean that *The Writer's Tool* is a simplistic, third grade level word processor—not by a long shot. It starts right out with a customizer program that lets you personalize *The Writer's Tool* to suit your own purposes and tastes. You can preset the printing format, screen display, and sound options so your preferences load automatically each time you boot the program. It's great to be able to change the luminance of the characters and background colors for clearer visibility. Or you can vary the blinking speed of the cursor—which, by the way, can be either a block or an underline. You can even adjust the screen width to display more or fewer characters per line.

Printing Versatility

By presetting the printer format, you can select new default values for page length, line spacing, beginning footer line, font, single sheet option, line length, left margin, justification, and all tab stops. The selectable fonts are interesting, too. I have two Centronics printers, a 737 (equivalent to the Atari 825) and a 739 (a 737 with graphics). According to their manuals, each has only three fonts plus elongated versions. But *The Writer's Tool* can print *four* fonts. Somehow it comes up with a second proportionally spaced font that Centronics doesn't even document!

The Writer's Tool, of course, supports all the major printers: Atari, the Epsons, Gemini 10X, Prowriter/NEC 8023, Okidata 82A and 92, Comriter CR-II, Mannesman Tally Spirit 80, and so on. There's also a generic printer option, or you can insert printer control codes directly into the text. Printer problems should be practically nonexistent with *The Writer's Tool*.

Among the special printing features is something called the automatic header block. SHIFT-CTRL-H puts a

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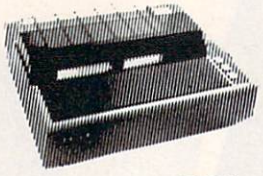

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block of easily modifiable printer commands on the screen for creating standard page formats. The block has a reverse slash that enables what OSS calls split justification. Everything to the left of the diagonal is justified to the left margin, while everything to the right is printed at the right margin. Now, printing tables of contents is a breeze.

In fact, *The Writer's Tool* offers *four* kinds of justification: (1) justification off, but word-wrap retained; (2) right justification; (3) word-wrap off; and (4) microspaced justification (for printers that offer this feature). You can insert "soft hyphens" in long words, but hyphenation occurs only if the word can be split between two print lines. Or you can insert "hard spaces" to prevent phrases like "Figure 5" from being split between lines.

Another special printing feature is a graphics driver that, with certain printers, lets you include pictures and graphs in your documents. The images can be created with a Koalapad, Atari Touch Tablet, Atari light pen, or virtually any other drawing program that uses graphics mode 7.5 or 8.

Like Atari's popular *AtariWriter* word processor, *The Writer's Tool* has a print-preview feature. But unlike *AtariWriter*, it lets you edit the previewed text as well. There's also a Print System screen that tells you, among other things, the number of words in the document. You can use the Disk I/O System screen to determine the number of characters in the document, the location of the cursor, the amount of available memory, and how much memory remains.

Typeover And Insert Modes

For entering text, *The Writer's Tool* offers both typeover and insert modes. Other word processors sometimes offer only one or the other (for example, *AtariWriter* is locked in insert mode). Even in typeover mode, you can insert characters or lines with *The Writer's Tool* by pressing CTRL-INSERT or SHIFT-INSERT. Pressing CTRL-I toggles the insert mode, denoted by a flashing vertical bar. If you don't like to watch the text ahead of the cursor repositioning itself as you insert, you can press SHIFT-CTRL-INSERT to open up a large block of empty space. After inserting your text, you can remove the unused space by pressing CTRL-J.

If you prefer one-handed cursor movement, CTRL-CAPS turns on a mode that lets you manipulate the cursor keys without simultaneously pressing CTRL. A reminder at the bottom of the screen indicates when this mode is switched on, along with the CAPS LOCK and inverse video modes.

A big kudo is deserved for the Merge command. Pressing M from the Print System menu activates the Merge System. This is a subprogram which handles the creation of database files and the merged printing of these files with template documents. That means that you can use the built-in database (or another, like *SynFile*) to automatically insert names and addresses, for example, into form letters. Don't worry. The tutorial section takes you through it step by step.

The Writer's Tool lets you move swiftly through your documents. You can quickly scroll forward or backward with CTRL-F (forward) or CTRL-R (reverse), though the text scrolls only 20 lines, so you have to glance up or down three lines to find where you left off. But it's *fast*—unlike *AtariWriter*.

A Few Criticisms

There are a few things about *The Writer's Tool* that could stand improvement. CTRL-W moves the cursor by word, which is nice, but if you move to the end of the document with CTRL-W, the cursor ends up on the last letter of the last word—so if you start typing immediately, you make a typo.

Another drawback is that *The Writer's Tool* uses OSS's DOS XL instead of Atari DOS. DOS XL supports single and double density but not the Atari 1050's one-and-a-half density. This isn't a severe handicap—since the disk isn't copy-protected, you can transfer the program to another disk that contains any DOS you like, including the latest DOS 2.5.

The provisions for tabs could be improved. A special feature of the old *Atari Word Processor* that came in handy was decimal *and* right-justified tabs. *The Writer's Tool* offers neither.

Still, I can live with a few relatively minor shortfalls. *The Writer's Tool* remains a superbly designed and executed word processor for serious use on Atari computers. OSS recently cut the price by $30 and now includes a 20,000-word spelling checker as well. And, for

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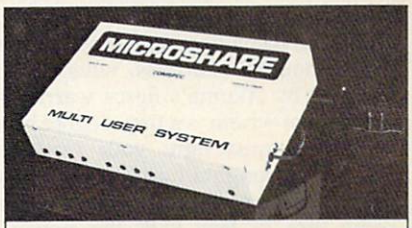

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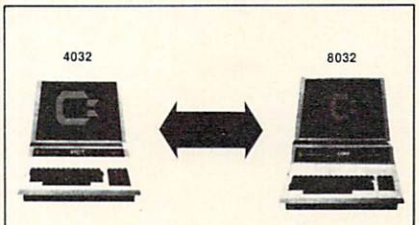

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once, "user-friendly" doesn't mean "reduced to second grade simplicity." If you've been waiting for a word processor that makes serious writing a pleasure, or if you intend to use your Atari for more than occasional writing, wait no longer. *The Writer's Tool* can take care of your word processing needs for a long time to come.

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San Jose, CA 95129
$69

Karateka

James V. Trunzo

Requirements: Apple II-series computer with at least 48K RAM and a disk drive; or a Commodore 64/128 with a disk drive. Joystick optional.

This superb action game is a nominee for the Most Underrated Program of the Year. It's a program that must be seen to be fully appreciated.

The theme of the game is simple. You, the hero, have been away from your village, studying karate under a master. Upon returning home, you find that the Japanese warlord Akuma has burned your village to the ground and kidnapped your betrothed, the lovely Mariko. Akuma has imprisoned Mariko in his mountain fortress, where she is guarded by Akuma's fierce warriors—the least of whom is a first-degree black belt. You must fight your way into Akuma's stronghold and defeat opponent after opponent until, at last, you come face to face with the powerful Akuma himself.

The Apple version of *Karateka* has by far the best animation I've seen in an Apple arcade game. The smoothness of the animation, complete with scrolling background and beautiful, full-colored details, makes the game almost as enjoyable to watch as it is to play.

Using either the keyboard or a joystick, you maneuver your persona about the screen, kicking and punching as if he were Bruce Lee. Each opponent that Akuma sends against you has a unique style. Some are better with their feet, others are better with their hands, some are balanced fighters. As the opponents become tougher (corresponding to your success), they are better able to coordinate several kicks and punches in a row. Victory comes only after you learn the best way to fight the various warriors, each easily identified by his headgear.

Warriors aren't the only obstacle between you and your beloved Mariko, however. Akuma's pet eagle attacks from time to time, and the fortress conceals deadly traps. Furthermore, even if you vanquish an opponent, you sustain injuries that accumulate as the game progresses. Of course, your opponents are always fresh!

Karateka has more to offer, too. There are delightful animated sequences showing, among other things, Mariko despairing in her call for help and Akuma sending forth his warriors. There are the sound effects that accompany a victory. There are...well, to tell you more would ruin the surprise.

Is *Karateka* the perfect game? No. When you're defeated, you must start the game from the very beginning. You don't have multiple "lives," each one picking up where the previous one left off. Considering the effort it takes to progress through Akuma's stronghold, this can get a bit frustrating. Also, there are times when you try to throw a kick but your character just stands there. It's not a bug in the program, but I'm not sure if it's poor joystick response, confused commands from trying to throw two punches and two kicks at once, or what. Still, these problems are relatively minor compared to the action and enjoyment that *Karateka* brings to the screen.

Karateka
Brøderbund Software
17 Paul Drive
San Rafael, CA 94903
$34.95

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1 Dir For IBM PC/PCjr

Arthur Leyenberger

Requirements: IBM PC/PCjr or compatible with at least 128K RAM (192K recommended), at least one disk drive, and DOS 2.0 or higher.

Whether you are a casual user or a "power user," getting the most from your IBM PC or compatible requires a thorough understanding of how to use MS-DOS. But the difference between merely understanding how to use MS-DOS and really using it effectively may be like the difference between walking around the block and competing in a marathon. With *1 Dir* from Bourbaki, Inc., you can easily run circles around MS-DOS.

1 Dir (pronounced "wonder") stands for *one directory.* Its purpose is to simplify the use of MS-DOS for anyone, regardless of their level of expertise. It is called a shell for DOS because it sits between you and the operating system, simplifying command execution.

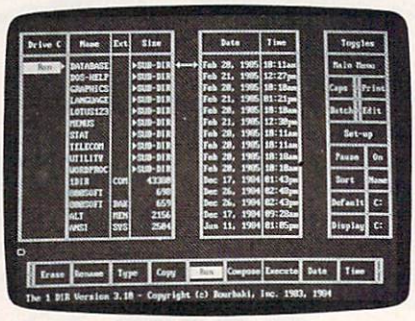
1 Dir eliminates the DOS A> prompt and the need to type filenames and commands on the command line. Instead, it presents a menu screen from which all operations take place (see photo). At the top left of the screen is an indicator showing which directory is being displayed; the indicator is blank for your root directory.

The rest of the screen is divided into seven columns grouped into three blocks. The first column displays the currently selected disk drive and a "file cursor"—a reverse video cursor used to select files from a directory. The next three columns list your filenames, extension names, and file sizes. The following two columns, grouped into another block, display the date and time that your files were last accessed. (If you like, *1 Dir* can also display system and disk statistics in this area rather than file information.) The last column, separated from the others in its own block, contains the toggle and setup information.

Sorted Directories

Toggles such as Caps, Print, Batch, and Edit are highlighted in reverse video when turned on. You can also switch the Pause option on or off, select which drive directory is displayed by default, and choose from four ways to sort file directories (by name, extension, date, and size). Each time you specify a different sort, the filenames instantly rearrange themselves on the screen.

A horizontal block at the bottom of the screen contains a "command cursor" and nine commands: Erase, Rename, Type, Copy, Run, Compose, Execute, Date, and Time. By moving the command cursor with the left and right arrow keys to the command you want, and then moving the file cursor with the up and down arrow keys to the filename you want, you can execute DOS commands without having to remember the proper syntax. Just above the horizontal command block is a one-line area for typing commands and responding to prompts.



1 Dir *makes it easier to use MS-DOS by organizing commands and file directories into menus.*

Let's say you want to erase three files on a disk whose filenames are too different to permit use of a wildcard (which is a risky way to delete files, anyhow). Rather than erasing each file separately by typing ERASE A:FILE1. EXT, with *1 Dir* you start by positioning the command cursor on the Erase command and then moving the file cursor to the first filename you want to delete. Press the + key to tag that file. Then move the file cursor to the second and third filenames and tag those files by pressing + each time. Although you've tagged the files, nothing yet has happened. When you press ENTER, the screen displays all three filenames and shows how many bytes will become available by erasing them. If you answer Y to the "Are you sure?" prompt, the files are deleted.

The Copy command works in much the same way. You point to either an individual file to be copied or tag several files. Then tell *1 Dir* where the file(s) should be copied to and press ENTER. If you want to copy an entire disk, you can tag the whole directory with one keystroke rather than tagging each file separately. You can also run programs simply by pointing to them with the file cursor, positioning the command cursor on Run, and pressing ENTER.

Batch Files, Too

One of the most powerful features of MS-DOS is its ability to execute a group of commands with a batch file. Unfortunately, creating batch files with Edlin (the MS-DOS line editor) can be difficult, especially for novices and casual users.

With *1 Dir*, creating batch files is easy. The Batch Builder feature automatically compiles a batch file as you issue the commands. In the Batch Builder mode, you can use *1 Dir* to change directories, run programs, copy and erase files, or do whatever you want. When you're done, just turn off the mode and *1 Dir* constructs the batch file.

1 Dir also lets you customize the command menu at the bottom of the screen. If you use the Batch Builder first to create your commands, it's easy to make menus corresponding to the batch files. You can put together customized shells in very little time.

I've been running *1 Dir* for several months on a two-drive AT&T 6300 computer and have found it invaluable and easy to use. Although it's very useful on a floppy disk computer, it's even better if your computer has a hard disk. I set it up on a hard disk system accessed mostly by casual users, and there's no question that this particular computer gets more use because of *1 Dir.*

A new version of *1 Dir*, promised to be available by the time you read this, is supposed to be even more powerful. It will have expanded color options, password protection, a rewritten manual, the ability to rename subdirectories, and custom commands that allow abbreviations or descriptions to be displayed rather than actual command syntax.

Whether you're a beginner or an experienced user, *1 Dir* can simplify your introduction to MS-DOS and make your time on the computer more productive.

1 Dir
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$95

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Save With Replace: Debugged At Last

Part 1

P. A. Slaymaker

Since the early days of the Commodore PET in the late 1970s, a controversy has raged over one particular disk command—Save-with-Replace. This convenient command automatically replaces an existing disk file with a new file of the same name, combining SCRATCH and SAVE in one operation. But for years, many Commodore users have shunned Save-with-Replace like poison, swearing that it contains a mysterious bug which unpredictably scrambles disks. And just as many other users contend the bug doesn't exist at all. Now, finally, there's proof: The bug does exist in the 1541 drive, it can be demonstrated, and most importantly, it can be avoided. This two-part article is the first full explanation of why the bug happens and how you can circumvent it. The author is the president of Quantum Software, which produces the Peek a Byte disk utility for the Commodore 64.

It's time to settle something once and for all: There *is* a Save-with-Replace bug! It afflicts the Disk Operating System (DOS) built into every 1541 disk drive, potentially threatening every disk on which you use the Save-with-Replace command. In this two-part series, we'll review what the Save-with-Replace bug typically does; list a program which demonstrates the bug beyond doubt; explain *why* it happens; and finally, recommend a procedure for avoiding the bug.

The Save-with-Replace command (typed as SAVE@) has been accused of scrambling, swapping, duplicating, or overwriting disk files and of messing up Block Allocation Maps (a BAM is a map on a disk which keeps track of which blocks are storing files and which are free). Many computer magazines and other authorities in the Commodore community have warned against using SAVE@. Yet other Commodore experts have never experienced problems with SAVE@ and swear the bug is an old hacker's tale. There are many anecdotes about when the bug strikes, which files are affected, and when the files or BAM will be garbled. The mystery has persisted for so long because usually the bug is not repeatable. But this article shows how to replicate the bug and explains why it is related primarily to the file length and the distribution of free blocks on the disk as determined by the BAM.

Recently some new evidence surfaced about SAVE@. In an article published in the July 1985 issue of *The Transactor*, "SAVE with Replace Exposed!!," author Charles H. Whittern showed that the bug exists under some conditions. This article made some observations on files likely to be affected and listed a program which repeatedly loaded and saved files using SAVE@. Afterward, an examination of the disk showed some files to be scrambled. Unfortunately, no details of the file configurations were given, and the editors admitted the bug had them baffled—but at least the problem was recognized, a first step.

Our investigation shows that the bug usually occurs when the drive number has not been specified on previous drive operations, such as loading a file or listing a directory. In other words, typing LOAD"filename",8 or LOAD"$",8 instead of LOAD"0:filename",8 or LOAD"0:$",8 sets up conditions for the bug. The drive number 0 should be specified in disk commands because, as we'll explain later, *the SAVE@ bug is related to the phantom software drive 1 in the 1541.* In addition, the bug tends to bite disks on which many files have been scratched and rewritten. This leaves gaps on the disk so that a file is scattered over many tracks. These gaps do not normally cause a problem if you specify the drive number in disk commands.

Therefore, the key to avoiding the SAVE@ bug is to always specify drive 0 when performing any disk drive function, or to always reset the drive before any SAVE@ operation. Resetting the drive requires either turning the drive off and then on, or sending a reset command (OPEN15,8,15,"UJ").

Demonstrating The Bug

At this point, some of you might be skeptical that the SAVE@ bug really exists. To prove that it does, the accompanying program formats a new disk with the single file "SAVE@ DEMO" and alters the BAM to simulate a partially used disk with a gap due to scratched files. Follow these instructions carefully:

COMPUTE! Back Issues

Here are some of the applications, tutorials, and games from available back issues of COMPUTE!. Each issue contains much, much more than there's space here to list, but here are some highlights:

May 1981: Named GOSUB/GOTO in Applesoft, Generating Lower Case Text on Apple II, Copy Atari Screens to the Printer, Disk Directory Printer for Atari, Realtime Clock on Atari, PET BASIC Delete Utility, PET Calculated Bar Graphs, Running 40 Column Programs on a CBM 8032, A Fast Visible Memory Dump, Cassette Filing System, Getting To A Machine Language Program, Epidemic Simulation.

June 1981: Computer Using Educators (CUE) on Software Pricing, Apple II Hires Character Generator, Ever Expanding Apple Power, Color Burst for Atari, Mixing Atari Graphics Modes 0 and 8, Relocating PET BASIC Programs, An Assembler In BASIC for PET, Quadra PET: Multitasking?, Mapping Unknown Machine Language, RAM/ROM Memory, Keeping TABs on a Printer.

July 1981: Home Heating and Cooling, Animating Integer BASIC Lores Graphics, The Apple Hires Shape Writer, Adding a Voice Track to Atari Programs, Machine Language Atari Joystick Driver, Four Screen Utilities for the PET, Saving Machine Language Programs on PET Tape Headers, Commodore ROM Systems, Using TAB, SPC, And LEN.

August 1981: Minimize Code and Maximize Speed, Apple Disk Motor Control, A Cassette Tape Monitor for the Apple, Easy Reading of the Atari Joystick, Blockade Game for the Atari, Atari Sound Utility, The CBM "Fat 40," Keyword for PET, CBM/PET Loading, Chaining, and Overlaying, Adding A Programmable Sound Generator, Converting PET BASIC Programs To ASCII Files.

October 1981: Automatic DATA Statements for CBM and Atari, VIC News, Undeletable Lines on Apple, PET, and VIC; Budgeting on the Apple, Atari Cassette Boot-tapes, Atari Variable Name Utility, Atari Program Library, Train Your PET to Run VIC Programs, Interface a BSR Remote Control System to PET, A General Purpose BCD to Binary Routine, Converting to Fat-40 PET.

December 1981: Saving Fuel $$ (multiple computers), Unscramble Game (multiple computers), Maze Generator (multiple computers), Animating Applesoft Graphics, A Simple Atari Word Processor, Adding High Speed Vertical Positioning to Atari P/M Graphics, OSI Supercursor, A Look At SuperPET, Supermon for PET/CBM, PET Mine Maze Game, Replacing The INPUT # Command, Foreign Language Text on The Commodore Printer, File Recovery.

January 1982: Invest (multiple computers), Developing a Business Algorithm (multiple computers), Apple Addresses, Lowercase with Unmodified Apple, Cryptogram Game for Atari, Superfont: Design Special Character Sets on Atari, PET Repairs for the Amateur, Micromon for PET, Self-modifying Programs in PET BASIC, Tinymon: A VIC Monitor, VIC Color Tips, VIC Memory Map, ZAP: A VIC Game.

May 1982: VIC Meteor Maze Game, Atari Disk Drive Speed Check, Modifying Apple's Floating Point BASIC, Fast Sort For PET/CBM, Extra Atari Colors Through Artifacting, Life Insurance Estimator (multiple computers), PET Screen Input, Getting The Most Out Of VIC's 5000 Bytes.

August 1982: The New Wave Of Personal Computers, Household Budget Manager (multiple computers), Word Games (multiple computers), Color Computer Home Energy Monitor, A VIC Light Pen For Under $10, Guess That Animal (multiple computers), PET/CBM Inner BASIC, VIC Communications, Keyprint Compendium, Animation With Atari, VIC Curiosities, Atari Substring Search, PET and VIC Electric Eraser.

September 1982: Apple and Atari and the Sounds of TRON, Commodore Automatic Disk Boot, VIC Joysticks, Three Atari GTIA Articles, Commodore Disk Fixes, The Apple PILOT Language, Sprites and Sound on the Commodore 64, Peripheral Vision Exerciser (multiple computers), Banish INPUT Statements (multiple computers), Charades (multiple computers), PET Pointer Sort, VIC Pause, Mapping Machine Language, Commodore User-defined Functions Defined, A VIC Bug.

January 1983: Sound Synthesis And The Personal Computer, Juggler And Thunderbird Games (multiple computers), Music And Sound Programs (multiple computers), Writing Transportable BASIC, Home Energy Calculator (multiple computers), All About Commodore WAIT, Supermon 64, Perfect Commodore INPUTs, VIC Sound Generator, Copy VIC Disk Files, Commodore 64 Architecture.

May 1983: The New Low-Cost Printer/Plotters, Jumping Jack (multiple computers), Deflector (multiple computers), VIC Kaleidoscope, Graphics on the Sinclair/Timex, Bootmaker For VIC, PET and 64, VICSTATION: A "Paperless Office," The Atari Musician, Puzzle Generator (multiple computers), Instant 64 Art, 64 Odds And Ends, Versatile VIC Data Acquisition, POP For Commodore.

June 1983: How To Buy The Right Printer, The New, Low-Cost Printers, Astrostorm (multiple computers), The Hawkmen Of Dindrin (multiple computers), MusicMaster For The Commodore 64, Commodore Data Searcher, Atari Player/Missile Graphics Simplified, VIC Power Spirals, UnNEW For The VIC and 64, Atari Fast Shuffle,

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VIC Contractor, Commodore Supermon Q & A.

July 1983: Constructing The Ideal Computer Game, Techniques For Writing Your Own Adventure Game, SpeedSki And Time Bomb (VIC), Castle Quest And Roadblock (Atari), RATS! And Goblin (64), How To Create A Data Filing System (multiple computers), How To Back Up Disks For VIC And 64, Atari Artifacting, All About The Commodore USR Command, TI-Mailing List.

August 1983: Weather Forecaster (multiple computers), First Math And Clues (multiple computers), Converting VIC And 64 Programs To PET, Atari Verify, Apple Bytechanger, VIC And 64 Escape Key, Banish Atari INPUT Statements, Mixing Graphics Modes On The 64, VICplot, VIC/64 Translations: Reading The Keyboard, Musical Atari Keyboard, VIC Display Messages.

September 1983: Games That Teach, Caves Of Ice, Diamond Drop, Mystery Spell, and Dots (multiple computers), VIC Pilot, Ultrasort (VIC, 64, PET), Easy Atari Page Flipping, Computer Aided Design On The TI, Relative Files On the VIC/64, Atari Fontbyter, TI Sprite Editor, All About Interrupts (multiple computers), Cracking The 64 Kernal, Making Change On The Timex/Sinclair, Build Your Own Random File Manager (multiple computers).

October 1983: Computer Games By Phone, Coupon File (multiple computers), Dragon Master And Moving Maze (multiple computers), Merging Programs From Commodore Disks, Atari Master Disk Directory, Sprites In TI Extended BASIC, Commodore EXEC, Multicolor Atari Character Editor, High Speed Commodore Mazer, Apple Sounds, Extra Instructions (multiple computers), Commodore DOS Wedges, Invisible Disk Directory For VIC And 64.

February 1984: What Makes A Good Game, Circus (multiple computers), Quatrainment (multiple computers), Commodore 3-D Drawing Master (Apple version also included), Speedy BASIC For VIC And 64, Dr. Video 64.

March 1984: All About Adding Peripherals, Modern Memory: The Future Of Storage Devices, Roader (multiple computers), Barrier Battle (multiple computers), Programming The TI: File Processing, Sound Shaper (multiple computers), Commodore Floating Subroutines, Big Buffer For Atari.

April 1984: Apple's Macintosh Unveiled, Securities Analysis (multiple computers), Worm Of Bemer (multiple computers), Programming The TI: File Processing, Part 2, 1540/1541 Disk Housekeeping, Hidden Atari DOS Commands, Function Keys For The Apple, TI Tricks And Tips, Super Directory (multiple computers).

May 1984: The Digital Palette: Fundamentals Of Computer Graphics, The Inside Story: How Graphics Tablets And Light Pens Work, Picture Perfect For Atari And Commodore 64, 64 Hi-Res Graphics Editor, Snertle (multiple computers), Pentominos: A Puzzle-Solving Program (multiple computers), A BASIC Cross-Reference (PET, 64).

June 1984: Choosing The Right Printer: The Easy Way To Hard Copy, Pests (multiple computers), Olympiad (multiple computers), Programming The TI: TI Graphics, MacroDOS For Atari, Part 1, Apple Variable Save, Programming 64 Sound, Part 1, Apple Input And Menu Screens.

July 1984: Evolutionary To The Core: The Apple IIc Heads For Home, The ABC's Of Data Bases, Statistics For Nonstatisticians (multiple computers), Bunny Hop (multiple computers), Blueberries (multiple computers), Atari Artist, Applesoft Lister, Program Conversion With Sinclair BASIC And TI BASIC, Commodore 64 ROM Generations.

September 1984: New Trends In Educational Computing, Choosing The Best Educational Software, Missile Math (multiple computers), Lightsaver (multiple computers), Multiple Choice Quiz Generator (multiple computers), Lightning Sort (multiple computers), Commodore Autoboot, Apple Editing Hints, Atari Paddle Fixer, Musical TI Keyboard.

January 1985: VIC/64 TurboTape: tape at disk speeds, Music In The Computer Age, Inside MSX, Paratrooper (multiple computers), Rescue Of Blondell (Commodore/Atari), Guitar Tuner (multiple computers), Which Computer Language Is Best?, Machine Language Multiplication, Part 1, Enhanced Applesoft Input, Atari Terminal Program, IBM Pie Chart Maker.

February 1985: Special Games Issue, The New Atari, Fame Games, Birth Of A Computer Game, Acrobat (multiple computers), Terminal Program For VIC & 64, Programming The TI Without A Math Background, Adding Sound Effects To Atari, Rebound: Machine Language IBM Game, Apple Bowling Champ, 64 Sound Effects.

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1. The program is for the Commodore 64. For the VIC-20, change these lines:

```
10 POKE 36879,8          :rem 5
100 IF K<>39 THEN 90: REM WAIT
    FOR F1               :rem 154
150 IF K=11 THEN 170: REM CONT
    INUE IF <Y>          :rem 187
```

   For the Plus/4 and 16, change these lines:

```
10 COLOR 0,1:COLOR 4,1:rem 183
340 POKE 239,0: REM CLEAR KEYB
    OARD BUFFER          :rem 80
5000 POKE239,0:POKE198,64: REM
     CLEAR KEYBOARD BUFFER
                         :rem 31
5010 K=PEEK(198)         :rem 102
```

   Type the program *exactly* as listed—including all uppercase REM statements (the lowercase rem statements are checksums for COMPUTE!'s "Automatic Proofreader"; *do not* type them in). It's important to type the program as listed because it must be at least nine blocks long on the test disk to insure proper results.
2. Save the program on another disk before running it.
3. Put a blank test disk in the drive and run the program. It will format the disk and save a file called SAVE@ DEMO on the disk. Type LOAD"$",8 to list the directory and notice that 254 blocks are free.
4. Reset the drive by turning it off, then on. Load the file by typing LOAD"SAVE@ DEMO",8.
5. Save the file three times using the SAVE@ command (SAVE"@0: SAVE@ DEMO",8). *Do not* list the directory or perform any other operation between SAVE@ commands.
6. List the directory by typing LOAD"$",8. What's this? There were 254 blocks free before, but now there are 258—a discrepancy of four blocks. (If you don't get this result, it probably means that you haven't followed the directions exactly. Start again at step 3.) If you examine the BAM with a disk utility, you'll see that the first four sectors of the file are marked as free! (Specifically, the file starts on track 17, block 0; blocks 0 through 3 are marked as unallocated.) If you executed a fourth SAVE@ command, it would overwrite the beginning of the file, and the disk would be corrupted even worse!
7. Now rerun the program to make a new test disk. Reset the drive and run the above test again, but specify the drive number for the load (LOAD"0:SAVE@ DEMO",8). The SAVE@ bug does *not* occur!

Always Specify Drive 0

This demonstration provides a powerful lesson: All DOS commands should include the drive number 0:

LOAD"0:filename",8 (Load file)
SAVE"0:filename",8 (Save file)
SAVE"@0:filename",8 (Save with Replace)
LOAD"$0",8 (Load directory)
LOAD"$0:filename",8 (Load directory entry with filename)
OPEN15,8,15,"I0":CLOSE15 (Initialize drive 0)
OPEN15,8,15,"V0":CLOSE15 (Validate BAM)

Similarly, all disk file commands should specify the drive number.

Most Commodore users do not specify the drive number when loading the directory or files. The *1541 User's Manual* examples for the LOAD command don't specify the drive, and neither do most magazine articles. If the drive number is not specified, the 1541 is supposed to default to drive 0. What actually happens very often causes an error message such as 74,DRIVE NOT READY,00,00. For a simple example, use the DOS 5.1 Wedge that comes with the 1541. List the directory for the file "TEST" on the *1541 Test/Demo* disk by using the Wedge command:

>$TEST (list directory for files "TEST")

Since this file doesn't exist on the *Test/Demo* disk, the red error light begins blinking. This command should include the drive number, but is accepted without it. Now repeat the command and read the error channel with this Wedge command:

> (read error channel)

The error will be 74,DRIVE NOT READY,00,00. Repeat this test, but specify the drive number:

>$0:TEST (List directory with drive specified)

No matter how many times this command is repeated, no error will occur.

The Missing Drive

Part 2 in next month's COMPUTE! will present a full technical explanation of the SAVE@ bug. For those who aren't so technically inclined, here's a brief summary.

The early Commodore PETs were available with dual disk drives—two drives in one unit. The drives were addressed as 0: and 1: when using disk commands. But on later Commodore computers designed to use the 1540/1541, multiple drives are addressed by changing the *device number*, not the *drive number*. The device number for a single drive is 8. That's why you type a command like LOAD "filename",8. On two-drive systems, the second drive is usually addressed as device 9, as in LOAD "filename",9. Therefore, most people stopped (or never started) specifying the drive number, which is 0: for all 1541 disk drives. Drive 1: simply doesn't exist with the 1541.

What happens when the drive number is not specified for a LOAD or SAVE? DOS first checks for a drive number. If none is specified, it assumes drive 0. Okay so far. Then DOS attempts to read the disk. If no disk is found, DOS automatically switches to the nonexistent drive 1. A DRIVE NOT READY error then results whether or not a drive number was specified. If a disk is found, DOS searches its internal directory for the specified file. If the default drive was used, DOS switches to drive 1 to continue searching. This also causes the DRIVE NOT READY error, since there is no drive 1. Furthermore, drive 1 remains the default drive as long as there are directory searches to be done. The internal drive pointers must be reset to recover from this error condition.

SAVE@ always works properly in our tests if the drive number is specified on all operations and no direct access buffers are allocated. We are not aware of anyone who has documented a failure under these conditions (assuming a closed file was specified, sufficient room was present on the disk, and no read or write errors occurred). Thus,

Commodore experts who claim there is no bug are partially correct. We have also found that if the drive number is not always specified during loads and directory listings, as is common practice, the SAVE@ bug can occur even though the drive number is specified in the SAVE@ command.

Files stored on just one or two tracks—such as short files on a fresh disk—are not prone to the SAVE@ bug. Files stored over many tracks on disks on which many files have been saved and scratched are the most susceptible, as are files saved with some utilities intended to speed up the 1541 disk drive.

Next month: Part 2 examines the technical reasons for the Save-with-Replace bug in more detail. Our special thanks to Jim Gracely of Commodore and Associate Editor Jim Butterfield for very helpful discussions.

SAVE@ Bug Demonstration

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" published bimonthly in COMPUTE!.

```
10 POKE 53281,0:POKE 53280,11
                          :rem 232
20 PRINT"{CLR}";CHR$(14)CHR$(8
   )                      :rem 66
30 PRINT"{YEL}{RIGHT}{RVS} SAV
   E@ BUG EXAMPLE "       :rem 90
40 PRINT"{CYN}{DOWN} THIS PROG
   RAM FORMATS":PRINT"A BLANK
   {SPACE}DISK, ALTERS"
                          :rem 167
50 PRINT"THE BAM, SAVES ITSELF
   ":PRINT"AND THEN ALTERS THE
   "                      :rem 149
60 PRINT"BAM AGAIN.":PRINT"
   {DOWN} SAVE@ WILL FAIL THE"
                          :rem 213
70 PRINT"THIRD TIME IT IS USED
   ":PRINT"ON THIS DISK."
                          :rem 133
80 PRINT"{DOWN}{RIGHT}{GRN}INS
   ERT DISK TO FORMAT - PRESS
   {SPACE}{RVS} F1 {OFF}."
                          :rem 116
90 GOSUB 5000: REM GET KEYPRES
   S                      :rem 34
100 IF K<>4 THEN 90: REM WAIT
    {SPACE}FOR F1         :rem 98
110 PRINT"{DOWN}{RED}WARNING!
    {SPACE}THE DISK WILL BE ER
    ASED."                :rem 116
120 PRINT"{DOWN}{RIGHT}{YEL}AR
    E YOU SURE?":PRINT"(PRESS
    {SPACE}{RVS}Y{OFF} TO CONT
    INUE.)"               :rem 31
130 FOR T=0 TO 100:NEXT: REM T
    IME DELAY             :rem 165
140 GOSUB 5000: REM GET KEYPRE
    SS                    :rem 78
150 IF K=25 THEN 170: REM CONT
    INUE IF <Y>           :rem 192
160 PRINT"{DOWN}{RIGHT}{YEL}PR
    OGRAM ABORTED.":GOTO 330
                          :rem 4
170 CLOSE2:CLOSE15: REM
    {2 SPACES}CLOSE CHANNELS
                          :rem 54
180 OPEN15,8,15: REM OPEN COMM
    AND CHANNEL           :rem 111
190 PRINT"{DOWN}{RIGHT}{CYN}NO
    W FORMATTING DISK - PLEASE
     WAIT."               :rem 28
200 PRINT#15,"N0:SAVE@ TEST"CH
    R$(44)"PS": REM FORMAT DIS
    K                     :rem 50
210 GOSUB 3000: REM CHECK ERRO
    R CHANNEL             :rem 213
220 PRINT"{UP}{RIGHT}{PUR}FORM
    ATTING COMPLETED.
    {2 SPACES}{3 SHIFT-SPACE}
    {8 SPACES}"           :rem 213
230 PRINT"{DOWN}{RIGHT}ALTERIN
    G BAM."               :rem 232
240 GOSUB 4010: REM OPEN DIREC
    T CHANNEL AND CHECK ERROR
    {SPACE}CHANNEL        :rem 147
250 GOSUB 1010: REM ALTER BAM
                          :rem 63
260 CLOSE2:CLOSE15: REM CLOSE
    {SPACE}CHANNELS       :rem 54
270 PRINT"{DOWN}{RIGHT}{RED}SA
    VING SAVE@ DEMO." :rem 190
280 SAVE"0:SAVE@ DEMO",8
                          :rem 111
290 PRINT"{DOWN}{RIGHT}{YEL}AL
    TERING BAM."          :rem 140
300 GOSUB 4000: REM OPEN DIREC
    T CHANNEL AND CHECK ERROR
    {SPACE}CHANNEL        :rem 143
310 GOSUB 2010: REM ALTER BAM
                          :rem 61
320 PRINT"{DOWN}{RIGHT}{CYN}
    {TAB}DISK IS FINISHED! NOW
     REFER TO TEXT."      :rem 236
330 CLOSE2:CLOSE15: REM CLOSE
    {SPACE}CHANNELS       :rem 52
340 POKE 198,0: REM CLEAR KEYB
    OARD BUFFER           :rem 84
350 END                   :rem 111
1000 REM * MODIFY BAM SECTOR F
     OR SAVE              :rem 77
1010 PRINT#15,"U1:2 0 18 0":GO
     SUB 3000: REM READ BAM SE
     CTOR                 :rem 90
1020 PRINT#15,"B-P:2 52":GOSUB
      3000: REM POSITION BUFFE
     R POINTER TRACK 13
                          :rem 159
1030 FOR I=1 TO 20:PRINT#2,CHR
     $(0);:NEXT: REM FILL BAM
     {SPACE}WITH ZEROS:rem 201
1040 PRINT#15,"B-P:2 76":GOSUB
      3000: REM POSITION BUFFE
     R POINTER TRACK 19
                          :rem 173
1050 FOR I=25 TO 92:PRINT#2,CH
     R$(0);:NEXT: REM FILL BAM
      WITH ZEROS          :rem 10
1060 PRINT#15,"U2:2 0 18 0":GO
     SUB 3000: REM WRITE TO BA
     M SECTOR             :rem 114
1070 PRINT#15,"I0":GOSUB 3000:
      REM INITIALIZE BAM
                          :rem 36
1080 RETURN               :rem 169
2000 REM * MODIFY BAM SECTOR A
     FTER SAVE            :rem 217
2010 PRINT#15,"U1:2 0 18 0":GO
     SUB 3000: REM READ BAM SE
     CTOR                 :rem 91
2020 PRINT#15,"B-P:2 60":GOSUB
      3000: REM POSITION BUFFE
     R POINTER TRACK 15
                          :rem 161
2030 REM FREE UP 12 SECTORS ON
      TRACKS 15 TO 17 :rem 204
2040 PRINT#2,CHR$(4)CHR$(15)CH
     R$(0)CHR$(0);        :rem 81
2050 PRINT#2,CHR$(4)CHR$(15)CH
     R$(0)CHR$(0);        :rem 82
2060 PRINT#2,CHR$(4)CHR$(15)CH
     R$(0)CHR$(0);        :rem 83
2070 PRINT#15,"U2:2 0 18 0":GO
     SUB 3000: REM WRITE TO BA
     M SECTOR             :rem 116
2080 PRINT#15,"I0":GOSUB 3000:
      REM INITIALIZE BAM
                          :rem 38
2090 RETURN               :rem 171
3000 INPUT#15,EN,E$,ET,ES
                          :rem 185
3010 IF EN=0 OR EN=73 THEN RET
     URN                  :rem 61
3020 PRINT"{2 DOWN}{RIGHT}"EN;
     E$;ET;ES             :rem 179
3030 CLOSE2:CLOSE15:END
                          :rem 149
4000 OPEN15,8,15:GOSUB3000: RE
     M OPEN COMMAND CHANNEL AN
     D CHECK ERROR        :rem 210
4010 OPEN2,8,2,"#":GOSUB3000:
     {SPACE}REM OPEN DIRECT CH
     ANNEL AND CHECK ERROR CHA
     NNEL                 :rem 179
4020 RETURN               :rem 166
5000 POKE198,0:POKE203,64: REM
      CLEAR KEYBOARD BUFFER
                          :rem 22
5010 K=PEEK(203)          :rem 89
5020 IF K=64 THEN 5010 :rem 61
5030 RETURN               :rem 168
```

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Dynamic Keyboard For Commodore Machines
Part 1

Jim Butterfield, Associate Editor

Dynamic keyboard techniques let you perform tasks that would otherwise be difficult or impossible in BASIC. The first article in this two-part series covers the fundamentals. In Part 2, we'll look at more advanced uses of the dynamic keyboard.

Many BASIC commands can be used in either *direct mode* (typed directly on the keyboard without a line number) or *program mode* (as part of a program). Certain commands, however, work only in direct mode. Using them in a program requires the *dynamic keyboard* technique, which lets a program act like it's you—typing commands on the keyboard. This method is especially effective on Commodore machines because of their full-screen editing. The term *dynamic keyboard* was first used by Mike Louder in 1978, though the technique had been used previously by Larry Tessler to merge programs.

Direct Versus Programmed

A direct-mode command doesn't have a line number and is executed as soon as you press RETURN. An example is PRINT "HELLO". In program mode, the command does have a line number and is executed only when you type RUN and then press RETURN. An example is 10 PRINT "HELLO". Most BASIC commands work in both direct and program mode.

A few BASIC commands cannot be used in direct mode, however; they may appear only in a program. GET, INPUT, GET#, and INPUT# are the best-known of these. Usually these commands use a segment of memory called the *input buffer* to store data as it arrives, and they won't work in direct mode because the same input buffer is used to hold the command itself. Thus, the incoming data might overwrite the command you typed in. An easy way to see this conflict is to use GOSUB as a direct command, calling a routine that does input. Try the following simple program:

```
300 INPUT "YOUR NAME";N$
330 RETURN
```

Execute this routine by typing GOSUB 300 and pressing RETURN. The subroutine will ask YOUR NAME?. If you reply with a one-character name, such as X, everything works fine. The RETURN takes you back to the keyboard, and the computer reports READY. But if you reply with a longer name such as CHARLOTTE, you may get a strange error message. Why? Your original command GOSUB 300 is still sitting in the input buffer. When the subroutine ends, the system looks beyond the GOSUB command to see what comes next. We expect it to find an end-of-command marker and quit. But the GOSUB command has been destroyed. It was overwritten by the name you typed in, which went to the same input buffer. The result is confusion.

On the other hand, some BASIC commands can be used only in direct mode—not in a program. CONT, for example, causes an indefinite pause when used in a program. LIST works in program mode, but on most Commodore computers the program ends after executing LIST. In direct mode, you can enter a program line to add to the program or change it. You can't do this while running a program. Again, there's a difference between programs and direct commands—they have different powers.

A very important difference is found in the LOAD command. If typed as a direct command, LOAD fills memory with a new program from tape or disk. If there was already a program in memory, it vanishes and its variables are thrown away. But a LOAD command executed within a program is quite different. The new program comes in, but existing variables are not scrapped—they are preserved so that the new program can use them. This is a powerful programming technique called *chaining*, which

lets one program continue processing data that was generated by a previous program.

Invisible Fingers

Direct keyboard statements can perform certain tasks that programs can't (at least, not in the usual way). For example, if we want a program to invite a student to type in a formula, BASIC doesn't allow the formula to be evaluated (an INPUT statement won't evalute the formula 2 + 2 as 4).

Similarly, suppose we want one program—perhaps a main menu program—to load and run another program. That's hard to do because BASIC wants to chain the new program to the old one. Instead of starting the next program fresh, it tries to make it a continuation of the previous program. On rare occasions, there may be a real need to allow a program to change itself, although this is tricky because every time you change a program (by editing a line, etc.), its variables go away. It's hard for any program to continue running after its variable values disappear.

We can accomplish these things, however, by using a startling technique: making the computer *type on its own keyboard*. How can a computer do this? It doesn't even have any fingers.

Here's how it works. When you strike a key, the information always goes first to a memory area called the *keyboard buffer*. After it gets there, it is picked up and used by the computer. If we can put a character in the keyboard buffer without actually pressing any keys, it will appear to have been typed, and the computer responds exactly as if the corresponding key was pressed.

Self-Keying

Let's try a quick example to see how it works. The keyboard buffer is located in different places on different computers, so the commands must be tailored to the machine involved. We'll ask the machine to self-type the letter X:

For VIC-20 or Commodore 64:

```
POKE 198,1:POKE631,88
```

For Plus/4 or 16:

```
POKE 239,1:POKE 1319,88
```

For PET/CBM (3.0 and 4.0 BASIC):

```
POKE 158,1:POKE 623,88
```

For Original ROM PETs:

```
POKE 525,1:POKE 527,88
```

For Commodore B-128 (Model 700)

```
BANK 15:POKE 209,1:POKE 939,
88
```

The first POKE in each line tells the computer how many characters are waiting in the keyboard buffer. The second puts the character X in the first slot of the buffer. After you type the line and press RETURN, the computer reports READY and acts as if you pressed the X key. The letter X appears on the screen and the cursor flashes to its right. It would be easier just to type the X, of course, but we've established a new capability. A program can now, in effect, type on the keyboard.

Using The Screen

With this technique alone, you're limited to pretty short commands. The keyboard buffer usually has a size limit of about nine characters. Also, it's cumbersome for a program to put characters into the buffer one at a time. But on Commodore machines we can take advantage of *screen editing* to process longer direct commands.

Whenever you press the RETURN key, the computer reads the screen. Whatever it finds there, it does—perform a command, enter a line, or whatever. To make a program execute a long direct-mode command, follow these steps:

1. PRINT the command on the screen in a known place.
2. Position the cursor a couple of lines above the command.
3. Put a carriage return in the keyboard buffer.
4. Terminate execution with an END command.

When the program reaches END, here's what happens. The desired command is on the screen and the RETURN is in the keyboard buffer. The program terminates, and the computer prints READY. Although the program has ended, the computer receives the RETURN as if you had just pressed that key, so it executes the line on the screen. Among other things, that line might contain a GOTO or CONT that would continue the program.

A Simple Example

Here's a simple program that uses the dynamic keyboard method to do something normally forbidden by BASIC: a computed GOTO. In most cases, a straightforward ON-GOTO command does the same job better, but let's use this example for the sake of simplicity. Type in line 100 as shown for your machine:

For VIC-20 or Commodore 64:

```
100 DATA 198,631
```

For Plus/4 or 16:

```
100 DATA 239,1319
```

For most PET/CBM:

```
100 DATA 158,623
```

Now enter the following lines:

```
110 READ A,B
120 PRINT "PICK A NUMBER 3 TO
    {SPACE}5"
130 INPUT "NUMBER";L
140 IF L<3 OR L>5 THEN 130
150 PRINT CHR$(147)
160 PRINT
170 PRINT
180 PRINT "GOTO";L*100
190 PRINT CHR$(19)
```

The program isn't finished, but you might like to see what we have so far. If you run it and enter 3 in response to the prompt, you'll find the program stopped with the cursor blinking over a line that says GOTO 300. To execute that direct command, all you'd need to do is press RETURN. When we complete the program, it will press RETURN by itself. Finish the program by entering these lines:

```
200 POKE A,1
210 POKE B,13
220 END
300 PRINT "THIS IS LINE 300"
310 GOTO 120
400 PRINT "HERE'S 400"
410 GOTO 120
500 PRINT "LINE 500 IS THE END
    "
```

It's as easy as that. Once you grasp the basic method, all sorts of interesting applications come to mind. Next time, we'll look at more advanced, useful applications of the dynamic keyboard technique.

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All About IBM Batch Files

Part 2

G. Russ Davies

Part 1 of this article (COMPUTE!, September 1985) covered the fundamentals of batch programming on the IBM PC/PCjr. This month we'll look at some advanced techniques and a utility that makes batch programs interactive and easier to use.

As we saw last month, IBM batch programs can be very powerful. The batch commands FOR, IF, and GOTO permit program loops, conditional tests, and program branching. You can also chain two or more batch programs together and pass information from one to another.

But batch programs have limitations, too. Visual displays are often unexciting, consisting of single-color alphanumerics (no graphics characters, etc.), and user input is even more restricted. The PAUSE command allows only two options: continuing after the pause or ending the program. This virtually rules out complex, interactive programs that let you select from several different options to perform various tasks.

Adding Choices

The "CHOOSE.COM" program below provides the equivalent of a new batch command. As the name suggests, CHOOSE lets you make a choice. It can be used by itself to request a yes/no response, or with additional information to offer several different options. Since CHOOSE.COM is a machine language program, we've included a BASIC filemaker program that creates it for you. Type in and save Program 1 as listed below, then run it. Once that's done, you can try out the simpler "yes/no" form of CHOOSE.

Remember from Part 1 that any batch program named AUTOEXEC.BAT loads and runs automatically when you boot the system. An AUTOEXEC.BAT program that doesn't include the DOS commands DATE and TIME won't prompt you to enter the date and time (as normally happens when you boot up). Though it's often valuable to have correct date and time information on new files, there are also many times when you don't need it.

The short batch program that follows lets you choose whether to add date and time settings. Enter it as listed, using the EDLIN program (on the *DOS Supplemental Programs* disk) or any word processor or text editor that produces standard ASCII output. Since this and the following examples are *not* BASIC programs, don't try to enter them with COMPUTE!'s "IBM Automatic Proofreader." Once you have entered this program, save it with the filename AUTOEXEC.BAT. Because the program calls CHOOSE.COM, you *must* save it on a disk that contains CHOOSE.COM.

```
echo off
MODE CO80
  echo Do you wish to set the
  date/time?
  rem press Y,y,N, or n to
  answer
  CHOOSE
  IF ERRORLEVEL 1 GOTO :setdt
  goto :next
:setdt
 date
 time
:next
 CHKDSK
 BASICA MENU
```

After saving this program, run it by rebooting the system (press Ctrl-Alt-Del or enter AUTOEXEC). When used without parameters, CHOOSE checks for a yes/no response, permitting uppercase as well as lowercase Y and N (it's not necessary to press the Enter key after typing Y or N). Other responses (except Ctrl-Break) cause the prompt message to be displayed until a valid choice is made.

ERRORLEVEL Is A Variable

After you respond with yes or no, CHOOSE passes this information to the batch program via ERRORLEVEL. As explained in Part 1, ERRORLEVEL is a special variable you can test with IF. In this example, CHOOSE sets ERRORLEVEL to 1 when the response is yes, and 0 when the response is no. The GOTO command then branches appropriately. Note that GOTO branches to a destination label, which is a colon followed by a string. This program uses the labels :setdt and :next. Don't confuse

the label :next with BASIC's NEXT statement (which doesn't exist in batch programming).

In this case, ERRORLEVEL can have only one of two possible values, but it can take higher values as well (see below). When testing ERRORLEVEL with IF, keep in mind that the IF ERRORLEVEL statement is true when ERRORLEVEL is *greater or equal to* the number being tested. If you tested for 0 first in this program, ERRORLEVEL would always be 0 (1 and 0 are both greater than or equal to 0). When testing ERRORLEVEL, you must always test for higher values before testing for lower ones.

Multiple Options

Most utility programs offer a variety of options. Typically, they display a menu with a list of options, and you choose the option you want by pressing a certain key. CHOOSE makes it easy to present such menus within a batch program. First display the options on the screen, then use CHOOSE followed by a list of the keys you wish to test. For instance, the statement CHOOSE ABC checks the A, B, and C keys and returns appropriate values in ERRORLEVEL. The ERRORLEVEL value corresponds to the position of the key in the list after the CHOOSE command. Thus, after the program performs CHOOSE ABC, ERRORLEVEL equals 1 if A was pressed, 2 if B was pressed, and so on.

When using CHOOSE with several option keys, it's critical to list the keys in the right order. Since you must always test for higher ERRORLEVEL values before testing for lower ones, you'll want to put the most likely (or most speed-critical) options at the *end* of the option key list. This assigns higher ERRORLEVEL values to the more important options.

Entering FILES.BAT

The "FILES.BAT" program below demonstrates multiple-option selection as well as a colorful, attractively formatted menu and help panel. It sorts any disk directory by file size, date, filename extension, or alphabetical order, and can also create separate batch files for mass DOS operations. Entering the program requires several steps:

1. Make sure your disk contains the system file called ANSI.SYS. If necessary, copy ANSI.SYS from the DOS disk with the COPY command. This file contains the screen/keyboard driver used for graphics displays and temporary key assignments.
2. Make sure your disk contains a file named CONFIG.SYS that includes the statement DEVICE=ANSI.SYS. If your disk already has a CONFIG.SYS file, add that statement to the file with EDLIN or another text editor. If your disk doesn't have a CONFIG.SYS file, create one by entering these lines:

   ```
   COPY CON:CONFIG.SYS
   DEVICE=ANSI.SYS
   ```

   Next press the F6 key to end the file, then press Enter. Your disk now contains the necessary CONFIG.SYS file.
3. Using EDLIN or some other text editor, enter Program 2 as listed below and save it on disk with the name FILES.BAT. (Since this is *not* a BASIC program, don't try to enter it with the IBM Automatic Proofreader.) Several lines in the listing contain the characters {CTRL-P}. The braces indicate that this is a special control character which you must enter by pressing a combination of keys. Do *not* type the braces. Instead, wherever you see {CTRL-P} in the listing, hold down the Ctrl key and press the P key. On the screen, you'll see the wedge-shaped control character that precedes special ANSI.SYS screen or keyboard instructions. Type everything else in Program 2 exactly as it appears.
4. In the same manner, enter Program 3 as listed and save it on disk with the name FILES.MNU (do not use any other filename). This file is graphics data for the menu. Whenever you see {CTRL-P} in the listing, enter CTRL-P as described in step 3. A number enclosed in braces indicates a graphics character (the number is an ASCII code) which you must enter with the Alt-keypad technique on the PC and by another method on the PCjr. For instance, where the listing contains {218}, hold down the Alt key, then type the characters 2, 1, and 8 on the numeric keypad. When you release the Alt key, character 218 appears on the screen. On the PCjr, hold down Alt, press Function-N, then enter the numbers as on the PC. After all three numbers are entered, release the Alt key; the character will appear on the screen. When the braces enclose two numbers, several characters are needed; the first value shows how many characters to enter, and the second is the ASCII code. For instance, where you see {5 196}, use the above procedure to enter character 196 five times. Where you see the letters SP followed by a number and enclosed in braces, you should type the space bar the indicated number of times. For example, {SP 16} means to type 16 spaces.
5. Enter Program 4 as listed, using the technique described for step 4, and save it on disk with the filename FILES.HLP (don't use any other filename). This file contains graphics data for the Help screen.
6. Enter a batch program that contains nothing but a REM statement and save it on disk with the filename QUIT.BAT. This can be done with a text editor or by entering these statements from DOS:

   ```
   COPY CON: QUIT.BAT
   REM ANYTHING
   ```

   Now press the F6 key followed by Enter.
7. Activate BASIC and type in Program 5. Since this program is listed in BASIC, enter and save it using the IBM Automatic Proofreader published bimonthly in COMPUTE!. You must save this program with the filename FILEGRP .BAS.
8. Finally, before using FILES.BAT, check your disk to make sure all the necessary files are present. It must contain CHOOSE.COM, ANSI.SYS, CONFIG.SYS, FILES.BAT, FILES.HLP, FILES.MNU, FILEGRP.BAS, and QUIT.BAT. The program will not work correctly unless all

these files are on one disk and named as shown here. Note that the FILEGRP option (see below) also requires BASIC.

Using FILES.BAT

Before you run this program, reboot the system by turning the computer off and on or by pressing Ctrl-Alt-Del. This guarantees that the ANSI.SYS driver is present. To run FILES.BAT, enter FILES after the DOS prompt and press Enter. Most of the program is self-explanatory—after all, that's what menus and help screens are for—so we won't describe every option.

The FILEGRP option lets you create a separate batch file (named FILEGRP.BAT) for performing operations on a group of files. Every line in FILEGRP.BAT consists of a filename from the subject disk and four dummy parameters in this order:

%1 filename.extension %2 %3 %4

Dummy parameters are replaced by actual parameters you supply when running FILEGRP.BAT. This makes it easy to perform the same operation (copy, print, delete, etc.) on a large group of files. After using the FILEGRP option, exit to DOS and use a word processor or text editor to edit FILEGRP.BAT as needed, deleting the names of any files you don't want to include in the operation. Then run FILEGRP.BAT by entering its name followed by the needed parameters. The first parameter can be any DOS command; the rest will be parameters that are relevant to that command. For instance, you might enter FILEGRP COPY B: /V to copy the files listed in FILEGRP.BAT onto drive B. Incidentally, BASIC does not provide any way to set ERRORLEVEL.

Advanced Batch Programming

FILES.BAT employs several techniques you may find useful. The DOS command BREAK ON makes the system respond to Ctrl-Break in more instances than normal. The TYPE command is used to display graphics like the menu and help screen. TYPE creates such displays much faster than the DOS ECHO command (you could also use COPY).

The ANSI.SYS driver assigns the lowercase keys a, s, d, e, b, and i to their uppercase equivalents to reduce the amount of testing required. The F1 and F10 keys are assigned to keys H and X, respectively, so those function keys perform their usual HELP and EXIT roles. After CHOOSE accepts a response, the modified keys are restored to their original definitions. Pressing Ctrl-Break while CHOOSE is active (or pressing Y in response to "Terminate batch file?") leaves these keys reassigned. To avoid this effect, you should normally exit by pressing F10.

The F10 (EXIT) function uses a trick to perform a quick exit. It simply runs QUIT.BAT, a batch program that consists of a do-nothing REM statement. When any batch program ends, it ends all preceding batch programs as well. Note that since ECHO OFF is in effect when QUIT.BAT is called, the REM is not displayed.

Batch commands are not particularly fast. To optimize speed, structure the program so that the most-often used (or speed-critical) routines are closest to the place you're branching from. The fewer program lines that a GOTO has to skip over, the quicker it executes. You can also speed up batch programs by using extra disk buffers as explained in the *DOS Manual*. REM statements slow batch programs drastically; if you want to document the program, store your comments in a separate file.

In some cases it's useful to test for the absence of a parameter. For instance, you might want to reprompt the user with a message like "You must enter more information." This can be done with a statement such as IF .——%1. GOTO .NOPARM. This line means "if a dot equals the parameter plus a dot then go to the no-parameter routine." The IF test is true only when no parameters have been entered.

Program 1: CHOOSE.COM Filemaker

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" published bimonthly in COMPUTE!.

```
QJ 100 OPEN "CHOOSE.COM" FOR OUT
       PUT AS #1
LA 110 READ X$:IF X$="/*" GOTO 1
       30
CA 120 PRINT #1,CHR$(VAL("&H"+X$
       ));:GOTO 110
ID 130 CLOSE #1:END
KB 140  DATA A0,80,0,3C,0,75,2D,
       90,BA,60,1,B4,9,CD,21,B4
PC 150  DATA C,B0,7,CD,21,3C,59,
       74,F,3C,4E,74,10,3C,79,74
FG 160  DATA 7,3C,6E,74,8,EB,E1,
       90,B0,1,EB,3,90,B0,0,B4
EL 170  DATA 4C,CD,21,90,BA,80,1
       ,B4,9,CD,21,B4,C,B0,8,CD
GN 180  DATA 21,88,C4,90,BD,0,0,
       45,8A,86,80,0,3C,D,74,E4
KC 190  DATA 38,E0,75,F3,89,E8,9
       0,48,B4,4C,CD,21,90,90,90
       ,90
NJ 200  DATA 43,68,6F,6F,73,65,2
       0,59,20,28,79,65,73,29,20
       ,6F
FM 210  DATA 72,20,4E,20,28,6E,6
       F,29,20,2E,2E,2E,D,A,24,2
       0
QJ 220  DATA 43,68,6F,6F,73,65,2
       0,64,65,73,69,72,65,64,20
       ,6F
OK 230  DATA 70,74,69,6F,6E,20,2
       E,2E,2E,D,A,24,0,0,0,0
KM 240 DATA /*
```

Program 2: FILES.BAT

```
echo off
rem Name: FILES.BAT
  [filename.ext]   See help
  panel for usage
break on
dir %1 >temp.dir
:menu
cls
type files.mnu
echo{CTRL-P}["a";"A"p{CTRL-P}[
  "s";"S"p{CTRL-P}["d";"D"p{CT
  RL-P}["e";"E"p{CTRL-P}["b";"
  B"p     {CTRL-P}["i";"I"p
echo{CTRL-P}[0;59;"H"p{CTRL-P}
  [0;68;"X"p {CTRL-P}[2A
choose EIBSDHAX
echo{CTRL-P}["a";"a"p{CTRL-P}[
  "s";"s"p{CTRL-P}["d";"d"p{CT
  RL-P}["e";"e"p{CTRL-P}["b";"
  b"p{CTRL-P}["i";"i"p
echo{CTRL-P}[0;59;0;59p{CTRL-P
  }[0;68;0;68p {CTRL-P}[0m
if errorlevel 8 QUIT
if errorlevel 7 goto :a
if errorlevel 6 goto :h
if errorlevel 5 goto :d
if errorlevel 4 goto :s
if errorlevel 3 goto :b
if errorlevel 2 goto :i
                goto :e
:a
cls
sort /+1 <temp.dir >con
pause
goto :menu
:h
copy files.hlp con
pause
goto :menu
:d
cls
sort /+24 <temp.dir >con
pause
goto :menu
:s
cls
sort /+14 /R <temp.dir >con
```

```
pause
goto :menu
:b
basic filegrp

echo -------- FILEGRP.BAT
  Created --------
pause
goto :menu
:i
cls
dir %1 /p
pause
goto :menu
:e
cls
sort /+10 <temp.dir >con
pause
goto :menu
```

Program 3: FILES.MNU

```
{CTRL-P}[2J {CTRL-P}[32m
{SP 16}{218}{5 196}
  {CTRL-P}[33m DIRECTORY
  DISPLAYS MENU {CTRL-P}[32m{5
  196}{191}
{SP 16}{179}{SP 35}{179}
{SP 16}{179}{CTRL-P}[35m A
  {CTRL-P}[32m- Alphabetical
  order by filename {179}
{SP 16}{179}{SP 35}{179}
{SP 16}{179}{CTRL-P}[35m E
  {CTRL-P}[32m- Ext name
  order{SP 17}{179}
{SP 16}{179}{SP 35}{179}
{SP 16}{179}{CTRL-P}[35m D
  {CTRL-P}[32m- Date order, Yr
  not significant {179}
{SP 16}{179}{SP 35}{179}
{SP 16}{179}{CTRL-P}[35m S
  {CTRL-P}[32m- Size order{SP
  21}{179}
{SP 16}{179}{SP 35}{179}
{SP 16}{179}{CTRL-P}[35m B
  {CTRL-P}[32m- Bat file
  creation: FILEGRP.bat {179}
{SP 16}{179}{SP 35}{179}
{SP 16}{179}{CTRL-P}[35m I
  {CTRL-P}[32m- Intrinsic
  order of dir entries {179}
{SP 16}{179}{SP 35}{179}
{SP 16}{179}{CTRL-P}[35mF1
  {CTRL-P}[32m- HELP{SP
  27}{179}
{SP 16}{179}{SP 35}{179}
{SP16}{179}{CTRL-P}[35mF10{CTRL
  -P}[32m- EXIT{SP 27}{179}
{SP 16}{179}{SP 35}{179}
{SP 16}{192}{36 196}{217}
{CTRL-P}[31m
```

Program 4: FILES.HLP

```
{CTRL-P}[44;33m{CTRL-P}[2J{CTR
  L-P}[1m
{SP 7}{201}{15 205}
  {CTRL-P}[35m DIRECTORY
  DISPLAY HELP {CTRL-P}[33m{16
  205}{187}
{SP 7}{186}{SP 2}PURPOSE:
  Produces a directory
  listing{SP 17}{186}
{SP 7}{186}{SP 12}sorted in
  the desired order.{SP
  16}{186}
{SP 7}{186}{SP 2}SYNTAX:{SP
  2}FILES
  [d:][filename][.ext]{SP
  20}{186}
{SP 7}{186}{SP 9}(if
  parameters are omitted, *.*
  used){SP 10}{186}
{SP 7}{186}{SP 56}{186}
{SP 7}{186}{SP 2}MENU
  OPTIONS:{SP 41}{186}
{SP 7}{186}{SP 4}A: Directory
  sorted ascending by
  filename{SP 11}{186}
{SP 7}{186}{SP 4}E: Directory
  sorted ascending by file
  extension{SP 5}{186}
{SP 7}{186}{SP 4}D: Directory
  sorted ascending by file
  date (mm-dd){SP 2}{186}
{SP 7}{186}{SP 7}giving
  calendar order, year least
  significant{SP 4}{186}
{SP 7}{186}{SP 4}S: Directory
  sorted DESCENDING by file
  size{SP 9}{186}
{SP 7}{186}{SP 7}allowing
  quick determination of
  largest files{SP 4}{186}
{SP 7}{186}{SP 4}B:
  FILEGRP.BAT created as : %1
  filename.ext %2 %3 %4{186}
{SP 7}{186}{SP 7}for editing
  and mass file copy, erase,
  type, etc.{186}
{SP 7}{186}{SP 4}I: Directory
  in the order of the
  directory entries{SP 2}{186}
{SP 7}{186}{SP 56}{186}
{SP 7}{186}{SP 4}H or F1:
  Displays this help panel{SP
  19}{186}
{SP 7}{186}{SP 4}X or F10:
  Fast exit to DOS{SP 26}{186}
{SP 7}{200}{56
  205}{188}{CTRL-P}[0m
```

Program 5: FILEGRP.BAS

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" published bimonthly in COMPUTE!.

```
NJ 10 'This program creates a ba
      tch file named FILEGRP.BAT
      , using the
LO 20 'TEMP.DIR file created by
      FILES.BAT. FILEGRP.BAT is
      useful for
JF 30 'group file operations suc
      h as copying, deleting, pr
      inting, etc.
EK 40 'Each line in FILEGRP.BAT
      has the format: %1 filenam
      e.ext %2 %3 %4
GK 50 'Use a word processor or t
      ext editor to delete non-p
      articipating
ID 60 'files from FILEGRP.BAT.
PE 70 OPEN "temp.dir" FOR INPUT
      AS #1'input file
MN 80 OPEN "filegrp.bat" FOR OUT
      PUT AS #2'output file
EC 90 FOR X= 1 TO 4:IF EOF(1) TH
      EN SYSTEM'skip 4-line head
      er
KD 100 LINE INPUT#1,X$:NEXT
GN 110 IF EOF(1) THEN SYSTEM'che
       ck for end-of-file
LA 120 LINE INPUT #1,X$'get inpu
       t line
DI 130 IF LEFT$(X$,1)=" " GOTO 1
       10'skip lines beginning w
       ith space
GE 140 Z=INSTR(X$," "):Z=Z-1'fin
       d length of filename
EG 150 PRINT #2,"%1 ";MID$(X$,1,
       Z);".";MID$(X$,10,3);" %2
        %3 %4"'form output
HL 160 GOTO 110'continue till en
       d-of-file
```

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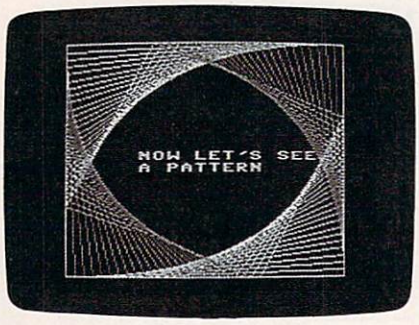

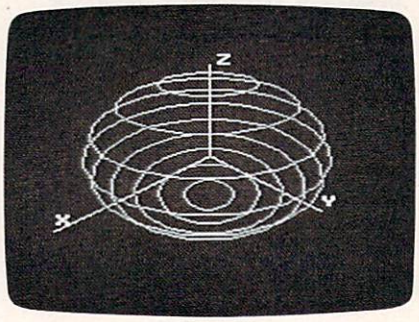

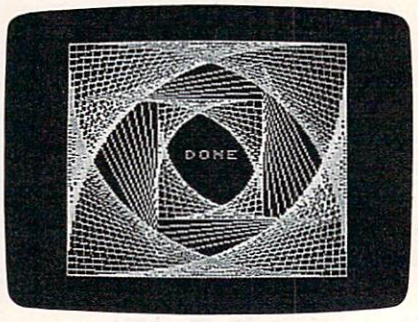

"Color Plotter 64" gives your Commodore 64 a set of 14 powerful new commands for plotting multicolor high-resolution graphics. You can even mix text and graphics on the same screen. The photos on these pages were generated by the demo program following this article.

Have you ever admired a multicolor high-resolution graphics display on the Commodore 64? Usually you have to learn machine language to create such displays yourself—but not now.

With "Color Plotter 64" those screens become easy because you'll have 14 special graphics commands added to your Commodore 64 BASIC. And because the commands are written in machine language, they work fast and efficiently. Here is a summary of the new commands:

IN, Turns on hi-res multicolor mode.

OFF, Turns off hi-res multicolor mode.

CL, Clears hi-res screen.

PC, Pen Clear. Clears everything on high-res screen drawn with current pen number.

P0,*n* Sets color of PEN 0, which is also the background color, where *n* is one of the 16 standard colors (0–15).

P1,*n* Sets color of PEN 1 (*n* = 0–15).

P2,*n* Sets color of PEN 2 (*n* = 0–15).

P3,*n* Sets color of PEN 3 (*n* = 0–15).

PEN,*n* Defines active pen number (*n* = 0–3).

PL,*x,y* Plots point on hi-res screen at coordinates *x,y* using active pen.

DR,*x,y* Draws best straight line from last point plotted to coordinates *x,y* using active pen.

CR,*x,y* Sets hi-res screen cursor to coordinates *x,y*.

**PR,*A$*** Prints contents of *A$* on high-res screen using active pen.

PR,*"text"* Prints text between quotes on hi-res screen using active pen.

Some of these commands may look familiar to those who have plotted graphics on other computers with other languages. You might be able to jump right in and

start plotting. Do note that all commands, even those without parameters (such as the IN, command), must be accompanied by the comma. There are also some special typing and loading instructions to follow with Color Plotter 64. For more details, see the sections below.

Entering The Program

Since Color Plotter is written entirely in machine language, it must be entered with the "MLX" machine language editor program, found elsewhere in this issue. To enter the Color Plotter program, load and run MLX. When MLX asks for the starting and ending addresses for the machine language data to be entered, respond with 49152 and 51353, respectively. MLX will then prompt you with the line number of the first line of data, 49152. Begin typing the data shown in Program 1 and continue until all the data is entered. If you do not type in all the data in one sitting, follow the directions in the MLX article for saving your incomplete work. When all the data is entered, you're ready to start using the Color Plotter commands.

Special Loading Instructions

You must issue a certain sequence of commands to load and activate Color Plotter 64. After turning on the power, enter these lines for disk, pressing RETURN each time:

```
LOAD "COLOR PLOTTER",8,1
POKE 44,64:POKE 16384,0:NEW
SYS 51260
```

For tape, change the first line above to:

```
LOAD "COLOR PLOTTER",1,1
```

Of course, you can save Color Plotter 64 on disk or tape with any filename you like. To load a program that contains Color Plotter commands, use the normal LOAD command.

Color Plotter Pen

As described above, the first three Color Plotter 64 commands (IN, OFF, and CL,) turn the hi-res multicolor mode on or off and clear the screen. (For those interested, the hi-res screen is located at memory addresses 8192 to 16191—hex $2000–$3F3F.)

PC, (Pen Clear) makes it possible to erase certain things off the screen while leaving all else intact. This is particularly useful for removing text, prompts, or messages while preserving the drawing in the background. To erase everything drawn with PEN 1, for example, execute:

```
PEN,1:PC,
```

The next five commands are very similar to each other; they all select drawing colors for the various pens. The parameter n should be a number, variable, or numeric expression in the range of 0 to 15 corresponding to standard Commodore 64 color numbers. (If you specify a number larger than 15, Color Plotter 64 does not report an error, however.) All the following statements are legal:

```
P0,0:REM Sets PEN 0 and background
     color to black.
P1,J:REM Sets color of PEN 1 to previ-
     ously defined value of variable J.
P2,J/2+1:REM Sets color of PEN 2 to
     value of expression J/2+1.
```

The command PEN,*n* defines the active pen number—in other words, which pen will be used with the drawing, printing, and pen-clearing commands that follow. Since there are only four pens, the parameter n should be a number, variable, or expression in the range of 0 to 3. PEN 0 is the background color, which makes it handy for erasing lines drawn with another color (simply draw over the lines with PEN 0).

As a technical aside, the pens draw in different colors by switching on different bit pairs on the hi-res screen. PEN 0 plots a 00 bit pair. PEN 1 plots the 01 pair, PEN 2 plots the 10 pair, and PEN 3 plots the 11 pair. PC, (Pen Clear) works by searching the screen and removing all occurrences of the bit pair that matches that of the active pen.

Drawing And Printing

The next five commands all perform the actual drawing, plotting, and printing in the colors specified by the pen commands. They use a coordinate system so you can place the pens anywhere on the screen.

PL,*x,y* is the plot command. Screen coordinates in the multicolor hi-res mode range from 0 to 159 horizontally (x) and 0 to 199 vertically (y). Important: The origin is the *lower-left* corner of the screen. That means the coordinates of the lower-left corner of the screen display are 0,0, the upper-left coordinates are 0,199, the upper-right coordinates are 159,199, and the lower-right coordinates are 159,0.

Again, the parameters x and y can be numbers, variables, or numeric expressions. Trying to plot a location out of range causes an ILLEGAL QUANTITY ERROR.

DR,*x,y* is the draw command. It works with the same coordinates as the plot command. Since the *x,y* parameters are the coordinates it *draws to*, at least one plot command should be executed to define the starting point before the first draw command.

CR,*x,y* positions the invisible hi-res cursor at the coordinates specified. This defines where a following print command will begin printing the text. Since a character is 8 bits high and 16 bits wide, the allowable range for coordinates with this command is 1 to 144 for x and 1 to 192 for y. Specifying a location out of range causes an ILLEGAL QUANTITY ERROR.

PR,A$ and PR,"" are the hi-res printing commands. To print a message, simply put the text between the quotes with PR,"" or define it as a string variable with PR,A$. String expressions such as PR,A$+B$ or PR,A$+"ABC" are *not* allowed.

Nondestructive Printing

The printing commands are specially written so they never write over a bit that is already on. This means they print nondestructively; they won't interfere with your graphics. This is handy in many instances. For example, if you create a drawing or a graph, you can label it without erasing any lines. Then you can erase the text with the PC, command without disturbing the graphics, assuming the text is printed in a different color.

The printing commands also update the invisible hi-res cursor automatically. They provide for line advances and wraparound from the bottom to the top of the screen.

There is one limitation with the

printing commands. They can print only those characters with ASCII codes 33 to 95 (this includes most punctuation symbols, numbers, and letters, but no keyboard graphics). Trying to print characters out of this range will cause an error.

You can do lots of exciting things with these 14 commands. By executing P1,1 everything drawn on the screen with PEN 1 will change to white in a flash. With a simple loop (FOR X=0 TO 15:P1, X:NEXT X) everything drawn with PEN 1 will flash through all 16 colors in an instant. Drawings or objects can be made to disappear by executing a command to match the pen color to the background color. Then they can be made to instantly reappear by executing another pen color command using a contrasting color.

Additional Notes

You should be aware that Color Plotter 64 affects a few normal BASIC commands. None of the new commands works with IF-THEN. For example, the following statement will cause a syntax error:

```
10 X=5:IF X=5 THEN CL,
```

Otherwise, IF-THEN works normally.

BASIC's pi function (π) also is affected. It still operates and is evaluated as 3.1415 . . . but appears as a graphic symbol when listed. If a line containing a pi symbol is edited, the pi symbol will have to be retyped at the edited line. I have found it convenient to define the variable PI=3.14159 and use PI instead of the pi symbol.

The IN, command should never be executed when already in the hi-res mode. Otherwise, a system crash and lockup may result. This is because the IN, command saves the normal error vector (ERRVEC) and replaces it with a new vector. If it is executed again before an OFF, command, the ERRVEC will point to the address of the replacement vector—in effect, it will point to itself.

Anytime there's a syntax error, the normal text screen with the default colors is restored. When a program is running in the hi-res mode, you can stop it as usual by pressing the RUN/STOP key. To return to the normal text screen, deliberately cause a syntax error by typing a key in direct mode and pressing RETURN.

If you press RUN/STOP-RESTORE, the Color Plotter 64 commands will no longer work. That's because BASIC ROM is switched back in. (Color Plotter 64 works by copying BASIC ROM into RAM and then modifying it to patch in the new routines.) In fact, the program won't even LIST properly. The first thing to do after pressing RUN/STOP-RESTORE is to enter SYS 51343 or POKE-1,PEEK(1) AND254. Either statement will switch out BASIC ROM and resurrect Color Plotter 64.

Program 1: Color Plotter 64

Please refer to the "MLX" article before entering this listing.

```
49152 :076,039,192,076,092,192,155
49158 :076,134,192,076,165,192,073
49164 :076,182,192,076,254,192,216
49170 :076,068,193,076,162,198,023
49176 :076,045,194,076,059,194,156
49182 :076,150,196,076,211,196,167
49188 :076,102,197,032,253,174,102
49194 :173,017,208,009,032,141,110
49200 :017,208,173,022,208,009,173
49206 :016,141,022,208,173,024,126
49212 :208,009,008,141,024,208,146
49218 :173,000,003,141,238,207,060
49224 :173,001,003,141,239,207,068
49230 :169,168,141,000,003,169,216
49236 :196,141,001,003,076,006,251
49242 :197,096,032,253,174,173,247
49248 :017,208,041,223,141,017,231
49254 :208,173,022,208,041,239,225
49260 :141,022,208,173,024,208,116
49266 :041,240,009,004,141,024,061
49272 :208,173,238,207,141,000,063
49278 :003,173,239,207,141,001,122
49284 :003,096,032,253,174,169,091
49290 :063,133,252,169,000,133,120
49296 :251,168,133,251,145,251,063
49302 :160,063,162,032,145,251,195
49308 :136,208,251,198,252,202,123
49314 :208,246,096,032,253,174,147
49320 :032,158,173,032,170,177,142
49326 :152,141,033,208,141,032,113
49332 :208,096,032,253,174,032,207
49338 :158,173,032,170,177,152,024
49344 :010,010,010,010,141,251,112
49350 :207,162,000,189,000,004,248
49356 :041,015,013,251,207,157,120
49362 :000,004,189,000,005,041,193
49368 :015,013,251,207,157,000,091
49374 :005,189,000,006,041,015,222
49380 :013,251,207,157,000,006,094
49386 :232,208,220,162,024,189,245
49392 :232,006,041,015,013,251,030
49398 :207,157,232,006,232,208,008
49404 :242,096,032,253,174,032,057
49410 :158,173,032,170,177,152,096
49416 :041,015,141,251,207,162,057
49422 :000,189,000,004,041,240,232
49428 :013,251,207,157,000,004,140
49434 :189,000,005,041,240,013,002
49440 :251,207,157,000,005,189,073
49446 :000,006,041,240,013,251,077
49452 :207,157,000,006,232,208,086
49458 :220,162,024,189,232,006,115
49464 :041,240,013,251,207,157,197
49470 :232,006,232,208,242,096,054
49476 :032,253,174,032,158,173,122
49482 :032,170,177,152,041,015,149
49488 :162,000,157,000,216,157,004
49494 :000,217,157,000,218,232,142
49500 :208,244,162,024,157,232,095
49506 :218,232,208,250,096,032,110
49512 :253,174,032,158,173,032,158
49518 :170,177,170,240,003,076,178
49524 :166,196,140,253,207,140,194
49530 :247,207,192,160,144,004,052
49536 :234,076,166,196,032,253,061
49542 :174,032,158,173,032,170,105
49548 :177,170,240,003,076,166,204
49554 :196,140,254,207,140,248,051
49560 :207,192,200,144,004,234,109
49566 :076,166,196,169,000,133,130
49572 :254,056,169,199,237,254,053
49578 :207,072,041,248,010,038,018
49584 :254,010,038,254,010,038,012
49590 :254,170,141,251,207,165,090
49596 :254,141,252,207,138,010,166
49602 :038,254,010,038,254,109,129
49608 :251,207,133,253,165,254,183
49614 :109,252,207,133,254,173,054
49620 :253,207,041,252,010,144,095
49626 :002,230,254,024,101,253,058
49632 :133,253,169,000,101,254,110
49638 :133,254,104,041,007,101,102
49644 :253,133,253,169,032,101,153
49650 :254,133,254,173,253,207,236
49656 :041,003,141,249,207,169,034
49662 :003,056,237,249,207,141,123
49668 :249,207,170,173,250,207,236
49674 :141,251,207,169,003,141,154
49680 :252,207,138,240,015,014,114
49686 :251,207,014,251,207,014,198
49692 :252,207,014,252,207,202,138
49698 :208,241,173,252,207,073,164
49704 :255,141,252,207,096,032,255
49710 :103,193,032,077,196,160,039
49716 :000,173,255,207,145,253,061
49722 :096,032,253,174,032,158,035
49728 :173,032,170,177,072,104,024
49734 :240,003,076,166,196,140,123
49740 :247,207,192,160,144,003,005
49746 :076,166,196,032,253,174,211
49752 :032,158,173,032,170,177,062
49758 :072,104,240,003,076,166,243
49764 :196,140,248,207,192,200,003
49770 :144,003,076,166,196,173,096
49776 :247,207,205,253,207,144,095
49782 :009,237,253,207,141,246,187
49788 :207,024,144,010,173,253,167
49794 :207,056,237,247,207,141,201
49800 :246,207,173,248,207,205,142
49806 :254,207,144,009,237,254,223
49812 :207,141,245,207,024,144,092
49818 :010,173,254,207,056,237,067
49824 :248,207,141,245,207,173,101
49830 :247,207,205,253,207,144,149
49836 :056,173,248,207,205,254,035
49842 :207,144,024,173,246,207,155
49848 :205,245,207,144,008,169,138
49854 :000,141,244,207,076,026,116
49860 :195,169,001,141,244,207,129
49866 :076,026,195,173,246,207,101
49872 :205,245,207,144,008,169,162
49878 :007,141,244,207,076,026,147
49884 :195,169,006,141,244,207,158
49890 :076,026,195,173,248,207,127
49896 :205,254,207,144,024,173,215
49902 :246,207,205,245,207,144,212
49908 :008,169,003,141,244,207,248
49914 :076,026,195,169,002,141,091
49920 :244,207,076,026,195,173,153
49926 :246,207,205,245,207,144,236
49932 :008,169,004,141,244,207,017
49938 :076,026,195,169,005,141,118
49944 :244,207,173,247,207,141,219
49950 :253,207,173,248,207,141,235
49956 :254,207,173,246,207,141,240
49962 :241,207,141,240,207,205,003
49968 :245,207,144,008,173,245,046
49974 :207,141,240,207,176,006,007
49980 :173,245,207,141,241,207,250
49986 :173,241,207,208,001,096,224
49992 :173,244,207,010,010,168,116
49998 :185,105,195,141,102,196,234
50004 :185,106,195,141,103,196,242
50010 :185,107,195,141,131,196,021
50016 :185,108,195,141,132,196,029
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50022 :076,091,196,009,196,167,069
50028 :195,167,195,009,196,167,013
50034 :195,197,195,197,195,167,236
50040 :195,197,195,137,195,137,152
50046 :195,197,195,137,195,009,030
50052 :196,009,196,137,195,165,006
50058 :253,041,007,073,007,240,247
50064 :008,230,253,208,017,230,066
50070 :254,208,013,024,165,253,043
50076 :105,057,133,253,165,254,099
50082 :105,001,133,254,096,165,148
50088 :253,041,007,208,015,056,236
50094 :165,253,233,057,133,253,244
50100 :165,254,233,001,133,254,196
50106 :208,008,165,253,208,002,006
50112 :198,254,198,253,096,238,149
50118 :249,207,173,249,207,201,204
50124 :004,208,016,169,000,141,230
50130 :249,207,056,165,253,233,093
50136 :008,133,253,176,002,198,218
50142 :254,173,249,207,170,173,168
50148 :250,207,141,251,207,169,173
50154 :003,141,252,207,138,240,191
50160 :015,014,251,207,014,251,224
50166 :207,014,252,207,014,252,168
50172 :207,202,208,241,173,252,255
50178 :207,073,255,141,252,207,113
50184 :096,173,249,207,208,018,191
50190 :024,165,253,105,008,133,190
50196 :253,165,254,105,000,133,162
50202 :254,169,004,141,249,207,026
50208 :206,249,207,173,249,207,043
50214 :170,173,250,207,141,251,206
50220 :207,169,003,141,252,207,255
50226 :138,240,015,014,251,207,147
50232 :014,251,207,014,252,207,233
50238 :014,252,207,202,208,241,162
50244 :173,252,207,073,255,141,145
50250 :252,207,096,160,000,177,198
50256 :253,045,252,207,013,251,077
50262 :207,141,255,207,096,173,141
50268 :241,207,141,242,207,074,180
50274 :141,243,207,032,234,234,165
50280 :032,077,196,173,243,207,008
50286 :024,109,240,207,141,243,050
50292 :207,176,005,205,241,207,133
50298 :144,009,237,241,207,141,077
50304 :243,207,032,234,234,032,086
50310 :077,196,160,000,173,255,227
50316 :207,145,253,206,242,207,120
50322 :208,209,234,096,032,253,154
50328 :174,032,158,173,032,170,123
50334 :177,152,041,003,141,250,154
50340 :207,096,162,014,072,138,085
50346 :072,152,072,032,095,192,017
50352 :169,006,141,033,208,169,134
50358 :014,141,032,208,169,147,125
50364 :032,210,255,173,238,207,023
50370 :141,000,003,173,239,207,189
50376 :141,001,003,104,168,104,209
50382 :170,104,108,000,003,032,111
50388 :253,174,032,158,173,032,010
50394 :170,177,170,240,003,076,030
50400 :166,196,192,153,144,003,054
50406 :076,166,196,140,236,207,227
50412 :032,253,174,032,158,173,034
50418 :032,170,177,170,240,003,010
50424 :076,166,196,192,193,144,191
50430 :003,076,166,196,140,237,048
50436 :207,096,120,165,253,072,149
50442 :165,254,072,169,225,141,012
50448 :040,003,169,142,032,210,100
50454 :255,173,014,220,041,254,211
50460 :141,014,220,165,001,041,098
50466 :251,133,001,169,000,133,209
50472 :251,169,209,133,252,169,199
50478 :000,133,253,169,008,133,230
50484 :254,160,000,177,251,145,015
50490 :253,200,208,249,169,208,065
50496 :133,252,230,254,177,251,081
50502 :145,253,200,208,249,165,010
50508 :001,009,004,133,001,173,141
50514 :014,220,009,001,141,014,225
50520 :220,169,237,141,040,003,130
50526 :088,104,133,254,104,133,142
50532 :253,096,032,253,174,032,172
50538 :158,173,032,163,182,032,078
50544 :166,182,208,003,076,138,117
50550 :198,141,242,207,165,034,081
50556 :133,251,141,245,207,165,242
50562 :035,133,252,141,246,207,120
50568 :165,253,072,165,254,072,093
50574 :160,000,177,251,201,032,195
50580 :208,003,076,097,198,141,103
50586 :243,207,173,236,207,201,141
50592 :153,144,023,169,000,141,022
50598 :236,207,173,237,207,201,147
50604 :008,176,006,169,200,141,104
50610 :237,207,056,233,008,141,036
50616 :237,207,173,237,207,201,166
50622 :192,144,006,169,192,141,010
50628 :237,207,024,105,007,141,149
50634 :015,208,173,253,207,072,106
50640 :173,254,207,072,173,236,043
50646 :207,141,253,207,173,015,186
50652 :208,141,254,207,032,161,199
50658 :193,104,141,254,207,104,205
50664 :141,253,207,169,000,133,111
50670 :252,173,243,207,201,032,066
50676 :176,003,076,166,196,201,038
50682 :096,144,003,076,166,196,163
50688 :056,233,032,010,038,252,109
50694 :010,038,252,010,038,252,094
50700 :133,251,024,165,252,105,174
50706 :008,133,252,160,000,169,228
50712 :008,133,002,177,251,141,224
50718 :240,207,152,072,173,240,090
50724 :207,234,234,010,141,240,078
50730 :207,144,024,160,000,173,238
50736 :252,207,073,255,049,253,113
50742 :234,234,234,234,234,234,178
50748 :208,007,177,253,013,251,201
50754 :207,145,253,032,009,196,140
50760 :198,002,208,214,032,137,095
50766 :195,169,008,133,002,032,105
50772 :197,195,198,002,208,249,109
50778 :104,168,200,192,008,144,138
50784 :182,173,236,207,024,105,255
50790 :008,141,236,207,206,242,118
50796 :207,240,021,238,245,207,242
50802 :208,003,238,246,207,173,165
50808 :245,207,133,251,173,246,095
50814 :207,133,252,076,142,197,109
50820 :104,133,254,104,133,253,089
50826 :169,000,141,236,207,173,040
50832 :237,207,201,008,176,005,210
50838 :169,200,141,237,207,056,136
50844 :233,008,141,237,207,096,054
50850 :032,253,174,165,251,072,085
50856 :165,252,072,169,032,133,223
50862 :252,169,000,133,251,168,123
50868 :162,031,173,250,207,141,120
50874 :243,207,010,010,141,244,017
50880 :207,010,010,141,245,207,244
50886 :010,010,141,246,207,177,221
50892 :251,240,064,041,192,205,173
50898 :246,207,208,006,177,251,025
50904 :041,063,145,251,177,251,120
50910 :240,047,041,048,205,245,024
50916 :207,208,006,177,251,041,094
50922 :207,145,251,177,251,240,225
50928 :030,041,012,205,244,207,211
50934 :208,006,177,251,041,243,148
50940 :145,251,177,251,240,013,049
50946 :041,003,205,243,207,208,141
50952 :006,177,251,041,252,145,112
50958 :251,200,208,185,230,252,060
50964 :202,208,180,198,252,165,201
50970 :251,201,064,240,012,169,195
50976 :064,133,251,160,192,162,226
50982 :001,024,144,161,234,104,194
50988 :133,252,104,133,251,096,245
50994 :073,206,079,070.198,067,231
51000 :204,080,195,080,176,080,103
51006 :177,080,178,080,179,080,068
51012 :069,206,080,204,068,210,137
51018 :067,210,080,210,000,000,129
51024 :234,234,234,234,234,234,204
51030 :234,234,234,234,234,038,014
51036 :192,091,192,133,192,161,029
51042 :198,164,192,181,192,253,254
51048 :192,067,193,149,196,044,177
51054 :194,058,194,210,196,101,039
51060 :197,234,234,032,115,000,160
51066 :032,128,199,076,174,167,130
51072 :240,027,233,128,144,024,156
51078 :201,076,144,023,201,089,100
51084 :176,019,233,075,010,168,053
51090 :185,092,199,072,185,091,202
51096 :199,072,076,115,000,096,198
51102 :076,165,169,076,243,167,030
51108 :032,008,200,201,204,144,185
51114 :015,173,055,200,233,076,154
51120 :141,055,200,169,199,162,078
51126 :050,076,190,199,169,160,002
51132 :162,158,141,050,167,142,240
51138 :049,167,141,058,167,142,150
51144 :057,167,032,249,199,076,212
51150 :026,167,032,008,200,173,044
51156 :252,165,201,160,208,015,189
51162 :169,199,162,050,032,026,088
51168 :200,032,249,199,160,000,040
51174 :076,184,165,169,160,162,122
51180 :158,032,026,200,032,249,165
51186 :199,189,000,002,076,007,203
51192 :166,173,054,200,072,173,062
51198 :055,200,174,056,200,172,087
51204 :057,200,040,096,008,141,034
51210 :055,200,142,056,200,140,035
51216 :057,200,104,141,054,200,004
51222 :173,055,200,096,141,190,109
51228 :165,216,142,189,165,141,022
51234 :001,166,142,000,166,202,199
51240 :224,255,208,003,056,233,251
51246 :001,141,252,165,142,251,230
51252 :165,096,255,255,255,255,053
51258 :255,255,162,032,160,000,154
51264 :169,160,133,252,169,000,179
51270 :133,251,177,251,145,251,254
51276 :200,208,249,230,252,202,137
51282 :208,244,234,169,076,141,130
51288 :225,167,141,004,166,169,192
51294 :119,141,226,167,169,199,091
51300 :141,227,167,169,208,141,129
51306 :005,166,169,199,141,006,024
51312 :166,169,164,141,006,003,249
51318 :169,199,141,007,003,169,038
51324 :000,141,254,207,141,253,096
51330 :207,141,252,207,141,251,049
51336 :207,141,236,207,141,237,025
51342 :207,165,001,041,254,133,175
51348 :001,096,255,013,013,013,027
```

Program 2: Color Plotter Demo

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" published bimonthly in COMPUTE!.

```
14 REM COLOR PLOTTER 64:rem 92
18 REM **** INITIALIZE FOR DEM
   O1******              :rem 32
20 PEN,1:REM START USING PEN1
                         :rem 232
25 P0,0:REM SET BKGRND COLOR=B
   LACK                  :rem 30
30 P1,12:REM SET PEN1=GRAY
                         :rem 1
35 P2,14:REM SET PEN2=LT BLUE
                         :rem 159
40 P3,5:REM SET PEN3=GREEN
                         :rem 22
45 IN,:REM TURN ON HI-RES SCRE
   EN                    :rem 152
47 CL,:REM CLEAR HI-RES SCREEN
                         :rem 19
50 REM*** DEMO1, RANDOM SYMMET
   RY*******             :rem 186
52 CR,0,192:PR,"DESIGNS IN ":P
   R," ":PR,"RANDOM SYMMETRY"
                         :rem 243
53 X1=79:Y1=100:X2=79:Y2=100:X
   4=79:Y4=100           :rem 60
54 CR,0,0:PR,"PRESS A KEY TO C
   ONT":PEN,2:PL,X1,Y1:
                         :rem 134
55 DX=INT(RND(0)*50)-25:DY=INT
   (RND(0)*80)-40:PEN,2:rem 90
60 X1=X1+DX:IFX1>159THENX1=159
                         :rem 63
62 IFX1<0THENX1=0        :rem 17
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64 Y1=Y1+DY:IFY1>170THENY1=170
                          :rem 58
66 IFY1<9THENY1=9         :rem 41
68 X2=X2-DX:IFX2>159THENX2=159
                          :rem 77
69 IFX2<0THENX2=0         :rem 26
70 Y2=Y2+DY:IFY2>170THENY2=170
                          :rem 59
72 IFY2<9THENY2=9         :rem 40
74 DR,X1,Y1:X3=X1:Y3=Y1:PEN,3:
   PL,X4,Y4:DR,X2,Y2:X4=X2:Y4=
   Y2                     :rem 160
75 PL,X3,Y3               :rem 119
76 K=K+1:IFK>15THENK=0:FORJ=0T
   O500:NEXTJ:PC,:PEN,2:PC,:GO
   TO55                   :rem 88
78 GETA$:IFA$=""THEN55:rem 252
79 POKE198,0:CL,          :rem 146
210 REM****DEMO2 GEOMETRIC PAT
   TERN*****              :rem 5
220 CL,:REM CLEAR SCREEN
                          :rem 148
225 PEN,3:CR,40,100:PR,"NOW LE
   T'S SEE":CR,40,90:PR,"A PA
   TTERN"                 :rem 18
230 X1=0:Y1=0:X2=159:Y2=0:X3=1
   59:Y3=199:X4=0:Y4=199
                          :rem 175
240 PEN,1:PL,X1,Y1:DR,X2,Y2
                          :rem 84
245 PEN,2:DR,X3,Y3        :rem 27
250 PEN,1:DR,X4,Y4        :rem 24
255 PEN,2:DR,X1,Y1        :rem 24
260 X1=X1+5:Y2=Y2+6.25:X3=X3-5
   :Y4=Y4-6.25            :rem 66
265 IFX1<160THEN240       :rem 77
268 PEN,3                 :rem 226
269 IFY1=50THEN280        :rem 37
270 X1=50:Y1=50:X2=110:Y2=50:X
   3=110:Y3=150:X4=50:Y4=150:
   GOTO240                :rem 92
280 PEN,3:PC,:K=0         :rem 199
290 FORI=1TO15:P1,I:P2,16-I:FO
   RJ=0TO400:NEXTJ        :rem 9
295 GETA$:IFA$=""THENNEXTI:K=K
   +1:IFK<2THEN290        :rem 0
300 P1,15:P2,3:P3,14:CR,65,100
   :PEN,3:PR,"DONE"       :rem 32
310 FORI=0TO500:NEXT:PEN,1:PC,
   :FORI=0TO500:NEXT:PEN,2:PC
   ,                      :rem 81
315 FORI=0TO200:NEXT:CL,
                          :rem 217
320 CR,0,160:PR,"MORE RANDOM D
   ESIGNS"                :rem 150
330 FORI=0TO800:NEXT:CL,
                          :rem 220
350 POKE198,0:PEN,1       :rem 63
400 REM****DEMO3, RANDOM DESIG
   NS*******              :rem 152
402 P0,0:REM SET PEN 0(BKGRND)
   =BLK                   :rem 174
403 P1,1:REM SET PEN 1=COLOR 1
   =WHITE                 :rem 62
404 P2,2:REM SET PEN 2=COLOR 2
   =RED                   :rem 157
405 P3,3:REM SET PEN,3=COLOR 3
   =CYAN                  :rem 30
406 PEN,1:REM DEFINE ACTIVE PE
   N =PEN1                :rem 147
415 CL,:REM CLEAR HI-RES SCREE
   N                      :rem 66
418 N=3:REM SET NUMBER OF RAND
   OM PTS                 :rem 123
420 N1=20:REM SET INTERVAL DIV
   IDER                   :rem 42
423 REM NEXT LINE GENERATES RA
   NDOM X,Y               :rem 32
430 FORI=0TON:X(I)=INT(RND(0)*
   120)+20:Y(I)=INT(RND(1)*19
   0):NEXTI               :rem 11
438 REM NEXT LINE COMPUTES DEL
   TX,DELTYS              :rem 220
440 FORI=0TON-1:DX(I)=(X(I+1)-
   X(I))/N1:DY(I)=(Y(I+1)-Y(I
   ))/N1:NEXTI            :rem 123
450 DX(N)=(X(0)-X(N))/N1:DY(N)
   =(Y(0)-Y(N))/N1        :rem 190
465 REM DRAW LINES BETWEEN POI
   NTS                    :rem 19
470 PL,X(0),Y(0):FORI=0TON:PEN
   ,I:DR,X(I),Y(I):NEXTI:PEN,
   2:DR,X(0),Y(0):PEN,3
                          :rem 61
476 REM COMPUTE NEW X AND Y VA
   LUES                   :rem 224
477 REM BASED ON NEWX=OLDX+DX
                          :rem 255
478 REM AND NEWY=OLDY+DY
                          :rem 218
480 FORI=0TON:X(I)=X(I)+DX(I):
   Y(I)=Y(I)+DY(I):NEXTI
                          :rem 103
485 REM CHECK IF DONE     :rem 152
486 REM IF NOT, DRAW LINES
                          :rem 219
487 REM BETWEEN NEW X AND Y'S
                          :rem 121
488 K=K+1:IFK<N1 THEN 470
                          :rem 108
491 REM KEY PRESSED?      :rem 192
492 REM IF TRUE THEN END
                          :rem 88
493 REM IF NOT THEN CONTINUE
                          :rem 152
500 GETA$:IFA$<>""THEN700
                          :rem 140
515 REM DELAY TO VIEW GRAPHICS
                          :rem 29
520 FOR I=0 TO 500:NEXTI
                          :rem 46
526 REM LOOP THROUGH GENERATIO
   N                      :rem 200
527 REM OF RANDOM COLORS
                          :rem 170
528 REM FOR PENS 2 AND 3
                          :rem 216
530 FOR I=0 TO 5:C1=INT(RND(1)
   *15)+1:C2=INT(RND(1)*15)+1
   :C3=INT(RND(1)*15)+1
                          :rem 123
532 P1,C1:P2,C2:P3,C3     :rem 119
534 REM TIME DELAY        :rem 30
536 FORJ=0TO300:NEXTJ     :rem 53
537 NEXTI                 :rem 39
538 CR,8,188:PR,"PRESS KEY TO
   {SPACE}EXIT":FORI=0TO500:N
   EXTI                   :rem 214
540 REM CLEAR SCREEN ONE PEN
                          :rem 105
541 REM AT A TIME WITH DELAY
                          :rem 46
545 PEN,1:PC,:FORI=0TO300:NEXT
   I                      :rem 166
550 PEN,2:PC,:FORI=0TO300:NEXT
   I                      :rem 163
560 PEN,3:PC,:FORI=0TO300:NEXT
   I                      :rem 165
580 REM CHECK FOR KEYPRESS
                          :rem 60
590 REM IF TRUE THEN EXIT
                          :rem 186
600 REM ELSE CONTINUE     :rem 8
610 GETA$:IFA$<>""THEN700
                          :rem 142
640 K=0:GOTO415           :rem 95
700 REM ****DEMO4 GLOBAL GRAPH
   ICS*****               :rem 80
710 CL,:P0,0:P1,1:P2,6:P3,2:PE
   N,1                    :rem 52
730 R=60:PI=3.14159       :rem 4
731 X=0:Y=0:Z=0:GOSUB900:PL,SX
   ,SY:X=0:Y=0:Z=65:GOSUB900:
   DR,SX,SY               :rem 70
732 SX=SX+3:CR,SX,SY:PR,"Z"
                          :rem 177
733 X=0:Y=0:Z=0:GOSUB900:PL,SX
   ,SY:Y=65:GOSUB900:DR,SX,SY
   :SY=SY+3:CR,SX,SY      :rem 243
734 PR,"Y":X=0:Y=0:Z=0:GOSUB90
   0:PL,SX,SY:X=80:Y=0:Z=0:GO
   SUB900:DR,SX,SY        :rem 235
735 SY=SY+4:CR,SX,SY:PR,"X":PE
   N,2                    :rem 48
740 FORTH=0TOPISTEP PI/10
                          :rem 44
750 Z=R*COS(TH):R1=R*SIN(TH)
                          :rem 206
760 X=R1*COS(1.9*PI):Y=R1*SIN(
   1.9*PI)                :rem 131
770 GOSUB900:PL,SX,SY     :rem 60
775 IFTH=0THENNEXTTH      :rem 69
780 FOR BETA=0TO 2*PISTEP PI/1
   0:                     :rem 70
790 X=R1*COS(BETA):Y=R1*SIN(BE
   TA):                   :rem 66
800 GOSUB900:DR,SX,SY     :rem 48
810 NEXT BETA             :rem 244
820 NEXT TH               :rem 117
830 PEN,3                 :rem 221
835 X=0:Y=0:Z=R:GOSUB900:PL,SX
   ,SY                    :rem 96
840 FORTH=0 TO 2*PI STEP PI/10
                          :rem 137
841 X=0:Y=0:Z=R:GOSUB900:PL,SX
   ,SY                    :rem 93
845 FOR BETA=0 TO PI STEP PI/1
   0                      :rem 178
850 Z=R*COS(BETA):X=R*SIN(BETA
   )*COS(TH):Y=R*SIN(BETA)*SI
   N(TH)                  :rem 68
855 GOSUB900:DR,SX,SY:NEXT BET
   A:X=0:Y=0:Z=-R:GOSUB900:DR
   ,SX,SY                 :rem 240
860 NEXT TH               :rem 121
865 PEN,1:PC,:FORI=0TO1000:NEX
   T                      :rem 144
866 FORI=0TO10:C2=INT(RND(0)*1
   6):C3=INT(RND(0)*16):P2,C2
   :FORJ=0TO150:NEXTJ:rem 179
867 P3,C3:FORJ=0TO150:NEXTJ:NE
   XTI                    :rem 96
870 PEN,1:CR,4,4:PR,"THAT'S AL
   L FOLKS"               :rem 189
875 FORI=0 TO 32:P1,I:FORJ=0TO
   50:NEXTJ,I             :rem 145
879 REM ****CLOSING CEREMONIES
   ******                 :rem 41
880 CL,:P0,14:P1,6:CR,15,95
                          :rem 190
885 PR,"COLOR PLOTTER 64"
                          :rem 202
888 PR," ":P2,1:PEN,1     :rem 77
895 FORI=0 TO 1000:NEXTI
                          :rem 105
897 P3,6:FORI=0TO101:PL,0,I:DR
   ,159,I:PL,0,199-I:DR,159,1
   99-I:NEXTI             :rem 105
898 OFF,:POKE53281,6:POKE53280
   ,14:PRINT"{CLR}"       :rem 24
899 END                   :rem 129
900 S1=SIN(PI/4):C1=COS(PI/4):
   S2=SIN(PI/4):C2=COS(PI/4):
   D=100:PH=120           :rem 237
905 XE=-X*S1+Y*C1         :rem 205
910 YE=-X*C1*C2-Y*S1*C2+Z*S2
                          :rem 62
915 ZE=-X*S2*C1-Y*S2*S1-Z*C2+P
   H                      :rem 25
920 SX=D*XE/ZE+80         :rem 239
925 SY=D*YE/ZE+100        :rem 31
930 RETURN                :rem 124
1000 END                  :rem 152 ©
```

Apple II Pull-Down Menus

Lee Swoboda

With this program, you can add attractive, Macintosh-like pull-down menus and instruction screens to any BASIC program. For all Apple II-series computers with DOS 3.3 or ProDOS.

Apple's Macintosh has forced programmers to reevaluate software for the venerable Apple II. Recent Apple II programs go to some lengths to emulate the Mac's pull-down menus and icons to make the software less intimidating. No amount of programming magic will turn an Apple II into a Mac, but the following programs let you add pull-down menus and instruction screens to any Applesoft BASIC program.

Two programs are needed to make this happen: a BASIC subroutine you can easily add to the end of any BASIC program, and a machine language (ML) routine that temporarily saves and later restores the text behind the pull-down menu. Although BASIC takes several seconds to move an entire text screen, machine language performs the same task in an instant. Don't worry if you're unfamiliar with machine language. We've listed a BASIC filemaker program that automatically creates the ML routine for you.

Starting Out

To get "Pull-Down Menus" running, you need to type in and save both programs listed below. Program 1 is the filemaker program that automatically saves the ML routine to disk as a binary file named MOVE. Type it in and save a copy, then run it. Program 2 is an example BASIC program that demonstrates pull-down menus. It is designed to run with either DOS 3.3 or ProDOS. If you're using DOS 3.3, type the program exactly as shown. For ProDOS, change line 150 as shown here:

```
75 150 HIMEN:35840
```

Since this program loads the MOVE file from disk, be sure to put the right disk in the drive before you run it. Once you have it running, the program simulates a crude word processor with a screenful of text. You can type on the screen and move the cursor with the arrow keys (use CTRL-J and CTRL-K for the up and down cursor keys if you don't have a IIe or IIc). When you press the ESC key, the pull-down menu appears. Then you can move the selection cursor inside the menu with the cursor keys, and choose a selection by pressing RETURN. Note that the text behind the menu is always restored correctly when you leave the menu.

Create Your Own Menus

The important part of the demonstration program is the subroutine beginning at line 63000. This routine allows you to add pull-down menus to your own programs with a minimum of work: It generates the window shape and calls MOVE at the appropriate time. All you need to do is add lines 63000–63500 to the end of any BASIC program, and follow the steps listed below:

1. Your program must BLOAD MOVE as shown in lines 180–190 before calling the ML routine.

2. Set HIMEM *immediately* (line 150) before you declare any strings or open any files. Use a value of 36914 for DOS 3.3 or 35840 for ProDOS.

3. Set the variable NN to equal the maximum number of items you will have in the largest menu (line 160). The menu subroutine automatically determines how many items are in each menu and adjusts the size of the menu window accordingly.

4. DIMension the string array MM$ for the number of menu selection labels you need (line 170). Then fill each array element with a label string, either by READing string DATA as in lines 200–220 or by defining each string expressly (with statements like MM$(1)="Leave menu").

5. Define the string variable TITLE$ as your menu title (line 470). The menu subroutine automatically centers the title for you.

6. Provide some means of branching to the rest of your program based on the value of the variable SELECT (line 480). This may be done with ON SELECT GOTO as in this program, or with ON SELECT GOSUB or a series of IF-THEN statements.

Lines 690–850 of the program show how to use MOVE to add instructions to your programs without losing the original screen. In this case, CTRL-I is used to request instructions.

Using A Mouse

If you have an Apple mouse, you can use it to call the menu and make selections. This requires several changes in the demonstration program. First, delete lines 320, 330, and 63360–63460. Then change lines 310, 450, and 63350 as follows:

```
E9 310 PRINT "PRESS ESC KEY OR M
       OUSE BUTTON FOR MENU";
9B 450 GOTO 311
66 63350 HTAB 3: VTAB SELECT + 2
       : INVERSE : PRINT ">" C
       HR$ (8);: NORMAL
```

Now add these lines:

```
D2 235 PRINT : HOME : PRINT D$"P
       R#2": PRINT CHR$ (1): PRI
       NT D$"PR#Ø"
#A 311 VTAB 15: HTAB 1: PRINT CH
       R$ (13)D$"IN#2"
55 312 VTAB 23: HTAB 4Ø: INPUT "
       ";X,Y,BØ
#F 313 IF BØ = 1 OR BØ < Ø THEN
       316
8Ø 314 VTAB CV: HTAB CH: FLASH :
        PRINT " ";: NORMAL
A8 315 GOTO 312
C2 316 PRINT D$"IN#Ø"
57 317 IF BØ = 1 THEN IN$ = CHR$
        (27): GOTO 319
8F 318 IN$ = CHR$ ( PEEK ( - 163
       84) - 128)
34 319 POKE - 16368,Ø
BD 32Ø VTAB CV: HTAB CH: PRINT "
       ";
F7 395 IF CH > Ø THEN HTAB CH
79 396 IF CV > Ø THEN VTAB CV
F8 63360 VTAB 1: HTAB LMAX + 5:
       PRINT : HTAB LMAX + 5:
       PRINT D$"IN#2": VTAB 1:
        HTAB LMAX + 5: INPUT "
       ";XØ,YØ,BØ
61 63370 IF BØ = 1 THEN 63430
8Ø 63380 YØ = INT (YØ / 1Ø)
6B 63390 VTAB SELECT + 2: HTAB 3
       : PRINT " ";
C9 63400 SELECT = YØ: IF SELECT
       > NITEMS THEN SELECT =
       NITEMS
3D 63410 IF SELECT < 1 THEN SELE
       CT = 1
#4 63420 GOTO 63350
DC 63430 PRINT D$"IN#Ø"
```

If you're using ProDOS, change line 311 to the following:

```
#1 311 VTAB 15: HTAB 1: PRINT D$
       "IN#2"
```

The PR#2 and IN#2 in lines 235, 311, and 63360 assume the mouse interface is in slot 2. If your interface is in another slot, substitute the appropriate slot number in those lines. If you have an Apple IIc, substitute PR#4 and IN#4 for PR#2 and IN#2 in those lines. (Although the IIc doesn't have *physical* slots, the mouse is in *logical* slot 4.) Once you've made all the changes, install the mouse and rerun the program. It works much as described above, using the mouse button instead of RETURN for menu selections.

For instructions on entering these listings, please refer to "COMPUTE!'s Guide to Typing In Programs" published bimonthly in COMPUTE!.

Program 1: MOVE Filemaker

```
B7 1ØØ REM BASIC PROGRAM FOR
A8 11Ø REM GENERATING THE
44 12Ø REM BINARY FILE
2B 13Ø REM 'MOVE'
4C 14Ø HOME
1C 15Ø VTAB 12: PRINT "WORKING .
       .."
92 16Ø FOR I = Ø TO 459
21 17Ø READ A
CC 18Ø POKE 36915 + I,A
D1 19Ø VTAB 12: HTAB 13: PRINT I
        + 1
DE 2ØØ NEXT I
FF 21Ø PRINT CHR$ (4)"BSAVE MOVE
       ,A36915, L46Ø"
2A 22Ø PRINT : PRINT "DONE!"
A8 23Ø DATA 173,89,17Ø,72,165,21
       7,72,165,118,72,169
3F 24Ø DATA 2,133,118,169,255,13
       3,217,169,191,133,51
5D 25Ø DATA 169,Ø,133,243,76,86,
       144,76,86,76,86
D8 26Ø DATA 76,86,169,8Ø,133,133
       ,169,144,16Ø,Ø,162
33 27Ø DATA 5,32,254,144,76,1Ø4,
       144,76,1Ø4,169,1Ø2
35 28Ø DATA 133,133,169,144,16Ø,
       Ø,162,1,32,254,144
97 29Ø DATA 169,Ø,141,8Ø,144,169
       ,4,141,81,144,173
F5 3ØØ DATA 81,144,2Ø1,8,48,14,2
       Ø8,9,173,8Ø,144
6Ø 31Ø DATA 2Ø1,Ø,144,5,24Ø,3,76
       ,234,144,173,8Ø
7D 32Ø DATA 144,141,161,144,173,
       81,144,141,162,144,173
99 33Ø DATA Ø,16,141,82,144,169,
       Ø,141,83,144,24
D1 34Ø DATA 169,255,1Ø9,1Ø2,144,
       141,84,144,169,145,1Ø9
#D 35Ø DATA 1Ø3,144,141,85,144,1
       73,84,144,141,2Ø4,144
8D 36Ø DATA 173,85,144,141,2Ø5,1
       44,173,82,144,141,Ø
D9 37Ø DATA 16,24,173,1Ø2,144,1Ø
       5,1,141,1Ø2,144,173
6E 38Ø DATA 1Ø3,144,1Ø5,Ø,141,1Ø
       3,144,238,8Ø,144,2Ø8
63 39Ø DATA 3,238,81,144,76,127,
       144,1Ø4,133,118,1Ø4
35 4ØØ DATA 133,217,1Ø4,141,89,1
       7Ø,169,141,141,1,2
C2 41Ø DATA 169,1,133,52,96,133,
       134,132,135,16Ø,Ø
8B 42Ø DATA 169,Ø,145,133,2ØØ,2Ø
       8,2,23Ø,134,138,2Ø8
F3 43Ø DATA 4,198,135,48,4,2Ø2,7
       6,4,145,96,173
B3 44Ø DATA 89,17Ø,72,165,217,72
       ,165,118,72,169,2
8A 45Ø DATA 133,118,169,255,133,
       217,169,191,133,51,169
44 46Ø DATA Ø,133,243,76,6Ø,145,
       76,6Ø,76,6Ø,76
E6 47Ø DATA 6Ø,169,54,133,133,16
       9,145,16Ø,Ø,162,5
84 48Ø DATA 32,228,145,76,78,145
       ,76,78,169,76,133
7A 49Ø DATA 133,169,145,16Ø,Ø,16
       2,1,32,228,145,169
E7 5ØØ DATA 255,141,54,145,169,1
       45,141,55,145,173,55
5A 51Ø DATA 145,2Ø1,149,48,14,2Ø
       8,9,173,54,145,2Ø1
85 52Ø DATA 255,144,5,24Ø,3,76,2
       Ø8,145,173,54,145
A7 53Ø DATA 141,135,145,173,55,1
       45,141,136,145,173,Ø
1E 54Ø DATA 16,141,56,145,169,Ø,
       141,57,145,24,169
BØ 55Ø DATA Ø,1Ø9,76,145,141,58,
       145,169,4,1Ø9,77
74 56Ø DATA 145,141,59,145,173,5
       8,145,141,178,145,173
4D 57Ø DATA 59,145,141,179,145,1
       73,56,145,141,Ø,16
#E 58Ø DATA 24,173,76,145,1Ø5,1,
       141,76,145,173,77
#4 59Ø DATA 145,1Ø5,Ø,141,77,145
       ,238,54,145,2Ø8,3
#7 6ØØ DATA 238,55,145,76,1Ø1,14
       5,1Ø4,133,118,1Ø4,133
22 61Ø DATA 217,1Ø4,141,89,17Ø,1
       69,141,141,1,2,169
33 62Ø DATA 1,133,52,96,133,134,
       132,135,16Ø,Ø,169
41 63Ø DATA Ø,145,133,2ØØ,2Ø8,2,
       23Ø,134,138,2Ø8,4
C9 64Ø DATA 198,135,48,4,2Ø2,76,
       234,145,96
```

Program 2: Apple II Pull-Down Menus

```
1C 1ØØ REM  LINES 15Ø-85Ø ARE
DB 11Ø REM A SAMPLE PROGRAM
EA 12Ø REM DEMONSTRATING
D6 13Ø REM PULL-DOWN MENUS
8A 14Ø REM
5B 15Ø HIMEM: 36914: REM FOR DOS
        3.3 ONLY. FOR PRODOS USE
       35840
14 16Ø NN = 2Ø: REM   MAXIMUM NU
       MBER OF ITEMS IN ANY MENU
C6 17Ø DIM MM$(NN): REM MM$=MENU
        SELECTIONS
62 18Ø D$ = CHR$ (4)
5C 19Ø PRINT D$"BLOAD MOVE"
FD 2ØØ FOR I = 1 TO 5
BE 21Ø READ MM$(I)
E2 22Ø NEXT I
4B 23Ø HOME
41 24Ø FOR I = 1 TO 15
57 25Ø PRINT "THIS IS A SAMPLE P
       ULL-DOWN MENU. ";
EA 26Ø NEXT I
B3 27Ø CV = 13:CH = 16
12 28Ø VTAB 21: HTAB 1: PRINT "-
       ----------------------
       ----------": REM 39 DA
       SHES
BE 29Ø PRINT TAB( 5)"USE ARROW K
       EYS TO MOVE CURSOR"
35 3ØØ PRINT TAB( 5)"PRESS CTRL-
       I FOR INSTRUCTIONS"
```

```
36 310 PRINT TAB( 8)"PRESS ESC K
       EY FOR MENU ";
8A 320 VTAB CV: HTAB CH
91 330 GET IN$
62 340 IF IN$ = CHR$ (9) THEN GO
       SUB 690
31 350 IF IN$ = CHR$ (27) THEN 4
       70
C4 360 IF IN$ = CHR$ (8) THEN CH
        = CH - 1
78 370 IF IN$ = CHR$ (21) THEN C
       H = CH + 1
D9 380 IF IN$ = CHR$ (11) THEN C
       V = CV - 1
53 390 IF IN$ = CHR$ (10) THEN C
       V = CV + 1
8A 400 IF IN$ > CHR$ (31) THEN P
       RINT IN$;:CH = CH + 1: IF
        CH > 40 THEN CH = 1:CV =
        CV + 1
73 410 IF CH < 1 THEN CH = 1
C6 420 IF CH > 40 THEN CH = 40
7E 430 IF CV < 1 THEN CV = 1
4F 440 IF CV > 20 THEN CV = 20
9A 450 GOTO 320
36 460 REM THE FOLLOWING LINE AC
       TIVATES THE MENU
33 470 TITLE$ = "MENU": GOSUB 63
       040
59 480 ON SELECT GOTO 280,490,50
       0,510,590
59 490 HOME : PRINT "THE FIRST F
       UNCTION OF YOUR PROGRAM G
       OES HERE": GOTO 520
74 500 HOME : PRINT "THE SECOND
       FUNCTION OF YOUR PROGRAM
       GOESHERE": GOTO 520
08 510 HOME : PRINT "THE THIRD F
       UNCTION OF YOUR PROGRAM G
       OES HERE": GOTO 520
3F 520 VTAB 24: PRINT "PRESS ANY
        KEY TO CONTINUE ... ";
D7 530 GET A$
35 540 FOR I = 1 TO NITEMS
97 550 MM$(I) = ""
ED 560 NEXT I
D0 570 RESTORE
1F 580 GOTO 200
25 590 HOME : PRINT "GOOD-BYE!":
        END
99 600 DATA "LEAVE MENU"
CD 610 DATA "FIRST SELECTION"
71 620 DATA "SECOND SELECTION"
B0 630 DATA "THIRD SELECTION"
AE 640 DATA "QUIT PROGRAM"
98 650 END
93 660 REM
8E 670 REM INSTRUCTIONS
97 680 REM
6C 690 CALL 36915
D5 700 HOME : INVERSE : PRINT BL
       ANK$
DC 710 VTAB 1: HTAB 14: PRINT "I
       NSTRUCTIONS": NORMAL : VT
       AB 3
68 750 PRINT "FOR THIS SAMPLE PR
       OGRAM, YOU CAN MOVE"
12 760 PRINT "THE CURSOR WITH TH
       E ARROW KEYS AND TYPE"
39 770 PRINT "ON THE SCREEN.  WH
       EN YOU PRESS ESC, THE"
64 780 PRINT "COMPUTER WILL DISP
       LAY A PULL DOWN MENU."
30 790 PRINT "USE THE ARROW KEYS
        TO MOVE THE SELEC-"
47 800 PRINT "TION CURSOR TO THE
        DESIRED OPTION, THEN"
9A 810 PRINT "PRESS RETURN TO SE
       LECT IT."
42 820 VTAB 24: PRINT "PRESS ANY
        KEY TO CONTINUE ... ";
DA 830 GET A$
61 840 CALL 37145
22 850 RETURN
A5 62999 REM  #63000
24 63000 REM
EA 63010 REM  PULL-DOWN MENU
81 63020 REM  SUBROUTINE
3C 63030 REM
98 63040 BLANK$ = "
         ": REM 39 SPACES
A4 63050 LMAX = 0:NITEMS = 0
53 63060 REM DETERMINE MENU SIZE
24 63070 FOR II = 1 TO NN
59 63080 IF MM$(II) = "" THEN 63
       120
A3 63090 LL = LEN (MM$(II))
62 63100 IF LL > LMAX THEN LMAX
       = LL
C2 63110 NITEMS = NITEMS + 1
CC 63120 NEXT II
65 63130 IF LMAX > 28 THEN PRINT
        "NAME IS TOO LONG": EN
       D
83 63140 REM SAVE SCREEN TEXT
9B 63150 CALL 36915
A3 63160 REM DISPLAY MENU
BA 63170 POKE 32,5: POKE 33,LMAX
        + 5: POKE 34,0: POKE 3
       5,NITEMS + 4: REM SET T
       EXT WINDOW FOR MENU SIZ
       E
6F 63180 HOME
32 63190 INVERSE : PRINT LEFT$ (
       BL$,LMAX + 5)
D4 63200 VTAB 1: HTAB 3 + ((LMAX
        - LEN (TITLE$)) / 2):
       PRINT TITLE$
C0 63210 FOR II = 1 TO NITEMS +
       2
0C 63220 VTAB II + 1: HTAB 1: PR
       INT " ";
6C 63230 HTAB LMAX + 5: PRINT "
       ";
E0 63240 NEXT II
C0 63250 POKE 35,24
0F 63260 PRINT LEFT$ (BL$,LMAX +
        5);
17 63270 POKE 35,NITEMS + 4
D0 63280 VTAB 1
7D 63290 NORMAL
AB 63300 FOR II = 1 TO NITEMS
78 63310 HTAB 4: VTAB II + 2: PR
       INT MM$(II)
D4 63320 NEXT II
03 63330 REM MAKE SELECTION
99 63340 SELECT = 1
88 63350 HTAB 3: VTAB SELECT + 2
       : PRINT ">" CHR$ (8);
43 63360 GET SELECT$
90 63370 HTAB 3: VTAB SELECT + 2
       : PRINT " "
A4 63380 IF SELECT$ = CHR$ (13)
       THEN 63480
DF 63390 IF SELECT$ < > CHR$ (10
       ) AND SELECT$ < > CHR$
       (21) THEN 63430
18 63400 SELECT = SELECT + 1
06 63410 IF SELECT > NITEMS THEN
        SELECT = 1
04 63420 GOTO 63350
56 63430 IF SELECT$ < > CHR$ (11
       ) AND SELECT$ < > CHR$
       (8) GOTO 63350
40 63440 SELECT = SELECT - 1
83 63450 IF SELECT < 1 THEN SELE
       CT = NITEMS
24 63460 GOTO 63350
5C 63470 REM RESTORE SCREEN TEXT
B3 63480 CALL 37145
94 63490 POKE 32,0: POKE 33,40:
       POKE 34,0: POKE 35,24:
       REM  RETURN THE TEXT WI
       NDOW TO NORMAL
72 63500 RETURN
```

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Using The Atari 130XE And DOS 2.5

Tom R. Halfhill, Editor

The Atari 130XE is the first computer in Atari's XE line and by far the least expensive 128K RAM computer on the market. Here's a guide to using the new features of the 130XE and the latest version of Atari DOS.

Making good on its promise to continue supporting the 8-bit line of computers first introduced in 1979, Atari recently brought out the 130XE, its most powerful 8-bit machine yet. Atari also started distributing free copies of its new disk operating system, DOS 2.5, to solve some compatibility problems between the single-density DOS 2.0 and the enhanced-density DOS 3.

Both products are evolutionary rather than revolutionary. DOS 2.5 bears a strong resemblance to DOS 2.0 and is designed to smoothly handle both Atari disk formats. Likewise, the 130XE has much in common with the XL series and original 400/800. Because the 130XE's internal operating system is virtually identical to the 800XL's, the 130XE works with all existing Atari peripherals and nearly all the software. Nevertheless, the 130XE does incorporate some features not found on earlier Ataris:

- 128K of Random Access Memory (RAM), with the extra 64K accessible by bank-switching in 16K banks. Without bank-switching, the amount of free memory for BASIC programs remains the same as on 48K and 64K Ataris—about 32K or 37K, depending on whether DOS is booted.
- A high-speed RAM disk option for the extra 64K when DOS 2.5 is booted with a special startup file. (A RAM disk is a disk drive simulated in memory; you can save and load files much faster with a RAM disk than with a conventional disk drive, although the contents of the RAM disk are erased when power is shut off.) The RAM disk can be disabled if you want to use the extra 64K for other purposes.
- Revision C Atari BASIC. The 130XE's BASIC has been cured of the infamous lockup bug that plagued the revision A BASIC cartridge sold for the 400, 800, and 1200XL, and the even-worse bugs that infested revision B BASIC in the 600XL and 800XL when Atari tried to fix revision A.
- Enhanced Cartridge Interface (ECI) for future expansion. The expansion connector found on the rear of the 600XL and 800XL has been slightly redesigned for the 130XE. The new ECI is supposed to be more versatile than the rarely used XL connector, allowing you to add faster disk drives, hard disks, and other devices—none of which have been announced, however. (Don't confuse the ECI with the ROM cartridge slot, which is fully compatible with cartridges made for older Atari computers.)
- Chroma and luma video outputs for sharper screen displays. This allows you to hook up the 130XE to video monitors with separate chroma and luma inputs for a much sharper image than with normal composite video. The old Atari 800 had this feature, but it was eliminated on later models.

Dual-Personality DOS

Before examining the 130XE's new features in greater detail, let's cover the new functions of DOS 2.5, since they affect all users of 8-bit Atari computers as well as 130XE owners.

First of all, if you don't have a copy of DOS 2.5, get one soon. Atari is shipping DOS 2.5 with 1050 disk drives and distributing it free through user groups, electronic bulletin boards, and the Atari forum on CompuServe. It is quickly replacing DOS 3 because it integrates the best features of existing DOS versions, is compatible with all Atari computers, and works interchangeably with both single-density (810 format) and enhanced-density (1050 format) disk drives. (Of course, enhanced density disks are still unreadable on 810 drives.)

The new DOS menu is identical to the DOS 2.0 menu except for one extra feature: option P, Format Single. Since DOS 2.5 is a dual-density DOS, it must be capable of formatting disks for both single density and enhanced density. Option P formats a disk in single density, leaving 707 sectors free (about 88K of storage). Option I, Format Disk, now defaults to *enhanced* density, leaving 1010 sectors free (about 126K). Also, one

existing option has been slightly changed: Option J, Duplicate Disk, now formats the target disk before copying.

Three new utility files are included with DOS 2.5. The first, SETUP.COM, lets you customize DOS in various ways without the POKEs that used to be necessary. For instance, you can significantly speed up disk accesses by turning off the write-with-verify mode. You can also set up one of three AUTORUN.SYS files: the usual RS-232 handler for the 850 Interface Module; a file which automatically boots a BASIC program; or a file which boots both the RS-232 handler *and* a BASIC program.

The second utility, DISKFIX.COM, can help clean up garbled disks by closing open files and verifying that allocated sectors correspond to information in the disk directory. It can even recover deleted files, as long as new data hasn't been saved over the deleted data. The third utility, COPY32.COM, converts DOS 3 files to 2.0/2.5 format. All three utilities guide you with screen prompts and are nearly foolproof.

New Disk Commands

DOS 2.5 also makes a few additional disk commands available in BASIC. There are now two methods of reading a disk directory:

```
OPEN #1,6,0,"D:*.*":FOR X=1 TO
  1E9:GET #1,A:? CHR$(A);:NEXT X
OPEN #1,7,0,"D:*.*":FOR X=1 TO
  1E9:GET #1,A:? CHR$(A);:NEXT X
```

The first method is the same as before. But the second method identifies files in the directory which cannot be accessed from DOS 2.0 because they occupy extra sectors on an enhanced-density disk. These files are flagged by a pair of less-than/greater-than symbols, such as <FILENAME.BAS>.

Also, there are now three ways to format a disk from BASIC:

```
XIO 253,#1,0,0,"D1:"
XIO 253,#1,34,0,"D1:"
XIO 254,#1,0,0,"D1:"
```

The first XIO statement formats a disk in single density. The second formats in enhanced density (generating an error 139 if attempted on an 810 drive). The third XIO statement attempts to format in enhanced density, then switches to single density if the drive isn't 1050-compatible.

Incidentally, if you select option J (Duplicate Disk) with DOS 2.5 when using a 1050 drive, the disk is automatically formatted in *enhanced* density before copying starts. Keep this in mind if you're duplicating a disk for someone who doesn't have an enhanced-density drive. Instead, you'll have to format the destination disk for single density (option P) and then copy the source disk one file at a time.

Memory Location 54017 (130XE Only)

Bit Position	Function
0	If 1, enable OS ROM, disable RAM from $C000–$FFFF (default) If 0, disable OS ROM, enable RAM from $C000–$FFFF
1	If 0, enable BASIC ROM at $A000–$BFFF (default)* If 1, disable BASIC ROM, enable RAM at $A000–$BFFF
2–3	If 00 (decimal 0), switch first 16K bank of extra 64K into $4000–$7FFF If 01 (decimal 4), switch second 16K bank of extra 64K into $4000–$7FFF If 10 (decimal 8), switch third 16K bank of extra 64K into $4000–$7FFF If 11 (decimal 12), switch fourth 16K bank of extra 64K into $4000–$7FFF
4	If 1, deny 6502 access to extra bank (default) If 0, allow 6502 access to extra bank
5	If 1, deny ANTIC access to extra bank (default) If 0, allow ANTIC access to extra bank
6	Not presently used. Default = 1
7	If 1, disable self-test ROM, enable RAM at $5000–$57FF (default after powerup) If 0, enable self-test ROM, disable RAM at $5000–$57FF

*Note: *A similar chart on page 122 of the 130XE* Owner's Manual *indicates that bit 1 should always be set. However, bit 1* should not *be set unless you want to disable BASIC.*

Instant DOS

The 130XE's extra 64K RAM can be used as either a superfast RAM disk with DOS 2.5 or as additional memory for programming. Of these two options, the RAM disk is by far the easiest to use, especially for those who aren't too familiar with bank-switching or bit manipulations.

The only accessory you need to set up a RAM disk with the 130XE is a free DOS 2.5 file called RAMDISK.COM. When you boot DOS 2.5 on a 130XE, RAMDISK.COM automatically initializes the RAM disk and loads two DOS files: DUP.SYS and MEM.SAV DUP.SYS is the DOS utility package—the part that normally must be loaded from disk when you type the DOS command in BASIC. Usually this takes 10 to 20 seconds or more. But with DUP.SYS stored in the RAM disk, the DOS 2.5 menu comes up almost instantly when you type DOS.

The second DOS file stored in the RAM disk, MEM.SAV, temporarily saves the portion of BASIC memory that would be overwritten when you enter DOS. That means you can enter DOS and return to BASIC without losing your BASIC program.

DUP.SYS and MEM.SAV take up 87 sectors total, leaving the RAM disk with 412 free "sectors"—51.5K of high-speed (though temporary) storage. If you don't mind waiting for the DOS menu to load from disk as usual, you can delete DUP.SYS and MEM.SAV from the RAM disk to create 499 free sectors (62.3K).

You access the RAM disk by addressing it as drive 8 (D8:). For example, LOAD"D8:FILENAME.EXT" or SAVE"D8:FILENAME.EXT" Almost all DOS commands work, too: Disk Directory, Delete File, Rename File, Copy File, Lock File, Unlock File, Binary Load, Binary Save, and Run At Address.

Duplicate File doesn't work because there's no way to swap disks

with a RAM disk (use the two-drive Copy File command instead). Also, the Format Disk and Duplicate Disk commands sometimes cause strange results and should be avoided. For instance, if you erase DUP.SYS by deleting it or formatting the RAM disk, then replace it by duplicating a floppy disk that contains DUP.SYS, you might not be able to enter DOS from BASIC afterward.

Aside from these exceptions, the 130XE RAM disk seems to be very transparent; it's worked with everything we've tried. Although a RAM disk is no substitute for a floppy—it's at the mercy of power interruptions and system crashes—it can make a world of difference when running disk-intensive applications, such as assemblers, compilers, database managers, mailing list programs, and word processors with linked files.

Like Memory In The Bank

Using the 130XE's extra memory for programming is a lot more difficult than using it as a RAM disk. For one thing, the 6502 microprocessor which is the central brain of 8-bit Atari computers was not designed to access more than 64K memory at a time. So even though the 130XE has 128K RAM, the 6502 is "blind" to the extra 64K.

Making the extra memory visible requires a technique known as *bank-switching*. A block, or bank, of memory in the regular 64K is temporarily switched off and replaced with a bank from the "hidden" memory. Under program control, banks can be switched in and out at will. It's sort of like reading a book and flipping between the page you're on and a footnote section in the back.

The 130XE organizes its extra 64K RAM into four 16K banks. Only one of these banks can be switched in at a time. When you're using the RAM disk, the RAMDISK.COM file and DOS 2.5 handle these details for you automatically. But using this memory for other purposes means writing your own bank-switching routine in BASIC or machine language.

Bank-switching on the 130XE is controlled by memory location 54017 ($D301 hexadecimal). This byte was previously reserved for port B of the Peripheral Interface Adapter (PIA), an input/output control chip. On the Atari 400 and 800, it's used for controller jacks 3 and 4, which have been eliminated on the XL and XE series. On the 1200XL, part of this byte controls the keyboard LEDs, which were dropped from the 600XL, 800XL, and XE series. On all XLs and XEs, location 54017 also lets you switch off the operating system and BASIC ROM to reveal the full 64K RAM underneath. On the 130XE, you can now flip other bits at this location to switch on any 16K bank of the extra 64K RAM into the address space from 16384 to 32767 ($4000 to $7FFF). See the accompanying table for a guide to this important address.

Notice that bits 4 and 5 control whether the 6502 and ANTIC chips can access the extra banks of memory. Some special applications may blind either chip from seeing the banks. Also note that the 130XE *Owner's Manual* contains errors on page 122 when explaining how location 54017 works. The location normally contains 241 when the RAM disk is booted and 253 otherwise, not 193; and all bits *except* bit 1 should be set for normal operations.

If you're an experienced machine language programmer, you shouldn't have any trouble manipulating the bits at location 54017. BASIC programmers won't have it so easy, because bit-flipping is rarely required in BASIC and Atari BASIC lacks bitwise operators. So try this formula:

POKE 54017,193+4*_bank_+16*_mode_

where *bank* is the 16K bank you want to select (0 = bank 1, 1 = bank 2, 2 = bank 3, 3 = bank 4) and *mode* chooses which chip has access to the extra banks (0 = 6502/ANTIC, 1 = ANTIC, 2 = 6502, 3 = neither).

A word of caution: One wrong POKE into this critical memory location could instantly disable the operating system or BASIC or both, triggering a hopeless system crash. The only recovery might be to switch the machine off and then on again, wiping out your program. So be careful when experimenting. ©

Atari Animation With P/M Graphics Part 2

Robert J. Powell

Part 1 of this series introduced the basic concepts of Atari player/missile graphics and showed how to display all four player strips on the screen. This month, Part 2 demonstrates how to redefine players into any shapes you want and how to move them horizontally.

If you ran last month's example program, you saw the Atari's players as they really appear: four colored strips which are eight bits wide and taller than the screen. To really make use of player/missile graphics, your program must transform these featureless strips into shapes of your own design. It isn't a difficult task, though it helps if you have a grasp of binary numbering. But even if you know nothing about binary, we'll provide plenty of step-by-step examples so you can learn by experimentation.

First, run last month's program again. (For those who missed it, it's listed below as Program 1.) When the program finishes, you should see four colored strips at the right side of the screen and the READY

prompt at the left. Don't press SYSTEM RESET or any other keys for now; we'll illustrate how shapes are defined by changing one of these players in direct mode so you can see the effects immediately.

If you refer to the P/M memory map in Part 1, you'll notice that the memory area for the four players extends from PMBASE+1024 to PMBASE+2048. That's a total of 1,024 bytes, or 1K. (Remember, this program is using *single-line resolution* P/M graphics, so each of the four players is 256 bytes tall. If it were using *double-line resolution*, each player would be only 128 bytes tall, and player memory would extend from PMBASE+512 to PMBASE+1024.)

The numbers stored in this memory area determine the shape of each player. Right now, the memory area for all four players is filled with the number 255, POKEd there by line 90 of Program 1. The players appear as solid strips because 255 is the largest number which can be stored in a single byte. *The key to defining a shape is to selectively display only parts of the player strip by POKEing numbers between 0 and 255 into the player's memory area.*

Building A Box

Let's start by redefining the shape of player 0 (by custom, the four players are numbered 0 to 3). Referring again to the P/M memory map in Part 1, notice that player 0's memory extends from PMBASE+1024 to PMBASE+1280 (256 bytes). This is the target for our POKEs. In direct mode—that is, without a line number—type this line and press RETURN:

```
FOR X=PMBASE+1024 TO PM
BASE+1280:POKE X,0:NEXT
 X
```

You should see the player 0 strip disappear. Why? Because this line POKEs 256 zeros into the memory area for player 0, erasing the 255s previously stored there. Notice that players 1, 2, and 3 remain unaffected.

Now let's restore part of the player 0 strip to make a simple shape. One by one, enter the following lines, pressing RETURN each time:

```
POKE PMBASE+1152,255
POKE PMBASE+1153,129
POKE PMBASE+1154,129
POKE PMBASE+1155,129
POKE PMBASE+1156,255
```

Each time you press RETURN, you should see a hollow box taking shape where the player 0 strip used to be. If you examine the POKE statements, you'll notice that the first number in each statement is a memory address in the middle of the player 0 memory area. These addresses determine the shape's vertical position within the strip—and therefore its vertical position on the screen.

The second number in each statement actually defines part of the box. Experiment by POKEing other numbers between 0 and 255 into these addresses (as well as other addresses in the player 0 memory area). Once you learn how these numbers are arrived at, you can create almost any shape you want.

Patterns Of Bits

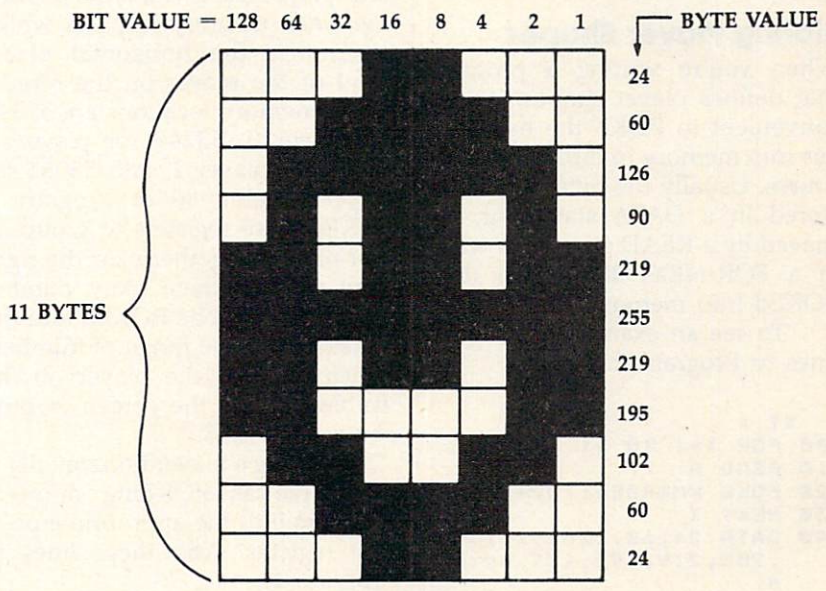
The numbers between 0 and 255, when POKEd into a byte, represent *bit values* in the binary number system. These bit values translate directly into player shapes.

A byte contains eight bits, or positions. Each position has a different value ranging from 1 to 128. When a certain bit position in a player/missile strip is turned "on," it appears onscreen as a tiny dot. Bits which are turned "off" do not appear onscreen. To define a shape, then, you have to figure out which bits to turn on, add up the bit values of their positions, and POKE the resulting number into the appropriate memory address.

The accompanying figure makes this explanation more clear. It shows the bit pattern for a player defined as a happy face. The bit values are the numbers running across the top of the figure; notice now the values double for each bit position running from right to left.

The numbers running down the side of the figure are the *byte values*, or the sums of the bit values for each byte. To arrive at the byte values, you add up all the bit values for "on" bits in each row. For instance, the top row, or byte, has two bit positions turned "on": bits 8 and 16. Therefore, the byte value for that row is 8 + 16, or 24. The next byte has four bit positions turned "on": bits 4, 8, 16, and 32. Therefore, the byte value is 4 + 8 + 16 + 32, or 60. All the other byte values are determined in a similar fashion. These are the numbers you POKE into the player memory area

Calculating byte values for a player shape.



to make the shape appear.

To see this in action, press SYSTEM RESET and run Program 1 again. When it stops, fill the player 0 memory area with zeros using the FOR-NEXT loop as we did before. Then enter these lines, pressing RETURN after each one:

```
POKE PMBASE+1152,24
POKE PMBASE+1153,60
POKE PMBASE+1154,126
POKE PMBASE+1155,90
POKE PMBASE+1156,219
POKE PMBASE+1157,255
POKE PMBASE+1158,219
POKE PMBASE+1159,195
POKE PMBASE+1160,102
POKE PMBASE+1161,60
POKE PMBASE+1162,24
```

Each time you press RETURN, another byte of the player shape should appear.

Try designing your own shape using a blank version of the grid in the figure. After coloring in each square to make the shape, add up the bit values to arrive at the numbers for your POKE statements. Remember that your shape can be only eight bits wide, but can be as tall as the screen.

Storing Player Shapes

When you're writing a program that defines player shapes, it's inconvenient to POKE the byte values into memory in direct mode, of course. Usually the byte values are stored in a DATA statement, retrieved by a READ statement within a FOR-NEXT loop, and then POKEd into memory.

To see an example, add these lines to Program 1:

```
   XT X
100 FOR X=1 TO 11
110 READ A
120 POKE PMBASE+1152+X,A
130 NEXT X
140 DATA 24,60,126,90,219
    ,255,219,195,102,60,2
    4
```

Line 90 clears out the player memory area with zeros. Lines 100–130 are the loop which READs the DATA in line 140. Notice that line 120 POKEs the byte values into the middle of the player 0 memory area. To define this shape as player 1, you could simply add 256 to this address; to define it as player 2, add 512; and to define it as player 3, add 768.

Missiles are defined in a similar way, with one important difference: Because each missile is only two bits wide, all four missiles share the same amount of memory as a single player. That means the bit patterns are two-bit slices of the grid in the figure. By referring to this figure and the P/M memory map in Part 1, you can see that missile 0 is defined by adding the bit values 1 and 2; missile 1 is defined by the bit values 4 and 8; missile 2 is defined by the bit values 16 and 32; and missile 3 is defined by the bit values 64 and 128.

Of course, with only two bits to work with, missile shapes are pretty limited. That's why they're used mostly in games as "bullets" fired by player shapes.

Horizontal Animation

By now you're probably wondering how to animate the shapes you've created. We'll tackle horizontal movement first because it's the easiest; we'll save vertical animation for Part 3 next month.

In Part 1 we mentioned that each player has a *horizontal position register*, a memory location which determines the horizontal placement of the player on the screen. These memory locations are 52348 for player 0, 53249 for player 1, 53250 for player 2, and 53251 for player 3. Line 80 of Program 1 POKEs these registers to group all four players together near the right edge of the screen. Any number from 0–255 can be POKEd into the registers, but the range of numbers which position the player on the visible part of the screen is only about 45 to 205.

Moving a player horizontally is as simple as POKEing different numbers into the appropriate position register. Add these lines to Program 1:

```
100 FOR X=45 TO 205
110 POKE 53248,X
120 NEXT X
```

When you type RUN, this loop moves player 0 across the screen from left to right. By changing the register address in line 110, you can move any of the four players.

Missiles are moved horizontally like players; the four horizontal position registers for the missiles are at memory locations 53252 to 53255. To see the missiles onscreen, add these lines to Program 1:

```
85 POKE 53252,140:POKE 53
   253,144:POKE 53254,148
   :POKE 53255,152
90 FOR X=PMBASE+768 TO PM
   BASE+2048:POKE X,255:N
   EXT X
```

One-Way Registers

There's only one tricky detail to keep in mind when manipulating the horizontal registers—they are *write-only* memory locations, which means they can be POKEd but do not return useful values when PEEKed. This makes your programming more complicated, because you can't keep track of a player or missile's horizontal screen position merely by PEEKing its horizontal register. Instead, you have to set aside a variable for each object to store its horizontal position. Every time the object moves, your program must update the corresponding variable.

This technique is demonstrated in Program 2. It's a modified version of Program 1 that lets you move player 1 left or right with a joystick plugged into port 1. Notice how the variable P1 keeps track of the player's horizontal position. Also notice how player 1 moves over players 2 and 3, but beneath player 0. These different *display priorities* let your programs simulate 3-D graphics effects.

Try modifying Program 2 yourself to move the other three players. Be careful about moving the player too far off the edges of the screen, though—if the program tries to POKE a value smaller than 0 or greater than 255 into the horizontal register, it will crash with an error.

In Part 3, we'll cover a method of vertical animation and a few other details about player/missile graphics as well.

For instructions on entering these listings, please refer to "COMPUTE!'s Guide to Typing In Programs" published bimonthly in COMPUTE!.

Program 1: P/M Demo

```
10 POKE 106,PEEK(106)-8
20 POKE 54279,PEEK(106)
```

```
HD 30 GRAPHICS 0:SETCOLOR 2,
      0,0
CN 40 PMBASE=PEEK(106)*256
ML 50 POKE 559,62
PM 60 POKE 53277,3
DP 70 POKE 704,68:POKE 705,1
      98:POKE 706,168:POKE 7
      07,148
PA 80 POKE 53248,160:POKE 53
      249,170:POKE 53250,180
      :POKE 53251,190
DN 90 FOR X=PMBASE+1024 TO P
      MBASE+2048:POKE X,255:
      NEXT X
```

Program 2: Horizontal Animation

```
10 POKE 106,PEEK(106)-8
20 POKE 54279,PEEK(106)
30 GRAPHICS 0:SETCOLOR 2,
   0,0
40 PMBASE=PEEK(106)*256
50 POKE 559,62
60 POKE 53277,3
70 POKE 704,68:POKE 705,1
   98:POKE 706,168:POKE 7
   07,148
80 POKE 53248,160:POKE 53
   249,170:POKE 53250,180
   :POKE 53251,190
90 FOR X=PMBASE+1024 TO P
   MBASE+2048:POKE X,255:
   NEXT X
100 P1=170
110 S=STICK(0)
120 IF S=7 THEN P1=P1+1:I
    F P1>255 THEN P1=255
130 IF S=11 THEN P1=P1-1:
    IF P1<1 THEN P1=1
131 POKE 53249,P1
140 GOTO 110
```

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Lightning Renumber For Atari

Raymond Citak

This fast, convenient utility renumbers any BASIC program. It runs on any Atari 400, 800, XL, or XE with at least 48K RAM.

If you write BASIC programs, you know how frustrating it can be to run out of space to insert program lines, especially when the program is nearly finished. Since Atari BASIC has no RENUMBER command, you may be forced to renumber dozens of lines manually, creating the risk that you'll inadvertently delete or misnumber a line. "Lightning Renumber" removes that worry and saves a lot of time, too. It can handle any Atari BASIC program, and it renumbers internal line references as well as the lines themselves. Because it uses a machine language (ML) routine, it does the job in only a few seconds. But it's easy enough for anyone to use, even if you don't know anything about machine language.

Type in and save Lightning Renumber as listed below, then run it. The program offers two options. You can either write the ML routine as a binary (machine language) file to disk, or POKE it directly into memory. The binary file option is straightforward: After you designate the drive number, the program creates and locks a binary file named RENUMBER.OBJ on your disk. The binary file can then be loaded into memory and called with a USR statement (see below) whenever you like. If you don't have a disk drive, select the second option to POKE the ML into memory.

Call It With USR

Once the ML routine is in memory, enter NEW and load the BASIC program you want to renumber. Now you can call the ML routine by typing in a USR statement and pressing RETURN. The USR statement must include three numbers: the address of the routine (always 38900), the starting line number, and the line increment value. For example, the statement U=USR(38900,10,10) renumbers a program so the first line is 10 and the rest are numbered in increments of 10 (20, 30, and so on). To start with line 1000 and renumber in increments of 100, use the statement U=USR(38900,1000,100), and so on. When the message **RENUMBERED** appears, the job is complete. At this point, you should resave the renumbered program.

The routine checks for several errors. First, it makes sure the renumbered program will not have line numbers above 32767. If the values you specify in the USR statement would create a line number greater than 32767, you'll get the

message ERROR — CHANGE YOUR USR ARGUMENTS. Enter a new USR statement with appropriate values.

Incorrect line references are detected as well. For instance, your program may contain the statement GOTO 300 when no line 300 exists. When such an error occurs, you'll see the message ERROR — LINE # MISMATCH. Mismatched line references (300 in this example) are replaced by 55555, and the rest of the program is renumbered as usual. When this error message appears, you must LIST the program and change any 55555 line references to the correct line numbers before resaving the program.

TRAP statements (except for TRAP 40000) are also renumbered by this routine. However, it cannot change *computed* line references (GOTOs or GOSUBs that use a variable to refer to a line number). If your program uses computed line references, LIST the program and change them yourself after the rest of the program is renumbered.

Possible Memory Conflicts

Although Lightning Renumber is designed to be reliable, it's possible to disrupt it by running BASIC programs. The ML normally resides in high memory just beneath the display list in GRAPHICS 0. Running a BASIC program that's very long or that uses the same memory area for other graphics modes, player-missile data, etc., may overwrite and destroy the ML. When that occurs, trying to call the routine may crash the computer (and destroy your program). When in doubt, save your BASIC program and reload the binary file (RENUMBER.OBJ) from disk; then reload the BASIC program and call the routine with USR.

If you use this routine frequently, you may want to include the USR call within the BASIC program itself. Since line 32767 will never be renumbered, place the USR statement in that line. Then you can renumber the program at any time by entering GOTO 32767.

You could also create an AUTORUN.SYS file that loads Lightning Renumber into memory automatically when the disk is booted. If you already have an AUTORUN.SYS file on the disk, you can append the renumber file to it from the DOS menu. Choose the Binary Save option, then type in AUTORUN.SYS/A,97F4,9BFF. Lightning Renumber will be appended to the existing AUTORUN.SYS file and will load automatically when you boot that disk.

If you want to save typing, send a blank disk or tape, a self-addressed postage-paid mailer, and $3 to:

Raymond Citak
1514 Park Avenue
Laramie, WY 82070

Special thanks to W. A. Bell for his useful line dump routine which appears in *COMPUTE!'s First Book of Atari.*

Lightning Renumber

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" published bimonthly in COMPUTE!.

```
JP 10 DIM DRIVE$(2),A$(15):P
      OKE 709,0:POKE 710,168
      :POKE 712,146
OD 20 ? CHR$(125):? :? "
      {9 SPACES}RENUMBER BA
      SIC "
HG 30 ? "TO LOAD THIS OBJECT
       FILE DIRECTLY
      {5 SPACES}INTO MEMORY
      AND NOT TO DISK, PRESS
      "
EE 40 ? "KEY ";CHR$(34);"L";
      CHR$(34);".  REQUIRES
      48K MEMORY.":? "PRESS
      ANY KEY FOR DISK WRITE
      ."
CB 50 OPEN #4,4,0,"K":GET #4
      ,Z:IF Z=76 THEN 1440
DD 60 CLOSE #4
IM 70 ? CHR$(125):? :? :? "
      {6 SPACES}RENUMBER.OB
      J - LORDER "
MJ 80 ? :? "**REQUIRES 48K M
      EMORY AND DOS v.2.**"
MJ 90 ? :? "To which disk dr
      ive would you like the
      file written to (D1,D2
      ,D3,or D4)";
LP 100 INPUT DRIVE$
NO 110 GOSUB 1380
LC 120 ? :? "One moment whil
      e I write the file to
      ":? DRIVE$;"..."
IN 130 A$(1,2)=DRIVE$:A$(3,1
      5)=":RENUMBER.OBJ"
HB 140 TRAP 300:OPEN #2,8,0,
      A$
GG 150 TRAP 180
OL 160 READ B:PUT #2,B
GI 170 GOTO 160
GE 180 CLOSE #2
PH 190 OPEN #1,12,0,A$:XIO 3
      5,#1,0,0,A$
FM 200 CLOSE #1
DF 210 ? CHR$(125):?
DN 220 ? "File is now writte
      n to ";DRIVE$;"."
PK 230 ? "You may now use th
      e DOS menu selection'
      L' to place the renum
      ber program "
EK 240 ? "into memory.  Retu
      rn to BASIC, load
      {3 SPACES}file to be
      renumbered, and use"
ON 250 ? "U=USR(38900, start
      ing line number,
      {4 SPACES}increment)
      to renumber your prog
      ram."
GE 260 ? "Or place the USR s
      tatement into your  p
      rogram at line 32767.
        Watch for"
PN 270 ? "possible overwrite
       of the renumber
      {4 SPACES}program if
      RUNning a BASIC progr
      am"
GG 280 ? "that changes GRAPH
      ICS modes, or uses  o
      ther high memory."
GE 290 POKE 709,202:POKE 710
      ,148:POKE 712,0:END
HH 300 ? CHR$(125):? :? "ERR
      OR #";:? PEEK(195);:?
       " trying to write th
      e file...":FOR I=1 TO
       500:NEXT I:RUN
KJ 310 REM THIS DATA FOR DIS
      K WRITE ONLY
CL 320 DATA 255,255,244,151,
      255,155
BL 330 REM THIS DATA FOR MEM
      ORY 38900($97F4) TO 3
      9935($9BFF)
ML 340 DATA 76,80,153,165,13
      6,133,203,165,137,133
KA 350 DATA 204,169,0,133,20
      5,133,206,133,207,96
GF 360 DATA 201,14,240,1,96,
      152,141,243,151,136
GN 370 DATA 177,203,32,61,15
      2,165,207,208,10,32
DL 380 DATA 101,152,165,207,
      208,3,76,40,152,32
MG 390 DATA 148.152,172,243,
      151,169,0,133,205,133
BA 400 DATA 206,133,207,141,
      243,151,200,200,200,2
      00
DC 410 DATA 200,200,96,201,1
      8,240,1,96,136,152
JH 420 DATA 201,3,240,249,17
      7,203,201,14,208,244
IK 430 DATA 136,177,203,201,
      23,240,11,201,24,240
EH 440 DATA 7,201,4,240,3,76
      ,66,152,169,1
AJ 450 DATA 133,207,96,172,2
      43,151,136,177,203,20
      1
CA 460 DATA 10,240,32,201,12
      ,240,28,201,23,240
BP 470 DATA 24,201,24,240,20
      ,201,13,240,16,201
MK 480 DATA 4,240,12,201,27,
      240,8,201,35,240
OG 490 DATA 1,96,32,220,154,
      169,1,133.207,96
DD 500 DATA 172,243,151,138,
      141,242,151,165,136,1
      33
CL 510 DATA 205,165,137,133,
      206,200,177,203,133,2
      12
CE 520 DATA 200,177,203,133,
      213,200,177,203,133,2
      14
CJ 530 DATA 200,177,203,133,
```

```
      215,200,177,203,133,2
      16
MP 540 DATA 200,177,203,133,
      217,32,198,154,32,210
MI 550 DATA 217,169,0,141,24
      0,151,141,241,151,160
HF 560 DATA 0,177,205,200,19
      7,212,208,6,177,205
EC 570 DATA 197,213,240,30,3
      2,90,154,160,2,177
IP 580 DATA 205,24,101,205,1
      33,205,144,2,230,206
NH 590 DATA 238,240,151,173,
      240,151,208,3,238,241
PP 600 DATA 151,76,207,152,1
      73,240,151,141,234,15
      1
CK 610 DATA 173,241,151,141,
      235,151,173,230,151,1
      41
ML 620 DATA 236,151,173,231,
      151,141,237,151,32,41
AI 630 DATA 155,24,173,238,1
      51,109,228,151,133,21
      2
AI 640 DATA 173,239,151,109,
      229,151,133,213,32,17
      0
DD 650 DATA 217,172,243,151,
      174,242,151,200,165,2
      12
CJ 660 DATA 145,203,200,165,
      213,145,203,200,165,2
      14
CO 670 DATA 145,203,200,165,
      215,145,203,200,165,2
      16
AD 680 DATA 145,203,200,165,
      217,145,203,96,104,10
      4
CO 690 DATA 141,229,151,104,
      141,228,151,104,141,2
      31
MH 700 DATA 151,104,141,230,
      151,173,6,228,170,232
DC 710 DATA 138,141,154,153,
      141,114,154,141,171,1
      54
NG 720 DATA 141,252,154,173,
      7,228,141,155,153,141
DF 730 DATA 115,154,141,172,
      154,141,253,154,173,2
      30
EG 740 DATA 151,208,8,173,23
      1,151,208,3,76,244
LG 750 DATA 154,32,138,155,1
      62,13,138,72,189,244
JN 760 DATA 153,32,176,242,1
      04,170,202,16,243,32
JN 770 DATA 247,151,160,0,17
      7,203,201,255,240,14
JC 780 DATA 201,0,208,20,200
      ,177,203,201,128,208
HA 790 DATA 13,76,2,154,200,
      177,203,201,127,208
NB 800 DATA 3,76,2,154,160,2
      ,177,203,170,200
LK 810 DATA 200,177,203,201,
      22,240,22,201,155,240
AO 820 DATA 6,32,8,152,76,20
      2,153,152,133,208
KF 830 DATA 230,208,228,208,
      240,3,76,202,153,138
FO 840 DATA 24,101,203,133,2
      03,144,2,230,204,76
KH 850 DATA 164,153,155,155,
      46,46,46,103,110,105
NL 860 DATA 107,114,111,87,1
      55,125,32,247,151,173
DL 870 DATA 228,151,133,205,
      173,229,151,133,206,1
      60
DB 880 DATA 0,177,203,201,25
      5,240,14,201,0,208
KC 890 DATA 20,200,177,203,2
      01,128,208,13,76,163
KA 900 DATA 154,200,177,203,
      201,127,208,3,76,163
NJ 910 DATA 154,160,0,165,20
      5,145,203,200,165,206
PL 920 DATA 145,203,200,177,
      203,170,173,230,151,2
      4
CC 930 DATA 101,205,133,205,
      173,231,151,101,206,1
      33
JA 940 DATA 206,138,24,101,2
      03,133,203,144,2,230
AH 950 DATA 204,76,15,154,16
      0,0,177,205,201,0
EL 960 DATA 208,7,200,169,12
      8,209,205,240,1,96
LE 970 DATA 162,22,138,72,18
      9,140,154,32,176,242
OA 980 DATA 104,170,202,16,2
      43,169,66,133,212,169
KJ 990 DATA 5,133,213,169,85
      ,133,214,133,215,104
BP 1000 DATA 104,76,43,153,1
      55,72,67,84,65,77
JC 1010 DATA 83,73,77,32,35,
      69,78,73,76,32
MI 1020 DATA 45,32,210,207,2
      10,210,197,162,18,13
      8
AM 1030 DATA 72,189,179,154,
      32,176,242,104,170,2
      02
BO 1040 DATA 16,243,96,155,1
      55,42,42,32,68,69
JP 1050 DATA 82,69,66,77,85,
      78,69,82,32,42
NA 1060 DATA 42,155,165,212,
      201,66,208,15,165,21
      3
DE 1070 DATA 201,4,208,9,165
      ,214,208,5,104,104
DN 1080 DATA 76,43,153,96,13
      6,152,201,3,240,13
CI 1090 DATA 177,203,201,54,
      208,244,104,104,104,
      104
JG 1100 DATA 76,40,152,96,10
      4,104,104,104,162,36
KH 1110 DATA 138,72,189,4,15
      5,32,176,242,104,170
FD 1120 DATA 202,16,243,96,1
      55,155,46,83,84,78
JJ 1130 DATA 69,77,85,71,82,
      65,32,82,83,85
JP 1140 DATA 32,82,85,79,89,
      32,69,71,78,65
GJ 1150 DATA 72,67,32,45,32,
      210,207,210,210,197
PI 1160 DATA 155,169,0,141,2
      32,151,141,233,151,1
      41
NN 1170 DATA 238,151,141,239
      ,151,162,16,24,78,23
      5
PL 1180 DATA 151,110,234,151
      ,144,40,24,173,238,1
      51
HB 1190 DATA 109,236,151,141
      ,238,151,173,239,151
      ,109
GN 1200 DATA 237,151,141,239
      ,151,176,153,173,238
      ,151
DC 1210 DATA 24,109,232,151,
      141,238,151,173,239,
      151
PM 1220 DATA 109,233,151,141
      ,239,151,24,14,236,1
      51
GJ 1230 DATA 46,237,151,144,
      13,24,14,232,151,46
AD 1240 DATA 233,151,238,232
      ,151,76,134,155,14,2
      32
BF 1250 DATA 151,46,233,151,
      202,208,176,96,169,2
      55
CG 1260 DATA 141,240,151,141
      ,241,151,32,247,151,
      160
JJ 1270 DATA 0,177,203,208,7
      ,200,177,203,201,128
JD 1280 DATA 240,29,160,2,17
      7,203,24,101,203,133
PG 1290 DATA 203,165,204,105
      ,0,133,204,238,240,1
      51
NF 1300 DATA 173,240,151,208
      ,3,238,241,151,76,14
      9
FN 1310 DATA 155,173,240,151
      ,141,234,151,173,241
      ,151
FN 1320 DATA 141,235,151,173
      ,230,151,141,236,151
      ,173
MJ 1330 DATA 231,151,141,237
      ,151,32,41,155,24,17
      3
HC 1340 DATA 238,151,109,228
      ,151,141,238,151,173
      ,239
AN 1350 DATA 151,109,229,151
      ,141,239,151,176,14,
      56
IG 1360 DATA 169,254,237,238
      ,151,169,127,237,239
      ,151
GM 1370 DATA 48,1,96,76,242,
      154
MJ 1380 REM CK FOR CORRECT E
      NTRY
KN 1390 IF DRIVE$(1,1)<>"D"
      OR LEN(DRIVE$)=1 THE
      N 1410
PI 1400 IF DRIVE$(2,2)="1" O
      R DRIVE$(2,2)="2" OR
       DRIVE$(2,2)="3" OR
      DRIVE$(2,2)="4" THEN
       1430
PF 1410 POP :? :? "Error in
      entry.  Try again...
      "
CD 1420 FOR Q=1 TO 300:NEXT
      Q:? CHR$(125):? :GOT
      O 70
KI 1430 RETURN
PK 1440 REM LOAD DATA INTO M
      EMORY
IC 1450 CLOSE #4:? :? "Loadi
      ng DATA into memory.
      ."
EE 1460 RESTORE 340:FOR I=38
      900 TO 38900+1035:RE
      AD A:POKE I,A:NEXT I
FD 1470 ? :? "Load complete.
        NEW this program,
      and LOAD or ENTER yo
      ur BASIC program to"
IE 1480 ? "be renumbered.  T
      hen use U=USR(38900,
       first line number,
      increment) to"
OI 1490 ? "renumber the prog
      ram.  All error
      {6 SPACES}checking i
      s done by the renumb
      er pro- gram."
IP 1500 POKE 709,202:POKE 71
      0,148:POKE 712,0:END
```

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Fred D'Ignazio, Associate Editor

More Adventures Of Junior, The Robot

Last month I described the trials of traveling across the country with a personal robot ("A Robot Toddler," September 1985). Among other things, my Heath HEROjr—nicknamed Junior—had panicked in the coat closet of a jetliner and started screaming for help, alarming some of the passengers.

We finally got Junior quieted down again, but more incidents were to follow. When we reached Chicago's giant O'Hare Airport, I suddenly realized that our connecting flight was at the opposite end of the terminal. Would I have to walk Junior clear across the airport? Luckily, two porters came to my rescue and pointed out a luggage cart I could rent for only a dollar. A moment later Junior and I were sailing along the corridors of O'Hare. Junior was perched high on the front of the cart singing "Summertime! Summertime! Sum-sum-summertime!" Meanwhile, I was pushing the cart like a good rickshaw boy and warning people, "Watch out for the robot! Please clear the way! The robot's trying to catch a plane!"

Drinks For Junior

I always tried to keep Junior quiet when loading him on a jet. I felt the best strategy was to keep a low profile so nobody would have second thoughts about flying with a robot. But it was no use. It's like accompanying Michael Jackson and expecting no one to notice. Everyone on board always seems to be aware of Junior. And everyone seems to delight in teasing me about him.

For instance, after stowing Junior in the closet and collapsing in my seat, a man came up and said, "Your robot just woke up and left the plane!" I leaped to my feet, alarmed, and he pushed me gently back down. "Just kidding," he said.

Another time, a flight attendant brought me a soda and a glass of champagne. I had ordered the soda, but not the champagne. "The champagne's for Junior," she explained, "compliments of the captain."

After one long flight, I headed for the men's room as soon as we landed. Naturally, I carried Junior along. Behind me, a number of men who were on the same flight saw us enter the men's room. They began laughing and followed us. "This I've gotta see," said one. I turned around and gave him a look of disapproval, then disappeared into one of the stalls. After all, even a robot deserves his privacy.

Is He Alive Or Isn't He?

Often, while waiting around to board a plane, I would set Junior on the floor, wake him up, then step back and quietly observe people's reactions.

It was fascinating. I loved to see the childlike curiosity and playfulness Junior would evoke in adults. And it was amazing to see the paradox Junior created in the adults' minds. I could almost see them wondering, "Is he alive, or isn't he?" And, "If he isn't alive, why does he seem to be alive?" This ambiguity seemed to create a tension in many people's minds that found its outlet in jokes about Junior being my son.

I observed another paradox as well. They seemed to ask themselves, "Is this machine a friend or an enemy? Is he here to help us do our jobs, or will he take our jobs away?"

The person who asked these questions the most simply and eloquently was the elderly cabbie in Roanoke, Virginia, who drove Junior and me back to my house at the end of our journey. The cabbie was fascinated by Junior and drawn to him, but his fascination was mixed with a pinch of fear. He began speculating about robots like Junior becoming humanlike and driving taxicabs. "If robots can do everything a man can," he said as he spat out the window, "we ought to hang it up." However, after some more thought, he decided: "There are just too many complications for a robot to be a good cab driver." And, referring to the possibility of robots getting out of control and taking over, he remarked, "There's more than one way to shut them off!"

The cabbie's fascination and affection for the robot ultimately won out over his fear. He pulled up in front of my house and turned around to face me and Junior. "You know something?" he said. "I sort of like that old box."

Time For A Recharge

When the cabbie dropped us off at the end of our trip, we were happy to be home and totally exhausted. We had traveled almost 7,000 miles together, and we had remained the best of friends in spite of crowded airports, grilling from customs officials, and Junior's tendency to wander off when I wasn't looking.

But now our trip was over, and boy, were we tired! The suitcases, computers, and Junior were sprawled across the front yard, and I was so groggy that I reclined on the grass for a little catnap.

I had just closed my eyes when, in a weak little voice, Junior pleaded, "Please charge my battery." Then he began mumbling a song: "All good robots sing this song: Doo Dah! Doooooo...."

"Okay, Junior," I said, getting up. "You win." I hefted the little robot on my shoulder and carried him into the house.

Five minutes later the two of us were fast asleep. ©

Computers and Society

David D. Thornburg, Associate Editor

Of Babbages And Things

Computer jargon and concepts have permeated our language in strange ways. This came home to me one night when I heard a caller on a talk show say that she had trouble "interfacing" with her partner. I guess this is just a reflection of the pervasiveness of computer technology. Every new technology spawns its own vocabulary, and computers are no exception.

In fact, the computer industry has provided us with both a rich assortment of words and a rich collection of concepts that alter how we think about our world. While the words of technology wax and wane in popularity, the concepts are longer-lived. This gives us the chance to misjudge the newness of a concept we have just learned. When this happens, a brief look at history often shows that what we thought was new was known a long time ago. I got caught in one of these historical time warps last spring. I was teaching a graduate-level computer course at Stanford University and had introduced a model of program design that I called a *microworld*.

To my way of thinking, microworlds are made of two kinds of things—objects and operators. The objects have certain attributes, and the operators work on these objects to create new instances of them. These new instances may inherit some or all of the attributes of the old objects. Sound like gobbledygook? Read on.

For example, the microworld of arithmetic contains objects we call numbers. These numbers have attributes (they may be integers, decimals, imaginary, etc.). The operators for arithmetic include addition, subtraction, multiplication, and so on. These operators combine the number objects to produce new numbers. Notice that this way of thinking about arithmetic has nothing to do with computers.

Computer Microworlds

Because we have devised ways to represent both numbers and their operations inside computers, the microworld of arithmetic is a suitable domain for implementation in a computer. Of course, the arithmetic microworld is not the only one we have. For example, word processing is a microworld which contains letters as objects and insert and delete as operators.

What I like about this concept is that it provides a framework for creating flexible computer programs in nearly any domain. To build a microworld, one has to identify the objects and operators, and then build representations of these in the computer using a suitable programming language.

I thought this way of looking at programming was fairly new, but I soon received the shock of my life while reading a collection of papers about Charles Babbage and the Analytical Engine—a nineteenth-century predecessor to the digital computer. At the end of one article translated into English by Ada Augusta, Countess of Lovelace, were some notes added by the Countess:

> In studying the action of the Analytical Engine, we find that the peculiar and independent nature of the considerations which in all mathematical analysis belong to *operations*, as distinguished from *the objects operated upon* and from the results of the operations performed upon those objects, is very strikingly defined and separated. It is well to draw attention to this point, not only because its full appreciation is essential to the attainment of any very just and adequate general comprehension of the powers and mode of action of the Analytical Engine, but also because it is one which is perhaps too little kept in view in the study of mathematical science in general.

Here was my microworld model, described by Ada Augusta in 1842!

So Much For Arithmetic

Lest you think she had only mathematics on her mind, she went on to say:

> By the word *operation*, we mean *any process which alters the mutual relation of two or more things*, be this relation of what kind it may. This is the most general definition, and would include all subjects in the universe.

In fact, she went on to point out that the Analytical Engine was capable of symbolic computation and was not restricted to numerical analysis. This capability came from the fact that the programs in the Analytical Engine (coded on punch cards) not only contained the values of variables, but also the sequence of commands and operations to be performed. The Analytical Engine had what we call today an instruction set. These primitive instructions allowed values to be read and saved to memory (which Babbage called the *store*), and a series of basic operations, such as addition, which were carried out in the central processing unit (which Babbage called the *mill*). The punch cards contained what we would call machine language programs.

The Analytical Engine embodied the basic concepts of today's computers, but nineteenth-century craftsmen lacked the technology to build it. Though it was not constructed in Babbage's lifetime, his dreams and Ada's ideas finally came to light a century later.

So the next time you toss computer jargon into your conversation to be trendy, remember that you might be reflecting on the trends of some British inventors in the 1800s!

©

Telecomputing Today

Arlan R. Levitan

The Latest Developments

AT&T Technologies and Bell Atlantic have been testing a new modem that works at 2400 bits per second (bps) since July of this year. The CTS-1620 will debut some time in 1986 and be pegged between $1,600 and $2,600. Why the relatively steep price tag? The CTS-1620 will be the communications giant's first *cellular* modem.

The testing is being conducted in the Baltimore-Washington, D.C. area and includes users in several government agencies, banks, insurance companies, and real estate agencies. The cellular modem requires a cellular telephone and transmitter, as well as an input/-display device. While the majority of initial buyers are expected to be lap computer owners, reliable sources within Ford Motor Company report that prototypes of a built-in dash terminal are being readied for trials late next year.

Although the CTS-1620 will be AT&T's first cellular modem, two lower-speed cellular units are already available from other companies. Motorola offers a 300 bps modem for $195, and Spectrum Cellular has a 1200 bps modem that goes for $695. Few details are available on the free-wheeling AT&T modem, but you can bet your seatbelt that by definition it will have "auto-answer" and "auto-dial."

Better Than Gorillas

The Source information service added 2400 bps access in August, with surcharges far lower than had been anticipated by industry watchers. Subscribers with 2400 bps modems pay $1.80 and $1.20 premiums for prime and nonprime time, respectively. With 1200 bps service priced at $25.80 and $10.80 for the same time periods, users are said to be moving to the higher-speed modems in droves.

Prices for 1200 bps modems continue to plummet. Cermetek of Sunnyvale, California has announced the Infomate 1200-TPC, an internal "bare minimum" Hayes-compatible modem for the IBM PC priced at $198. Cermetek isn't alone in the under-$200 market. A recent issue of a popular electronic hobbyist publication contained several advertisements for stand-alone Hayes compatibles, with prices as low as a $129 kit version for those bold enough to wield a soldering iron.

And 300 bps modems for under $50—including software—are springing up like mushrooms after three days of rain. I fully expect them to be given out as party favors at upscale kids' birthday parties. Tacky? It's a definite improvement over singing gorillas with balloons.

The 2400 bps market is heating up as well. With industry leader Hayes at $895 and the bulk of its competitors at $795, U.S. Robotics (the manufacturer of Apple's 300 and 1200 bps modems) raised more than a few eyebrows when it dropped the list price of its Courier 2400 to $695. Hats off to U.S. Robotics not only for lowering prices, but also for a number of "now why hasn't somebody else done that before" features of the Courier.

The Speed Of Choice

Here are some examples. Ever lose the "handy" reference card of commands that comes with most modems? The bottom of the Courier is imprinted with a complete command and register summary as well as an RS-232 pin assignment cheat sheet. If you're too lazy to turn the modem over, there are three separate full-screen help displays that can be called up while online. Also directly accessible on the bottom of the unit are DIP switches for changing the default settings, and a sliding volume control that (unlike those on some modems) can actually be manipulated by human beings to control the internal speaker.

U.S. Robotics is working closely with system operators of computer-based bulletin boards to encourage 2400 bps. A special acquisition deal available to operators of heavily trafficked systems is rapidly making 2400 bps the speed of choice for serious telecomputerists. (If you're a system operator who'd like more information on the U.S. Robotics program, contact the company at 8100 North McCormick Boulevard, Skokie, IL 60076.)

The rapid move to 2400 bps seems to have caught some people unawares, however. During a recent visit to Atari Corp. in Sunnyvale, I was pleasantly surprised to find that the new ST series of computers includes a terminal emulator as a standard desktop accessory. But I was even more surprised when I opened its configuration menu and was presented with choices of 300, 1200, 4800, or 9600 bps. Something was missing—apparently an oversight.

"What happened to 2400?" I asked. The person showing me the ST managed to minimize his look of distress to a few nanoseconds. "Hmmmm...I'll have to write that one down," he said. "Hey, look at this graphics demo...."

Atari's 4800 and 9600 bps options indicate that some companies are looking far beyond 2400 bps, though. If 2400 bps isn't fast enough for you, how about 10,000 bps—over *regular phone lines?* Digital Communications Associates of Alpharetta, Georgia has unleashed both internal ($1,995) and external ($2,395) modems, dubbed DCA Fastlinks. Even more of a mouthful than the Fastlink's speed is the proprietary DCA protocol it uses, called *Dynamically Adaptive Multicarrier Quadrature Amplitude Modulation,* or DAMQAM for short. And I thought that was an engine problem. ©

Donald B. Trivette

Games People Play

In February I wrote about a new adventure game called *King's Quest*—and about a million of you wrote back asking me for the dwarf's name. Now the sequel is out. Sierra On-Line has just published *King's Quest II: Romancing the Throne*, and it is every bit (sorry) as challenging as the original game.

Playing the role of Sir Graham—now King Graham in the sequel—you can move through 93 three-dimensional animated screens looking for your true love, the fair maiden Valanice. But before you can find and rescue her, you must swim with a mermaid, bargain with an antique dealer, pray with a monk, and defy the curse of Dracula. Yes, there's even a mushy kissing scene at the end. To accumulate points, you have to solve such problems as crossing the poison lake surrounding Dracula's castle—although the points are secondary to rescuing Valanice. Like the original *King's Quest*, the game is full of hidden goodies: If you visit the entrance to the Hag's cave often enough, occasionally a Batmobile comes roaring out. (If you keep falling through the bridge, write and I'll tell you why.)

Ken and Roberta Williams, the husband-and-wife founders of Sierra On-Line, live in the foothills of the Sierra mountains in a real stone castle—complete with spiral stairs, three hot tubs, and a racquetball court. (Incidentally, the most technically difficult part of *Kings Quest II* was to program King Graham realistically winding his way up the castle's spiral stairs.) Roberta writes and draws the storyline on a giant sheet of paper, and Ken works with a group of programmers to turn her ideas into computer language and a finished game. Then Ken's brother John helps promote the product—he's the director of public relations (and he lives in a conventional house).

If you've never played an adventure game, and are reluctant to part with $49.95 to try *King's Quest II*, check around for a free demonstration disk. Instead of spending a lot of money running advertisements, Sierra On-Line has produced 15,000 incomplete versions of *KQII* and shipped them to dealers and computer clubs across the country. If you like the demo, you'll love the game.

King's Quest II runs on all IBM PCs, PCjrs, and most compatibles with 128K RAM, one disk drive, and a color monitor. (An Apple II version is under construction.) This is one game that no PCjr owner will want to be without; the color and sound are excellent.

Climbing The Money Tree

If galloping around 93 screens in search of a maiden isn't your idea of fun, then how about slogging through 77 weeks' worth of financial data in an attempt to make a million dollars?

Blue Chip Software creates games for the Walter Mitty in us. *Millionaire* is for wheelers and dealers on the New York Stock Exchange; *Tycoon*, for the commodity speculators; and *Baron*, for those who believe that the only sure way to millions is real estate. These games are available for the IBM PC family of computers, most compatibles, the Apple II series, Macintosh, and Commodore 64/128. The IBM version costs $49.95; the others a little less.

Which of these games you'll want to play depends on your perspective and experience. I bought my first stock when I was 12 years old. The company promptly went bankrupt and my three-share certificate now graces my wall. How to invest in real estate has become the biggest TV-ad fad since how to grow hair on a bald head—and about as successful, I imagine. The only thing I know about commodity speculation is that I shouldn't. Therefore, *Tycoon* was the game I chose to test my financial acumen.

Before you can begin *Tycoon*, the computer takes about four minutes to generate a unique trading environment from 300,000 possibilities. Once the environment is set, you are given $10,000 and a list of 15 commodities to buy and sell.

Although I've never seen a soybean, and can't stand soy sauce, I selected them as a likely vehicle for my fortune. Somewhere I read that the way to play commodities is to pick one and stick with it—not to jump from wheat to pork bellies (yuck!) to heating oil. Apparently that is sound advice. By ignoring all other commodities and concentrating on soybeans, I parlayed my $10,000 into $1,082,598 in just 60 weeks. (If only I were so lucky in real life!)

But *Tycoon* is more than a game for those of us too chicken to buy real soybeans. Like *Millionaire* and *Baron*, it is an educational game which closely simulates actual economic situations and the workings of real markets. Blue Chip Software says these programs are used at all levels of instruction—from fifth-grade economics classes in the Chicago Public Schools to college courses at Penn State and Southern Illinois University.

It's true, you will learn about interest, commissions, taxes, margins, short-selling, and options, but these games may not make you a more successful investor. They may have just the opposite effect. Once you see how easy it is to make money, once you think you've mastered the technique, you may be tempted to mortgage the house and play in the real world. But before you do, give me a call. I've got a tonic guaranteed to grow hair.... ©

Bill Wilkinson

Atari Disk Drive Compatibility

Way back in 1978, when Atari announced the double-density 815 disk drive, Percom Data Corporation saw the prototypes displayed at several shows and decided it could easily build a better drive which would sell for less.

Because Percom produced both single- and double-sided disk drives using both single and double density, and because it wanted to maintain compatibility with both the single-density 810 and double-density 815 drives, Percom invented the *configuration block* (more on this below). With some cooperation from a small, brand-new software company (wonder who that could be) which had inherited the source code rights to Atari's File Management System (FMS), Percom succeeded in establishing standards which have been adhered to by all other Atari-compatible drive manufacturers. All Atari-compatible drive manufacturers except one, that is: Atari. Before the 815 even hit the market, Atari dropped it from the product line. Years later, in 1984, Atari introduced the "enhanced density" 1050, which is actually somewhere between single- and double-density. Sigh.

As of this writing, the following drives and/or modification kits are known to be capable of understanding the Percom-standard double-density mode and configuration table: Percom, Indus, Amdek, Astra, Trak, Rana, SWP (ATR-8000), Happy Doubler, and ICD's US Doubler.

The Percom Config Block

As defined by the Percom standard, a config block is a set of 12 bytes within the memory of the disk control microprocessor—which is inside your disk drive(s). You read a drive's config block by passing "N" to it as an SIO command. You can write a new config block to a drive via an "O" command. The "N" and "O" commands closely parallel the "R" and "W" sector input/output commands, except the data length is always 12 bytes and no sector number is needed. The 12 bytes in the block are shown in the table.

Byte #	# of Bytes	Description
0	1	Number of Tracks
1	1	Step Rate
2-3	2	Sectors per Track
4	1	Number of Sides or Heads
5	1	Density (0=Single, 4=Double)
6-7	2	Bytes per Sector
8	1	Drive Selected?
9	1	Serial Rate Control
10-11	2	Miscellaneous (reserved)

This table requires some explanation. First, all the double-byte values are in high-byte/low-byte order, the opposite of normal 6502 practice (because that's how the microprocessor Percom used in their drives worked). Also, not all these values have meaning to all manufacturers. In fact, some don't allow you to change more than two or three of the values listed here.

The Step Rate controls the speed of a drive's head stepping motor, and the values used here have no universal meaning. A step rate of 2 may mean 6 milliseconds per track to one drive, 20 milliseconds per track to another, or be illegal to yet another.

Number of Sides is actually one less than the actual number. So most drives use a zero here, meaning one head.

Changing the value of Drive Selected may turn the drive off as far as the computer is concerned. Percom must have had its reasons for this, but I don't know what they were.

Changing The Config Block

For the Density byte of the config block, I don't know of any drives which use values other than 0 (FM mode, single density) or 4 (MFM mode, double density). If you find a drive that actually *uses* some other value (not just ignores it), let me know.

The Serial Rate Control value and Miscellaneous bytes have no universal meanings. Some drives will remember these values if you change them; other drives ignore your values.

So that leaves Number of Tracks, Sectors per Track, and Bytes per Sector, all of which should be self-explanatory. Again, though, many drives ignore values outside certain legal ranges. Indus drives, for example, reject any changes to the number of tracks or sectors. In fact, Indus pays attention only to the Bytes per Sector and the Density bytes. Experiment with your own drive(s). See what they will and will not allow. And even if they seem to allow a change, do they execute it or ignore it? (Fun, if you're a masochist, right?)

And just how do you read and/or change the config block? Have a look at the BASIC program following this column. It should be pretty much self-explanatory. You can use the subroutines at 8010, 8210, and 9010 in your own programs. Remember what we said at the beginning, however: Atari drives do not follow the Percom config block standard. As a result, *this program works only on Atari-compatible disk drives, not on the Atari 810 or 1050.*

Configuration Block Modifier

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" published bimonthly in COMPUTE!.

```
KG 1010 REM
NP 1020 REM CONFIGURE FROM B
        ASIC
KI 1030 REM
DJ 1050 DIM TEMP$(20),TBL$(1
        2),CMD$(1)
GK 1060 GRAPHICS 0:PRINT "
        *** DISK CONFIGURATI
        ON PROGRAM ***"
MO 1070 PRINT :PRINT :PRINT
```

```
        "What disk drive wil
        l we work with";
ND 1080 INPUT DRIVE
EA 1090 IF DRIVE<1 OR DRIVE>
        8 OR DRIVE<>INT(DRIV
        E) THEN RUN
NL 1100 GRAPHICS 0:PRINT "DR
        IVE #";DRIVE;
AL 1110 GOSUB 8000
PB 1120 IF SIOSTATUS<128 THE
        N 1170
DI 1130 PRINT " won't let me
         read"
IJ 1140 PRINT "{3 SPACES}the
         configuration block
        ."
OI 1150 PRINT :PRINT "It gav
        e me error #";SIOSTA
        TUS
AO 1160 STOP
CA 1170 PRINT " looks like t
        his:":PRINT
CI 1180 PRINT TRACKS;" TRACK
        S of ";SECTORSPERTRA
        CK;" SECTORS each"
JB 1190 PRINT :PRINT "each s
        ector has ";BYTESPER
        SECTOR;" BYTES, & de
        nsity"
NB 1200 PRINT "  is ";DENSIT
        Y;", considered ";
MO 1210 IF DENSITY=0 THEN PR
        INT "SINGLE density,
        "
MM 1220 IF DENSITY=4 THEN PR
        INT "DOUBLE density,
        "
DM 1230 IF DENSITY<>0 AND DE
        NSITY<>4 THEN PRINT
        "UNKNOWN DENSITY,"
JN 1240 PRINT "  with ";SIDE
        S;" SIDE(s)."
IG 1250 PRINT :PRINT "the ST
        EP RATE setting is "
        ;STEPRATE
AI 1260 PRINT "other setting
        s are SELECT=";SELEC
        T;","
MN 1270 PRINT "  ACIA=";ACIA
        ;", and MISC=";MISC
EJ 1280 PRINT :PRINT "SELECT
         A CHOICE:"
BH 1290 PRINT "{3 SPACES}0 -
         quit and save confi
        guration"
DF 1300 PRINT "{3 SPACES}1 -
         change drive settin
        g(s)"
HP 1310 PRINT "{3 SPACES}2 -
         work with another d
        rive"
EI 1320 PRINT :PRINT "your c
        hoice ";:INPUT CHOIC
        E
GK 1330 IF CHOICE=0 THEN JUN
        K=USR(58484)
JF 1340 IF CHOICE=2 THEN RUN

ED 1350 GRAPHICS 0:PRINT "En
        ter new values.  Hit
         RETURN to"
AB 1360 PRINT "  leave a val
        ue unchanged."
FI 1370 PRINT
BF 1380 PRINT "TRACKS";:TEMP
        =TRACKS
IJ 1390 GOSUB 7000:TRACKS=TE
        MP
HM 1400 PRINT "SECTORS PER T
        RACK";:TEMP=SECTORSP
        ERTRACK
DJ 1410 GOSUB 7000:SECTORSPE
        RTRACK=TEMP
PM 1420 PRINT "BYTES PER SEC
        TOR";:TEMP=BYTESPERS
        ECTOR
PK 1430 GOSUB 7000:BYTESPERS
        ECTOR=TEMP
NA 1440 PRINT "NUMBER OF SID
        ES";:TEMP=SIDES
DG 1450 GOSUB 7000:SIDES=TEM
        P
ME 1460 PRINT "DENSITY";:TEM
        P=DENSITY
OA 1470 GOSUB 7000:DENSITY=T
        EMP
FK 1480 PRINT
FH 1490 PRINT "STEP RATE";:T
        EMP=STEPRATE
CC 1500 GOSUB 7000:STEPRATE=
        TEMP
AA 1510 PRINT "SELECT";:TEMP
        =SELECT
HM 1520 GOSUB 7000:SELECT=TE
        MP
JO 1530 PRINT "ACIA";:TEMP=A
        CIA
MM 1540 GOSUB 7000:ACIA=TEMP
MA 1550 PRINT "MISCELLANEOUS
         WORD";:TEMP=MISC
OM 1560 GOSUB 7000:MISC=TEMP
BH 1570 GOSUB 8200
PE 1580 IF SIOSTATUS<128 THE
        N 1100
CD 1590 PRINT :PRINT
GI 1600 PRINT "Unable to set
         that configuration!
        "
JH 1610 PRINT "  drive issue
        d error #";SIOSTATUS
BP 1620 PRINT :PRINT "(hit R
        ETURN to continue)"
MF 1630 GOTO 1100
CH 7000 REM ENTER DATA OR NO
         CHANGE
LN 7030 PRINT " [";TEMP;"] ?
        ";
LF 7040 INPUT TEMP$
BF 7050 IF LEN(TEMP$) THEN T
        EMP=VAL(TEMP$)
KN 7060 RETURN
IP 8000 REM EXTRACT INFO FRO
        M TABLE
IM 8030 TBL=ADR(TBL$):ADDR=T
        BL
MJ 8040 CMD$="N":GOSUB 9000:
        REM ---READ BLOCK---
IF 8050 TRACKS=PEEK(TBL+0)
CH 8060 STEPRATE=PEEK(TBL+1)
OI 8070 SECTORSPERTRACK=PEEK
        (TBL+2)*256+PEEK(TBL
        +3)
JI 8080 SIDES=PEEK(TBL+4)+1
OG 8090 DENSITY=PEEK(TBL+5)
KJ 8100 BYTESPERSECTOR=PEEK(
        TBL+6)*256+PEEK(TBL+
        7)
IC 8110 SELECT=PEEK(TBL+8)
NC 8120 ACIA=PEEK(TBL+9)
PA 8130 MISC=PEEK(TBL+10)*25
        6+PEEK(TBL+11)
KN 8140 RETURN
FP 8200 REM PUT NEW INFO INT
        O TABLE
IO 8230 TBL=ADR(TBL$):ADDR=T
        BL
CO 8240 POKE TBL+0,TRACKS
NA 8250 POKE TBL+1,STEPRATE
PB 8260 POKE TBL+2,INT(SECTO
        RSPERTRACK/256)
JE 8270 POKE TBL+3,SECTORSPE
        RTRACK-PEEK(TBL+2)*2
        56
EE 8280 POKE TBL+4,SIDES-1
JA 8290 POKE TBL+5,DENSITY
KP 8300 POKE TBL+6,INT(BYTES
        PERSECTOR/256)
FG 8310 POKE TBL+7,BYTESPERS
        ECTOR-PEEK(TBL+6)*25
        6
CN 8320 POKE TBL+8,SELECT
HN 8330 POKE TBL+9,ACIA
MM 8340 POKE TBL+10,INT(MISC
        /256)
JO 8350 POKE TBL+11,MISC-PEE
        K(TBL+10)*256
DO 8360 CMD$="O":GOSUB 9000:
        REM ---WRITE BLOCK--
        -
LC 8370 RETURN
ME 9000 REM DISK DENSITY CHA
        NGE ROUTINE
LA 9030 REM
LN 9040 REM ENTER:  DRIVE NU
        MBER IN DRIVE
DC 9050 REM .{5 SPACES}buffe
        r address in ADDR
IP 9060 REM .{12 SPACES}comma
        nd in CMD$
LE 9070 REM
GH 9080 REM (ONLY "N" AND "O
        " ARE VALID FOR CMD$
        )
LG 9090 REM
GM 9100 REM EXIT: status in
        SIOSTATUS
KP 9110 REM
OL 9130 TRAP 9190:REM activa
        ted if SIOCALL$ alre
        ady DIM'd
IL 9140 DIM SIOCALL$(16)
MF 9150 RESTORE 9180
JM 9160 FOR CNT=1 TO 14:READ
         BYTE
FD 9170 SIOCALL$(CNT)=CHR$(B
        YTE):NEXT CNT
MI 9180 DATA 104,32,89,228,1
        73,3,3,133,212,169,0
        ,133,213,96
FH 9190 TRAP 40000:REM turn
        off TRAP
ML 9200 POKE 768,ASC("1"):RE
        M don't ask me why
FP 9210 POKE 769,DRIVE:REM m
        ust be 1 through 8
OG 9220 POKE 770,ASC(CMD$)
MA 9230 POKE 771,128:REM ass
        ume output
LI 9240 IF CMD$="N" THEN POK
        E 771,64
GN 9250 POKE 773,INT(ADDR/25
        6):REM buffer addres
        s
PC 9260 POKE 772,ADDR-256*PE
        EK(773)
FH 9270 POKE 774,3:REM short
         timeout
KA 9280 POKE 775,0:REM (high
         byte of timeout)
BI 9290 POKE 776,12:POKE 777
        ,0:REM assume std co
        nfig block
HG 9300 SIOSTATUS=USR(ADR(SI
        OCALL$))
KN 9310 RETURN
```

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The Beginners Page

Tom R. Halfhill, Editor

Clearing Up Variable Cloudiness

If you're just learning to program, variables can be confusing at first—especially because there are so many varieties of variables. Last month's column introduced the concept of numeric variables. But, depending on your computer's BASIC, there are also integer variables, double-precision variables, string variables, numeric array variables, and string array variables. This month we'll cover integer variables and tackle the rest later.

Numeric variables, you'll recall, represent ordinary numbers. For instance, you can store the number 10 in the variable X with the BASIC statement X = 10. Numeric variables can represent fractions just as easily, as in X = 98.6. An *integer variable* is similar, but with one important difference. As the term implies, integer variables can only represent *integers*—whole numbers. Fractions like 98.6 aren't allowed. There's one other limitation, too. In most BASICs which allow integer variables, the value cannot range beyond a maximum of 32,767 or a minimum of −32,768.

At first, these restrictions may seem odd. What's the advantage of limiting a variable to a whole number, and especially a whole number within a relatively narrow range?

The answer has to do with the way computers manipulate numbers. Internally, they use the binary numbering system instead of our everyday decimal system. Translating decimal numbers into binary gets tricky when the decimal number is a fraction, or *floating point* number (so-called because the decimal point can "float" to the left or right, as in 98.6 or 9.86). The conversion process requires a few valuable microseconds, and it takes several bytes of memory just to store a single floating point number.

Are Integers Faster?

Integer variables can greatly simplify matters for a computer. Because fractions aren't allowed, the operating system doesn't have to spin its wheels performing lengthy floating point conversions. And when the integers are limited to a range of −32,768 to 32,767, each number can be stored in only two bytes of memory.

Saving a few bytes of memory isn't a terribly important consideration anymore, now that nearly all personal computers come with at least 64K of RAM. But on certain computers, integer variables *can* help your programs run faster—often significantly faster.

In Commodore BASIC, Applesoft, and IBM BASIC, you declare an integer variable by appending a percent symbol (%) to the variable name, as in X% = 10. (Integer variables are not available in TI BASIC or Atari BASIC, but are supported in Atari Microsoft BASIC.) A common mistake is to accidentally omit the % symbol in a statement somewhere, often leading to a mysterious error or unexpected result. Keep in mind that two variable names such as X and X% are treated by the computer as completely separate variables—they can store independent values and are as different as A and Z.

To test the performance of integer variables versus regular variables on your computer, enter this simple program:

```
10 FOR X=1 TO 32000
20 Y=Y+1
30 NEXT X
40 PRINT Y
```

Use a watch to measure how long this program takes to execute. Jot down the result, then change all three occurrences of Y to integer variables by adding the % symbol. Now run the program and time it again.

Surprising Results

What happened? If you have an IBM PC or PCjr, the program should run measurably faster. But if you have a Commodore or Apple, the program actually runs *slower*. What's going on?

Integer variables are indeed faster and more memory-efficient on IBM computers. But on Commodore and Apple computers, integer variables actually execute slower and consume just as much memory as regular variables. This is true even though all three computers have versions of Microsoft BASIC. The reason is that the math routines in the Commodore and Apple are designed to handle floating-point numbers only. Therefore, the computer must convert integer variables into floating-point values, perform the math requested by the program, and then convert the results back into integers. All this conversion takes so long (in computer terms) that integer variables really aren't any faster than regular variables on Commodore or Apple computers.

It would seem, then, that integer variables are useless if you have a Commodore or Apple. But in fact, they can speed up your programs and save memory when used to construct *arrays*—a future column topic.

In the meantime, let's clear up another mystery raised by the above program. If you examine it closely, you might wonder why converting Y to Y% makes it run faster even on the IBM. Since the FOR-NEXT loop is incrementing Y by steps of one, Y is never a fraction, anyway—it's always a whole number. But computers handle all numeric variables as floating point numbers, *even when the value is a whole number and not a fraction.* Defining a variable as an integer variable forces the IBM to treat it as an integer. ©

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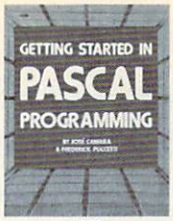

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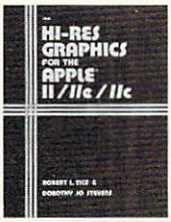

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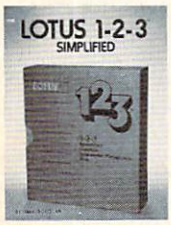

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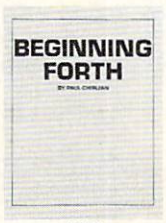

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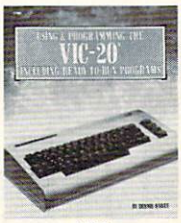

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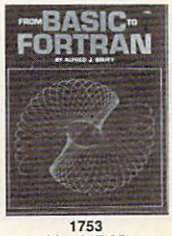

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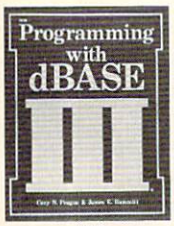

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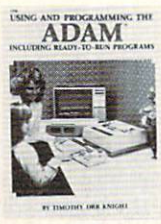

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HOTWARE: Software Best Sellers

This Month	Last Month	Title	Publisher	Remarks	Systems: Apple	Atari	Commodore	IBM	Macintosh
Entertainment									
1.	4.	*The Hitchhiker's Guide To The Galaxy*	Infocom	Comic adventure strategy game	•	•	•	•	•
2.	3.	*F-15 Strike Eagle*	MicroProse	Air combat simulation	•	•	•	•	
3.	1.	*Flight Simulator II*	SubLogic	Aircraft simulation	•	•	•		
4.	5.	*Flight Simulator*	Microsoft	Aircraft simulation				•	
5.	2.	*Karateka*	Brøderbund	Action karate game	•		•		
Education									
1.	3.	*New Improved MasterType*	Scarborough	Typing instruction program	•	•	•	•	•
2.	2.	*Typing Tutor III*	Simon & Schuster	Typing instruction program	•		•	•	•
3.	1.	*Math Blaster!*	Davidson	Introductory math program, ages 6-12	•	•	•	•	
4.	4.	*Early Games*	Springboard	Educational games, ages 2-6	•	•	•	•	
5.		*Music Construction Set*	Electronic Arts	Music composition program	•	•	•		
Home Management									
1.	1.	*Print Shop*	Brøderbund	Do-it-yourself print shop	•	•	•		
2.	2.	*Print Shop Graphics Library*	Brøderbund	100 additional graphics	•	•	•		
3.		*Print Shop Graphics Library II*	Brøderbund	More graphics	•	•	•		
4.	5.	*The Newsroom*	Springboard	Do-it-yourself newspaper	•		•	•	
5.	3.	*HomePak*	Batteries Included	Word processing, telecommunications, & data management	•	•	•	•	

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CAPUTE!

Modifications or Corrections To Previous Articles

Commodore Disk 64 Commander

A character was smudged in the listing for this disk utility program from the September issue. Line 3315 (p. 82) should read as follows:

```
3315 :168,160,000,177,098,153,231
```

Also, the DOPEN command example for relative files (p. 81) is incorrect. The record length must be specified *outside* the quotes surrounding the filename, not within the quotes as shown. Thus, the example for opening a relative file named TEST with a record length of 20 characters should read:

```
DOPEN#1,"TEST",L20
```

Commodore 64 Headliner

The large characters displayed by this program from the August issue (p. 72) do not have the desired color on newer 64s, and are invisible on older 64s which do not fill color memory. This is because the variable G, which is defined in line 100 as the address of the start of color memory and intended for use in line 530 to color the large characters, is redefined when it is used for another purpose in lines 200 and 220. There are several possible solutions to this problem, the simplest of which is to change the G in lines 200 and 220 to some other variable:

```
200 PRINTCHR$(147)TAB(125)"DOW
    NLOADING THE CHARACTER SET
    ":C=53248:GN=12288:rem 114
220 POKE 56333,127:POKE1,51:FO
    R Q=0TO1023:POKEGN+Q,PEEK(
    C+Q):NEXT          :rem 85
```

When adding the "Headliner" routine to your own programs, you should make sure that your program does not use any of the variables in the main subroutine (lines 500–550) for any other purpose. The variables are P, L, X$, G, CC, and SL.

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MLX Machine Language Entry Program For Commodore 64

Charles Brannon, Program Editor

MLX is a labor-saving utility that allows almost fail-safe entry of machine language programs published in COMPUTE!. You need to know nothing about machine language to use MLX—it was designed for everyone. At least 8K expansion memory is required.

MLX is a new way to enter long machine language (ML) programs with a minimum of fuss. MLX lets you enter the numbers from a special list that looks similar to BASIC DATA statements. It checks your typing on a line-by-line basis. It won't let you enter illegal characters when you should be typing numbers. It won't let you enter numbers greater than 255 (forbidden in ML). It won't let you enter the wrong numbers on the wrong line. In addition, MLX creates a ready-to-use tape or disk file.

Using MLX

Type in and save the appropriate version of MLX (you'll want to use it in the future). When you're ready to type in an ML program, run MLX. MLX for the 64 asks you for two numbers: the starting address and the ending address. These numbers are given in the article accompanying the ML program.

When you run MLX, you'll see a prompt corresponding to the starting address. The prompt is the current line you are entering from the listing. It increases by six each time you enter a line. That's because each line has seven numbers—six actual data numbers plus a *checksum number*. The checksum verifies that you typed the previous six numbers correctly. If you enter any of the six numbers wrong, or enter the checksum wrong, the computer rings a buzzer and prompts you to reenter the line. If you enter it correctly, a bell tone sounds and you continue to the next line.

MLX accepts only numbers as input. If you make a typing error, press the INST/DEL key; the entire number is deleted. You can press it as many times as necessary back to the start of the line. If you enter three-digit numbers as listed, the computer automatically prints the comma and goes on to accept the next number. If you enter less than three digits, you can press either the space bar or RETURN key to advance to the next number. The checksum automatically appears in inverse video for emphasis.

To simplify your typing, MLX redefines part of the keyboard as a numeric keypad (lines 581–584):

```
   U  I  O          7  8  9
H  J  K  L  become  0  4  5  6
   M  ,  .          1  2  3
```

64 MLX Commands

When you finish typing an ML listing (assuming you type it all in one session), you can then save the completed program on tape or disk. Follow the screen instructions. If you get any errors while saving, you probably have a bad disk, or the disk is full, or you've made a typo when entering the MLX program itself.

You don't have to enter the whole ML program in one sitting. MLX lets you enter as much as you want, save it, and then reload the file from tape or disk later. MLX recognizes these commands:

SHIFT-S: Save
SHIFT-L: Load
SHIFT-N: New Address
SHIFT-D: Display

When you enter a command, MLX jumps out of the line you've been typing, so we recommend you do it at a new prompt. Use the Save command to save what you've been working on. It will save on tape or disk, as if you've finished, but the tape or disk won't work, of course, until you finish the typing. Remember what address you stop at. The next time you run MLX, answer all the prompts as you did before, then insert the disk or tape. When you get to the entry prompt, press SHIFT-L to reload the partly completed file into memory. Then use the New Address command to resume typing.

To use the New Address command, press SHIFT-N and enter the address where you previously stopped. The prompt will change, and you can then continue typing. Always enter a New Address that matches up with one of the line numbers in the special listing, or else the checksum won't work. The Display command lets you display a section of your typing. After you press SHIFT-D, enter two addresses within the line number range of the listing. You can abort the listing by pressing any key.

64 MLX: Machine Language Entry

```
10 REM LINES CHANGED FROM MLX
   {SPACE}VERSION 2.00 ARE 750
   ,765,770 AND 860      :rem 50
20 REM LINE CHANGED FROM MLX V
   ERSION 2.01 IS 300 :rem 147
100 PRINT"{CLR}{6}";CHR$(142);
    CHR$(8);:POKE53281,1:POKE5
    3280,1                :rem 67
101 POKE 788,52:REM DISABLE RU
    N/STOP                :rem 119
110 PRINT"{RVS}{39 SPACES}";
                          :rem 176
120 PRINT"{RVS}{14 SPACES}
    {RIGHT}{OFF}{*}£{RVS}
    {RIGHT} {RIGHT}{2 SPACES}
    {*}{OFF}{*}£{RVS}£{RVS}
    {14 SPACES}";         :rem 250
130 PRINT"{RVS}{14 SPACES}
    {RIGHT} {G}{RIGHT}
    {2 RIGHT} {OFF}£{RVS}£
    {*}{OFF}{*}{RVS}
    {14 SPACES}";         :rem 35
140 PRINT"{RVS}{41 SPACES}"
                          :rem 120
200 PRINT"{2 DOWN}{PUR}{BLK} M
    ACHINE LANGUAGE EDITOR VER
    SION 2.02{5 DOWN}":rem 238
210 PRINT"{5}{2 UP}STARTING AD
    DRESS?{8 SPACES}{9 LEFT}";
                          :rem 143
215 INPUTS:F=1-F:C$=CHR$(31+11
    9*F)                  :rem 166
220 IFS<256OR(S>40960ANDS<4915
    2)ORS>53247THENGOSUB3000:G
    OTO210                :rem 235
225 PRINT:PRINT:PRINT :rem 180
230 PRINT"{5}{2 UP}ENDING ADDR
    ESS?{8 SPACES}{9 LEFT}";:I
    NPUTE:F=1-F:C$=CHR$(31+119
    *F)                   :rem 20
240 IFE<256OR(E>40960ANDE<4915
    2)ORE>53247THENGOSUB3000:G
    OTO230                :rem 183
250 IFE<STHENPRINTC$;"{RVS}END
    ING < START{2 SPACES}":GOS
    UB1000:GOTO 230       :rem 176
260 PRINT:PRINT:PRINT :rem 179
300 PRINT"{CLR}";CHR$(14):AD=S
                          :rem 56
310 A=1:PRINTRIGHT$("0000"+MID
    $(STR$(AD),2),5);":";
                          :rem 33
315 FORJ=ATO6             :rem 33
320 GOSUB570:IFN=-1THENJ=J+N:G
    OTO320                :rem 228
390 IFN=-211THEN 710      :rem 62
400 IFN=-204THEN 790      :rem 64
410 IFN=-206THENPRINT:INPUT"
    {DOWN}ENTER NEW ADDRESS";Z
    Z                     :rem 44
415 IFN=-206THENIFZZ<SORZZ>ETH
    ENPRINT"{RVS}OUT OF RANGE"
    :GOSUB1000:GOTO410:rem 225
417 IFN=-206THENAD=ZZ:PRINT:GO
    TO310                 :rem 238
420 IF N<>-196 THEN 480
                          :rem 133
430 PRINT:INPUT"DISPLAY:FROM";
    F:PRINT,"TO";:INPUTT
                          :rem 234
440 IFF<SORF>EORT<SORT>ETHENPR
    INT"AT LEAST";S;"{LEFT}, N
    OT MORE THAN";E:GOTO430
                          :rem 159
450 FORI=FTOTSTEP6:PRINT:PRINT
    RIGHT$("0000"+MID$(STR$(I)
    ,2),5);":";           :rem 30
451 FORK=0TO5:N=PEEK(I+K):PRIN
    TRIGHT$("00"+MID$(STR$(N),
    2),3);",";            :rem 66
```

```
460 GETA$:IFA$>""THENPRINT:PRI
    NT:GOTO310              :rem 25
470 NEXTK:PRINTCHR$(20);:NEXTI
    :PRINT:PRINT:GOTO310
                            :rem 50
480 IFN<0 THEN PRINT:GOTO310
                            :rem 168
490 A(J)=N:NEXTJ            :rem 199
500 CKSUM=AD-INT(AD/256)*256:F
    ORI=1TO6:CKSUM=(CKSUM+A(I)
    )AND255:NEXT            :rem 200
510 PRINTCHR$(18);:GOSUB570:PR
    INTCHR$(146);           :rem 94
511 IFN=-1THENA=6:GOTO315
                            :rem 254
515 PRINTCHR$(20):IFN=CKSUMTHE
    N530                    :rem 122
520 PRINT:PRINT"LINE ENTERED W
    RONG : RE-ENTER":PRINT:GOS
    UB1000:GOTO310          :rem 176
530 GOSUB2000               :rem 218
540 FORI=1TO6:POKEAD+I-1,A(I):
    NEXT:POKE54272,0:POKE54273
    ,0                      :rem 227
550 AD=AD+6:IF AD<E THEN 310
                            :rem 212
560 GOTO 710                :rem 108
570 N=0:Z=0                 :rem 88
580 PRINT"£";               :rem 81
581 GETA$:IFA$=""THEN581
                            :rem 95
582 AV=-(A$="M")-2*(A$=",")-3*
    (A$=".")-4*(A$="J")-5*(A$=
    "K")-6*(A$="L")         :rem 41
583 AV=AV-7*(A$="U")-8*(A$="I"
    )-9*(A$="O"):IFA$="H"THENA
    $="0"                   :rem 134
584 IFAV>0THENA$=CHR$(48+AV)
                            :rem 134
585 PRINTCHR$(20);:A=ASC(A$):I
    FA=13ORA=44ORA=32THEN670
                            :rem 229
590 IFA>128THENN=-A:RETURN
                            :rem 137
600 IFA<>20 THEN 630        :rem 10
610 GOSUB690:IFI=1ANDT=44THENN
    =-1:PRINT"{OFF}{LEFT}
    {LEFT}";:GOTO690        :rem 62
620 GOTO570                 :rem 109
630 IFA<48ORA>57THEN580
                            :rem 105
640 PRINTA$;:N=N*10+A-48
                            :rem 106
650 IFN>255 THEN A=20:GOSUB100
    0:GOTO600               :rem 229
660 Z=Z+1:IFZ<3THEN580      :rem 71
670 IFZ=0THENGOSUB1000:GOTO570
                            :rem 114
680 PRINT",";:RETURN        :rem 240
690 S%=PEEK(209)+256*PEEK(210)
    +PEEK(211)              :rem 149
691 FORI=1TO3:T=PEEK(S%-I)
                            :rem 67
695 IFT<>44ANDT<>58THENPOKES%-
    I,32:NEXT               :rem 205
700 PRINTLEFT$("{3 LEFT}",I-1)
    ;:RETURN                :rem 7
710 PRINT"{CLR}{RVS}*** SAVE *
    **{3 DOWN}"             :rem 236
715 PRINT"{2 DOWN}(PRESS {RVS}
    RETURN{OFF} ALONE TO CANCE
    L SAVE){DOWN}"          :rem 106
720 F$="":INPUT"{DOWN} FILENAM
    E";F$:IFF$=""THENPRINT:PRI
    NT:GOTO310              :rem 71
730 PRINT:PRINT"{2 DOWN}{RVS}T
    {OFF}APE OR {RVS}D{OFF}ISK
    : (T/D)"                :rem 228
740 GETA$:IFA$<>"T"ANDA$<>"D"T
    HEN740                  :rem 36
750 DV=1-7*(A$="D"):IFDV=8THEN
    F$="0:"+F$:OPEN15,8,15,"S"
    +F$:CLOSE15             :rem 212
760 T$=F$:ZK=PEEK(53)+256*PEEK
    (54)-LEN(T$):POKE782,ZK/25
    6                       :rem 3
762 POKE781,ZK-PEEK(782)*256:P
    OKE780,LEN(T$):SYS65469
                            :rem 109
763 POKE780,1:POKE781,DV:POKE7
    82,1:SYS65466           :rem 69
765 K=S:POKE254,K/256:POKE253,
    K-PEEK(254)*256:POKE780,25
    3                       :rem 17
766 K=E+1:POKE782,K/256:POKE78
    1,K-PEEK(782)*256:SYS65496
                            :rem 235
770 IF(PEEK(783)AND1)OR(191AND
    ST)THEN780              :rem 111
775 PRINT"{DOWN}DONE.{DOWN}":G
    OTO310                  :rem 113
780 PRINT"{DOWN}ERROR ON SAVE.
    {2 SPACES}TRY AGAIN.":IFDV
    =1THEN720               :rem 171
781 OPEN15,8,15:INPUT#15,E1$,E
    2$:PRINTE1$;E2$:CLOSE15:GO
    TO720                   :rem 103
790 PRINT"{CLR}{RVS}*** LOAD *
    **{2 DOWN}"             :rem 212
795 PRINT"{2 DOWN}(PRESS {RVS}
    RETURN{OFF} ALONE TO CANCE
    L LOAD)"                :rem 82
800 F$="":INPUT"{2 DOWN} FILEN
    AME";F$:IFF$=""THENPRINT:G
    OTO310                  :rem 144
810 PRINT:PRINT"{2 DOWN}{RVS}T
    {OFF}APE OR {RVS}D{OFF}ISK
    : (T/D)"                :rem 227
820 GETA$:IFA$<>"T"ANDA$<>"D"T
    HEN820                  :rem 34
830 DV=1-7*(A$="D"):IFDV=8THEN
    F$="0:"+F$              :rem 157
840 T$=F$:ZK=PEEK(53)+256*PEEK
    (54)-LEN(T$):POKE782,ZK/25
    6                       :rem 2
841 POKE781,ZK-PEEK(782)*256:P
    OKE780,LEN(T$):SYS65469
                            :rem 107
845 POKE780,1:POKE781,DV:POKE7
    82,1:SYS65466           :rem 70
850 POKE780,0:SYS65493      :rem 11
860 IF(PEEK(783)AND1)OR(191AND
    ST)THEN870              :rem 111
865 PRINT"{DOWN}DONE.":GOTO310
                            :rem 96
870 PRINT"{DOWN}ERROR ON LOAD.
    {2 SPACES}TRY AGAIN.{DOWN}
    ":IFDV=1THEN800         :rem 172
880 OPEN15,8,15:INPUT#15,E1$,E
    2$:PRINTE1$;E2$:CLOSE15:GO
    TO800                   :rem 102
1000 REM BUZZER             :rem 135
1001 POKE54296,15:POKE54277,45
    :POKE54278,165          :rem 207
1002 POKE54276,33:POKE 54273,6
    :POKE54272,5            :rem 42
1003 FORT=1TO200:NEXT:POKE5427
    6,32:POKE54273,0:POKE5427
    2,0:RETURN              :rem 202
2000 REM BELL SOUND         :rem 78
2001 POKE54296,15:POKE54277,0:
    POKE54278,247           :rem 152
2002 POKE 54276,17:POKE54273,4
    0:POKE54272,0           :rem 86
2003 FORT=1TO100:NEXT:POKE5427
    6,16:RETURN             :rem 57
3000 PRINTC$;"{RVS}NOT ZERO PA
    GE OR ROM":GOTO1000
                            :rem 89
```

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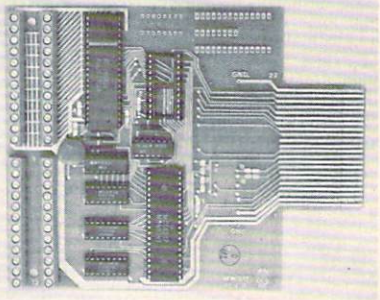

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Programming the TI

C. Regena

Sprites In TI Extended BASIC

Since this month's COMPUTE! is a game issue, let me remind you that *COMPUTE!'s First Book of TI Games* is still available. It offers a variety of games that do not require TI Extended BASIC.

Eventually, however, game programmers usually want the Extended BASIC command module because it adds several programming features, including up to 28 *sprites* (smoothly moving screen objects). With one statement you can define a sprite and set it in continuous motion. For example, try this short program:

```
100 REM TI EXTENDED BASIC
110 REM SPRITE DEMO
120 DEF R(X)=INT(X*RND)
130 CALL CLEAR
140 FOR S=1 TO 28 :: RAND
    OMIZE
150 CALL SPRITE(#S,64+S,R
    (15)+2,90,128,R(255)-
    127,R(255)-127)
160 NEXT S
170 GOTO 170
180 END
```

This month's main program, "Sprite Tester," offers a way to test your sprites before putting them into a program of your own. After it displays a sprite on the screen, it lets you change various characteristics of the sprite by entering different numbers. You may experiment as much as you wish. When you have the sprite moving as you want, simply jot down the CALL SPRITE statement shown at the bottom of the screen.

Designing The Sprite

To get started, type in and run Sprite Tester. Choose a magnification factor from 1 to 4. (A regular-size character is magnification 1 and a four-times size is magnification 2. Magnification 3 is made up of four regular-size characters, and magnification 4 is four large characters.)

Next choose a character number from 33 to 95—one of the characters from the regular ASCII character set. If you prefer to use your own graphic character, insert a CALL CHAR statement to redefine a character.

You may then choose a sprite color. Since 1 is transparent (the screen color), you must choose a color number from 2 to 16. If you choose color 8, the screen changes so you'll be able to see the sprite. All other colors use the cyan background screen.

Next choose a dot row and dot column position from which the sprite should start moving. Then, to move the sprite, select a row velocity and column velocity. Since these may be positive or negative numbers, first choose + or −, press ENTER, then pick the number and press ENTER again. If you want to experiment with the position of the sprite, keep the row velocity and column velocity at +0. Otherwise, the sprite will be in motion, and you may not be able to see the dot row and dot column changes.

As you enter parameters, the CALL MAGNIFY and CALL SPRITE statements at the lower part of the screen show the sprite's present conditions. The program continues until you press FCTN-CLEAR.

Extended BASIC Features

Extended BASIC contains a number of statements which make programs such as Sprite Tester easier to write. The DISPLAY AT statements, for instance, allow you to print at a specified row and column. USING helps to format output, right-justifying numbers in this case.

The ACCEPT statement is quite versatile for accepting input. BEEP sounds a tone when the computer is waiting for the input. AT() lets you receive the input starting at a certain row and column on the screen, and SIZE limits the input to a specified number of characters. VALIDATE allows you to specify what characters are acceptable as input. To erase or change before you press ENTER, you can press FCTN-ERASE. Unfortunately, if you enter something wrong, an error message appears and the printing on the screen starts to scroll. Afterward, the cursor may not be lined up with the original question.

Unlike Console BASIC, Extended BASIC lets you follow THEN and ELSE in IF statements with either a line number or a command.

The CALL SPRITE statement specifies the sprite number, the character number for the sprite, the foreground color, the beginning dot row and dot column positions, and the row velocity and column velocity.

CALL MAGNIFY sets the magnification factor. You can change characteristics of the sprite either by using another CALL SPRITE statement or CALL PATTERN for the character number, CALL COLOR for color, and CALL MOTION for the velocities.

If you prefer to save typing effort, you can obtain a copy of this program by sending a blank cassette or disk, a stamped, self-addressed mailer, and $3 to:

C. Regena
P.O. Box 1502
Cedar City, UT 84720

Please be sure to specify that you want Sprite Tester.

```
100 REM TI EXTENDED BASIC
110 REM SPRITE TESTER
120 CALL CLEAR
130 CALL SCREEN(8)
140 CALL CHAR(96,"0804020F
    F0204080")
150 CALL COLOR(9,10,1)
160 CALL CHAR(95,"1010707C1
    0100007C")
170 CH=42
180 COLOR=2
```

```
190 DROW=96
200 DCOL=128
210 VROW=0
220 VCOL=0
230 M=1
240 CALL MAGNIFY(M)
250 DISPLAY AT(20,1):"CAL
    L MAGNIFY(1)"
260 DISPLAY AT(22,1):"CAL
    L SPRITE(#1,42, 2, 96
    ,{3 SPACES}128,
    {3 SPACES}0,
    {3 SPACES}0)"
270 CALL SPRITE(#1,CH,COL
    OR,DROW,DCOL,VROW,VCO
    L)
280 CALL HCHAR(1,3,96)
290 DISPLAY AT(1,2):"MAGN
    IFY 1-4:"
300 ACCEPT AT(1,16)VALIDA
    TE("1234")BEEP SIZE(1
    ):M
310 CALL MAGNIFY(M)
320 CALL HCHAR(20,16,M+48
    )
330 CALL HCHAR(1,3,32)
340 CALL HCHAR(3,3,96)
350 DISPLAY AT(3,2):"CHAR
    ACTER 33-95:"
360 ACCEPT AT(3,20)VALIDA
    TE(DIGIT)BEEP SIZE(2)
    :CH
370 IF (CH<33)+(CH>95)THE
    N 360
380 CALL PATTERN(#1,CH)
390 DISPLAY AT(22,16):USI
    NG "##":CH;
400 CALL HCHAR(3,3,32)
410 CALL HCHAR(5,3,96)
420 DISPLAY AT(5,2):"COLO
    R 2-16:"
430 ACCEPT AT(5,15)VALIDA
    TE(DIGIT)BEEP SIZE(2)
    :COLOR
440 IF (COLOR<2)+(COLOR>1
    6)THEN 430
450 IF COLOR<>8 THEN 480
460 CALL SCREEN(16)
470 GOTO 490
480 CALL SCREEN(8)
490 CALL COLOR(#1,COLOR)
500 DISPLAY AT(22,19):USI
    NG "##":COLOR;
510 CALL HCHAR(5,3,32)
520 CALL HCHAR(7,3,96)
530 DISPLAY AT(7,2):"DOT
    ROW 1-196:"
540 ACCEPT AT(7,18)VALIDA
    TE(DIGIT)BEEP SIZE(3)
    :DROW
550 IF (DROW<1)+(DROW>196
    )THEN 540
560 CALL SPRITE(#1,CH,COL
    OR,DROW,DCOL,VROW,VCO
    L)
570 DISPLAY AT(22,22):USI
    NG "###":DROW;
580 CALL HCHAR(7,3,32)
590 CALL HCHAR(9,3,96)
600 DISPLAY AT(9,2):"DOT
    COLUMN 1-256:"
610 ACCEPT AT(9,21)VALIDA
    TE(DIGIT)BEEP SIZE(3)
    :DCOL
620 IF (DCOL<1)+(DCOL>256
    )THEN 610
630 CALL SPRITE(#1,CH,COL
    OR,DROW,DCOL,VROW,VCO
    L)
640 DISPLAY AT(23,1):USIN
    G "###":DCOL;
650 CALL HCHAR(9,3,32)
660 CALL HCHAR(9,3,32)
670 CALL HCHAR(11,3,96)
680 DISPLAY AT(11,2):"ROW
     VELOCITY _127:  +"
690 ACCEPT AT(11,22)VALID
    ATE("+-")BEEP SIZE(1)
    :S$
700 ACCEPT AT(11,23)VALID
    ATE(DIGIT)SIZE(3):VRO
    W
710 IF VROW>127 THEN 680
720 IF S$="-" THEN VROW=-
    VROW
730 CALL MOTION(#1,VROW,V
    COL)
740 DISPLAY AT(23,5):USIN
    G "####":VROW;
750 CALL HCHAR(11,3,32)
760 CALL HCHAR(13,3,96)
770 DISPLAY AT(13,2):"COL
    UMN VELOCITY _127:  +
    "
780 ACCEPT AT(13,25)VALID
    ATE("+-")BEEP SIZE(1)
    :S$
790 ACCEPT AT(13,26)VALID
    ATE(DIGIT)SIZE(3):VCO
    L
800 IF VCOL>127 THEN 770
810 IF S$="-" THEN VCOL=-
    VCOL
820 CALL MOTION(#1,VROW,V
    COL)
830 DISPLAY AT(23,10):USI
    NG "####":VCOL;
840 CALL HCHAR(13,3,32)
850 GOTO 280
860 END                    ©
```

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What the world really needs is a 99 cent Double Sided, Double Density Diskette with a LIFETIME WARRANTY!

And DISK WORLD! has it.

Introducing Super Star Diskettes: the high quality diskette with the lowest price and the best LIFETIME WARRANTY!

In the course of selling more than a million diskettes every month, we've learned something: higher prices don't necessarily mean higher quality.

In fact, we've found that a good diskette manufacturer simply manufactures a good diskette...no matter what they charge for it. (By way of example, consider that none of the brands that we carry has a return rate of greater than 1/1,000th of 1 percent!)

In other words, when people buy a more expensive diskette, they aren't necessarily buying higher quality.

The extra money might be going toward flashier advertising, snazzier packaging or simply higher profits.

But the extra money in a higher price isn't buying better quality.

All of the good manufacturers put out a good diskette. Period.

How to cut diskette prices ...without cutting quality.

Now this discovery posed a dilemma: how to cut the price of diskettes without lowering the quality.

There are about 85 companies claiming to be "diskette" manufacturers.

Trouble is, most of them aren't manufacturers.

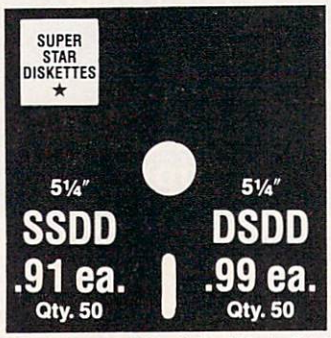
Rather they are fabricators or marketers, taking other company's components, possibly doing one or more steps of the processing themselves and pasting their labels on the finished product.

The new Eastman Kodak diskettes, for example, are one of these. So are IBM 5¼" diskettes. Same for DYSAN, Polaroid and many, many other familiar diskette brand names. Each of these diskettes is manufactured in whole or in part by another company!

So, we decided to act just like the big guys. That's how we would cut diskette prices...without lowering the quality.

We would go out and find smaller companies to manufacture a diskette to our specifications...specifications which are higher than most...and simply create our own "name brand" diskette.

Name brand diskettes that offered high quality at low prices.



Super Star diskettes are sold in multiples of 50 only. Diskettes are shipped with white Tyvec sleeves, reinforced hubs, user ID labels and write-protect tabs.

Boy, did we get lucky. Our Super Star Diskettes are the same ones you've been using for years...without knowing it.

In our search for the low priced, high quality diskette of our dreams, we found something even more interesting.

We found that there are several manufacturers who don't give a hoot about the consumer market for their diskettes. They don't spend millions of dollars in advertising trying to get you, the computer user, to use their diskettes.

Instead, they concentrate their efforts on turning out the highest quality diskettes they can...because they sell them to the software publishers, computer manufacturers and other folks who (in turn) put their name on them...and sell them for much higher prices to you!

After all, when a software publisher or computer manufacturer or diskette marketer puts their name on a diskette, they want it to work time after time, everytime. (Especially software publishers who have the nasty habit of copy-protecting their originals!)

Super Star Diskettes. You already know how good they are. Now you can buy them...cheap.

Well, that's the story.

Super Star diskettes don't roll off the boat from Pago-Pago or emerge from a basement plant just east of Nowhere.

Super Star diskettes have been around for years...and you've used them for years as copy-protected software originals, unprotected originals. Sometimes, depending on which computer you own, the system master may have been on a Super Star diskette. And maybe more than once, you've bought a box or two or more of Super Star diskettes without knowing it. They just had some "big" company's name on them.

Super Star Diskettes are good. So good that a lot of major software publishers, computer manufacturers and other diskette marketers buy them in the tens or hundreds of thousands.

We buy them in the millions.

And than we sell them to you.

Cheap.

When every little bit counts, it's Super Star Diskettes.

You've used them a hundred times...under different names.

Now, you can buy the real McCoy, the same diskette that major software publishers, computer manufacturers and diskette marketers buy...and call their own.

We simply charge less.

Super Special!

Order 50 Super Star Diskettes and we'll be happy to sell you an Amaray Media-Mate 50 for only $8.75, shipping included...a lot less than the suggested retail price of $15.95.

Regular DISK WORLD! price: $9.69 ea. + $2.00 Shpng.

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SHIPPING: 5¼" & 3½" DISKETTES—Add $3.00 per each 100 or fewer diskettes. **OTHER ITEMS:** Add shipping charges as shown in addition to other shipping charges. **PAYMENT:** VISA, MASTERCARD and Prepaid orders accepted. **COD ORDERS:** Add additional $3.00 special handling charge. **APO, FPO, AK, HI & PR ORDERS:** Include shipping charges as shown and additional 5% of total order amount to cover PAL and insurance. We ship only to United States addresses, except for those listed above. **TAXES:** Illinois residents, add 8% sales tax.

MINIMUM ORDER: $35.00 or 20 diskettes.

The Super Star LIFETIME WARRANTY!

Super Star Diskettes are unconditionally warranted against defects in original material and workmanship so long as owned by the original purchaser. Returns are simple: just send the defective diskettes with proof of purchase, postage-paid by you with a short explanation of the problem, and we'll send you the replacements. (Incidentally, coffee stained diskettes and diskettes with staples driven through them don't qualify as "defective".)

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Built-in disk drive! Intelligent high speed unit with 5¼" floppy disk recorder. 170K formatted data storage; 35 tracks. 16K ROM. Uses single sided, single density disk. Serial interface. Second serial port to chain second drive or printer.

Built-in color monitor! Displays 40 columns x 25 lines of text on 5" screen. High resolution. 320 x 200 pixels. 16 background, character colors.

Built-in ROM cartridge port! Insert ROM program cartridge. Multitude of subjects available in stores across the nation!

Mfr. List Price $995.00

Liquidation Priced At Only **$388**

Item H-621-63631-00 Ship, handling: $20.00

THE PRINTER

Print method: Bi-directional impact dot matrix.
Character matrix: 6 x 7 dot matrix.
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Graphics: 7 vertical dots — maximum 480 columns. Dot addressable.
Character codes: CBM ASCII code.
Print speed: 60 characters per second.
Maximum columns: 80 columns.
Character spacing: 10 characters per inch.
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Line feed speed: 5 lines per second in character mode. 7.5 lines per second in graphics mode.
Paper feed: Friction feed.
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Multiple copies: Original plus maximum of two copies.
Dimensions: 13"W x 8"D x 3¼"H. Wt.: 6½ lbs. **Power:** 120V AC, 60 Hz.

Mfr. List: $200.00

Liquidation Priced At **$118**

Item H-621-63831-00 Ship, handling: $7.00

THE SOFTWARE

"Easy Script" One of the most powerful word processors at any price! Cut re-typing, create documents from standard paragraphs, do personalized letters, see and change a document before it is printed. Instruction manual has extensive training section that simplifies use . . . even for someone who has never used a computer or word processor before!

"The Manager" A sophisticated database manager for business or home use. Business uses: accounts payable/receivable, inventory, appointments, task manager. Home uses: mailing lists, home inventory, recipes, collection organizer, investment tracking, checkbook balancing. School uses: research article index, gradebook.

Mfr. List: $73.98

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Item H-621-64011-03 Ship, handling: $3.00

BUY INDIVIDUAL UNITS OR GET THIS ULTRA-FAMOUS SYSTEM AT ONE LOW PACKAGE PRICE!

TOTAL Personal Computer System available at FAR BELOW dealer cost!

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Compatible with above Computer System (Not included in package price.)

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Mfr. List: $59.90 pr.
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5.25″ SSDD➡.79 ea. 5.25″ DSDD➡.89 ea.
5.25″ DSDD-HD➡$2.35 ea.
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Based on multiples of 100 each.
Boxed in 10's with heavy-duty cardboard sleeves, user ID labels, reinforced hubs (where appropriate) and write-protect tabs.

Introducing Wabash Pinnacle Series Diskettes.

Two years ago, if you'd told me I'd be writing this ad, I would have laughed.

At that time, Wabash diskettes were synonymous with "s—t".

Just saying that quality control was poor would be charitable.

So much was wrong that DISK WORLD wouldn't sell them.

That was yesterday.

Kearney-National Inc., a $202-million division of a much larger company, came into Wabash.

Out went the old management, the old methods, the old production techniques...and in went a lot of new people, ideas, production lines and some really imaginative thinking.

The end result.

Today, I'm proud to offer you the Wabash Pinnacle Series of diskettes at the prices shown.

This isn't evolution in diskette manufacturing: it's revolution.

Here's what you get.

Wabash Pinnacle diskettes are
...certified 100% Error Free
...are coverd by a LIFETIME WARRANTY
...meet or exceed all industry specifications (by quite some distance)
...and are simply the best value in diskettes available today.

The torture test.

Considering Wabash's earlier dubious reputation, I wasn't exactly a true believer when their Director of Marketing came into my office with samples.

So I took a box at random, selected a disk, bent the thing every which way and slipped it into my IBM-PC.

It formatted. It booted. It stored and retrieved data.

That wasn't enough.

I gave samples of the diskettes to Curt Rostenbach and, in turn, to Tom Streit, both hackers of long experience and members of the Waukegan (Illinois) Apple Users Group.

Tom really went at it.

He took a quartz-halogen lamp, aimed it at the diskette until it started to smoke (and melt)...and then formatted, booted the diskette and stored and retrieved data!

The same terribly (and intentionally) mutilated diskette ran on an ITT, Corona and IBM.

Curt was nicer.

He simply bent the diskette every which way...and it still formatted, booted and ran on his Apple.

The best buy I've ever seen.

DISK WORLD!, Inc. sells more flexible magnetic media by mail-order than anyone else in the world.

I, as President of the corporation, won't tolerate a product with a failure rate of more than 1/1000th of 1 percent.

I also don't like companies who try to milk a "quality" or "premium" image for a higher price like Dysan and Verbatim did...until they failed.

As President of DISK WORLD!, Inc., my motto is simple: "the best diskette for the least amount of money."

Wabash is it.

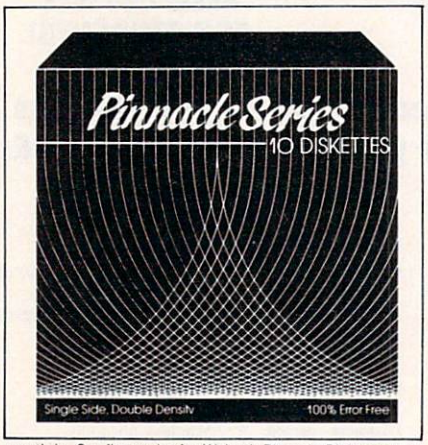
Right now, there is no better value than the Wabash Pinnacle Series of diskettes.

Granted, you have to buy a hundred at a time, but so what? Split the order with friends, relatives, co-workers or even your worst enemies.

The key thing is to get the most diskette for the money.

And this is it.

(Incidentally, as a corporation, we put our money where our mouth is. Our first order for Wabash Pinnacle Diskettes was 1.5-million units.)



That's an awful lot of faith and confidence.

But, then again, I have the diskette that Tom Streit literally melted...and kept on running.

The truth about $1.00 or less diskettes.

More and more ads are popping up offering diskettes for $1.00 or less.

By the same token, more and more people who were selling used cars a few months ago are now selling diskettes by mail.

We did a little survey of current ads for diskettes advertised for a dollar or less and did some analysis of the market and here's what we found as it applies to 5.25″ DSDD diskettes "supposedly" selling for a dollar or less.

VENDOR:	ADVERTISED LOW PRICE:	ACTUAL PRICE PER 100:	ACTUAL MFGR.:
Unitech	.89 ea.	.92 ea.	Unspecified.
Datatech	.99 ea.	.99 ea.	Unspecified.
Computer Club	.95 ea.	.98 ea.	Unspecified.
	.99 ea.	1.02 ea.	Unspecified.
Communications & Electronics	.49 ea.	.80 ea.	Unspecified.
Precision Data	.89 ea.	.93 ea.	Unspecified.
Diskette Connec.	.93 ea.	.93 ea.	Unspecified.
Comp Soft Serv.	.77 ea.	.77 ea. + shpg.	Unspecified.
Computer/Computer	.99 ea.	.99 ea.	Unspecified.
DISK WORLD	.89 ea.	.92 ea.	Wabash Datatech

The real truth about $1.00 or less diskettes.

It costs all diskette manufacturers about the same to produce a diskette. Some may charge more because they want to project a "premium quality" image, ala the late, lamented Dysan who bought their basic media from 3M.

Some charge less because they sell a sub-standard product...and we're not foolish enough to name names here.

But here's the truth about the $1.00 or less diskette market.

It falls into four categories:

1. The DISK WORLD's of the universe who simply are so big that they can buy first quality product in massive quantities and choose to pass on the savings to you. (Precision Data and Diskette Connection on **BRAND NAME** products also fall into this category.)

2. The people who buy "cosmos"...stuff from major manufacturers that usually hits quality control standards, but is cosmetically blemished and thus can't be packaged and sold under the manufacturer's own name.

3. "Duplicator Quality". Uncertified media, usually below manufacturer's own standards and frequently below ANSI and IBM standards. Sold on an "as-is" basis with the understanding that the manufacturer's name will never be divulged. Usually about a 20% reject rate...as compared to DISK WORLD's standard of less than 1/1000th of 1% reject/return rate. Next to garbage, this is the source of most diskettes advertised at a dollar or less.

They may work...and then again they may not. (Frankly, the odds at the Blackjack table in Las Vegas are more in your favor.)

4. Garbage. Stuff that shouldn't be sold at all. But some manufacturers are hurting for cash, so they sell it anyway. (After all, they want to meet their payroll. Look what happens when you don't: you become a Dysan or Verbatim. Lots of history, but no money.) More and more garbage is being dumped into the market as manufacturers become pressed for cash and are motivated into selling anything and everything they can manufacture. (Read the article in FORBES about Verbatim and its "Bonus" brand.)

Finally, the Taiwanese counterfeiters are moving into the act. Perfect duplicates of the packaging of major manufacturers with one exception: the quality isn't there.

The Critical Factor.

Only DISK WORLD!, Inc. offers fully brand-identified, LIFETIME-WARRANTY product for less than a dollar.

Every one else offering 5.25″ product for less than a buck doesn't tell you who makes it.

We do.

And that ought to tell you a lot right there.

Ordering & Shipping Instructions

SHIPPING: Wabash Pinnacle Diskettes are sold in multiples of 100 only. Shipping charges are $3.00 per 100, regardless of type or size.

PAYMENT: VISA, MASTERCARD and PREPAID orders accepted. Corporations rated 3A2 or better and government and quasi-government open accounts are accepted on a NET 15 basis.

C.O.D. orders are subject to a $5.00 special handling charge. (Sorry for the increase, but too many people have been refusing C.O.D. orders or using bad checks. It's a classic example of a few "bad eggs" making life more expensive for everyone else.)

APO, FPO, AK, HI & PR ORDERS: Include shipping as shown **and** an additional 5% of the total amount of the order to cover PAL and insurance.

No other non-continental U.S. orders are accepted.

TAXES: Illinois residents only, add 7%.

All orders subject to acceptance.
Not responsible for typographical errors.

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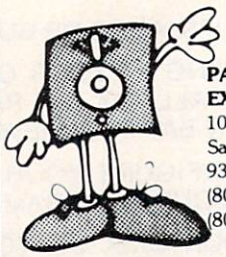

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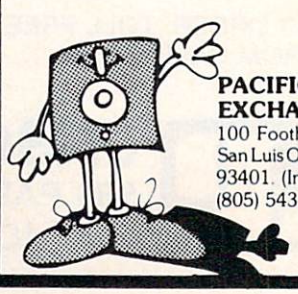

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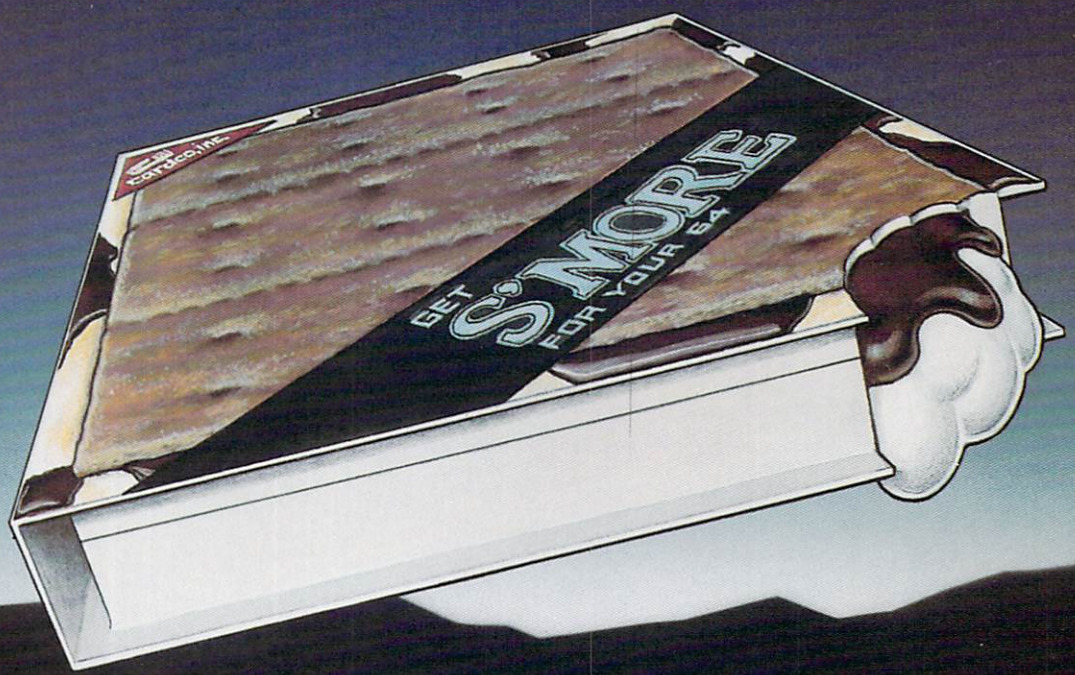

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An expanded keyboard that puts more commands at your fingertips for easier programming. So you can be a whiz at using more varied graphics and text. Or a musical genius playing full three-part melody in any tempo you set. And there's even a "help" key that comes to your rescue, listing programming errors on-screen with the error in reverse field.

There's also a new faster disk drive. With a separate "Burst" mode that can transfer up to 3,000 characters per second. Just in case you're a speed demon.

"Thanks for the memory!" You're welcome. And for the expandability. And compatibility. And versatility. And for making it all very affordable. After all, one of the other things that should go into a more intelligent computer is a price that makes sense.

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A Higher Intelligence

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