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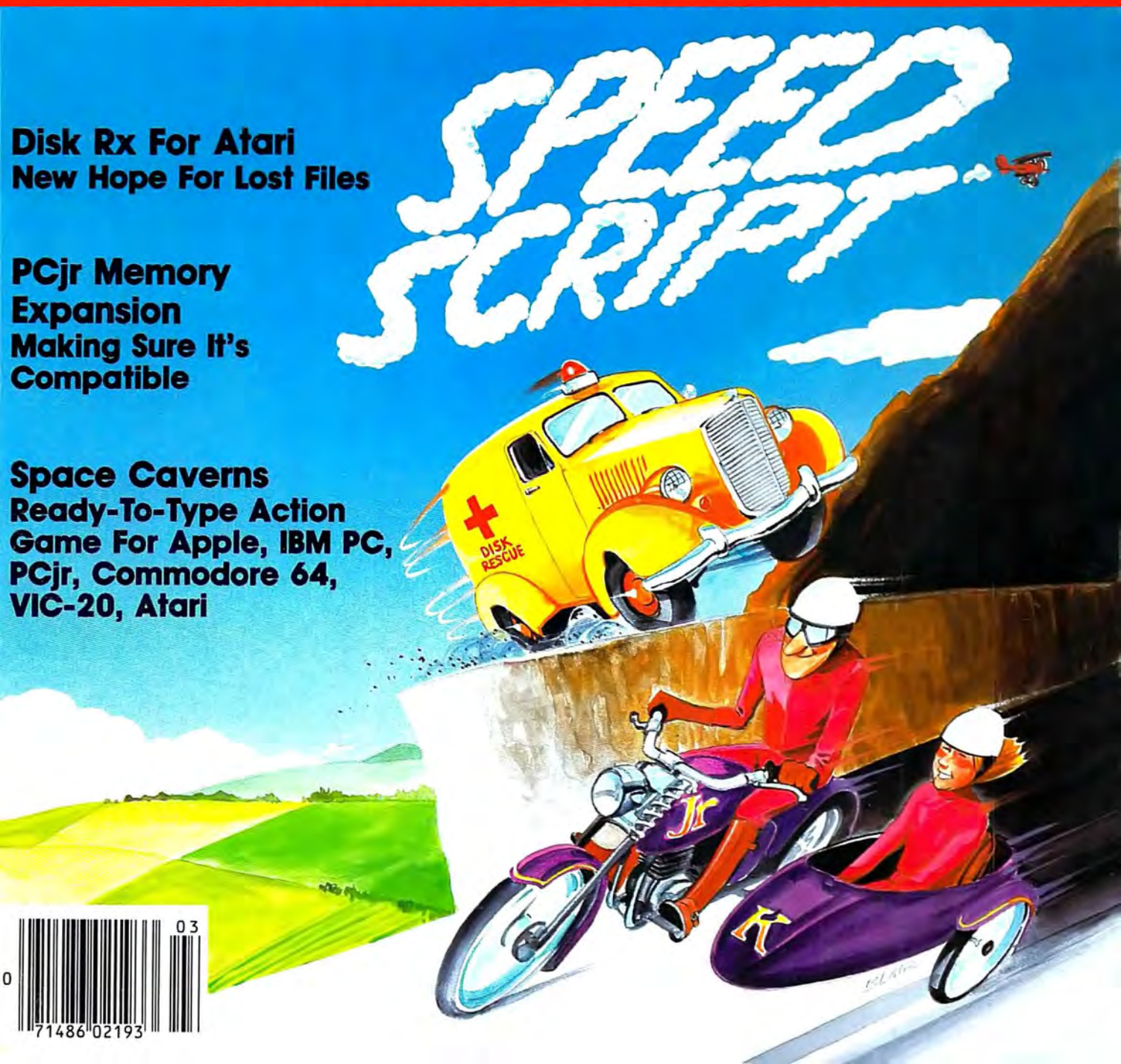

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(CHARACTERS)							
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COMMODORE GRAPHICS	YES	♠♥♦♣ ◠ ▒ ● ┘ ← π ↑	YES	YES	YES	YES	YES
(OTHER FEATURES)							
SINGLE DENSITY BIT IMAGE	YES	C64	YES	NO	YES	YES	NO
EXPANDED	YES	EXPANDED	YES	YES	YES	YES	YES
REVERSE	YES	REVERSED	YES	YES	YES	YES	YES

NO

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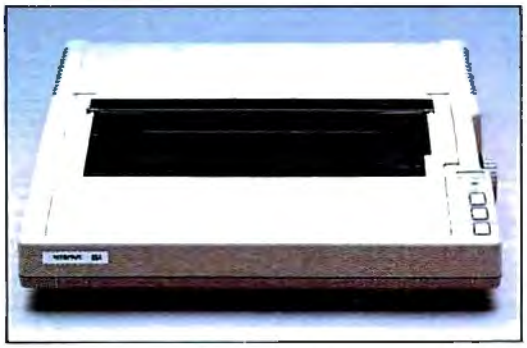

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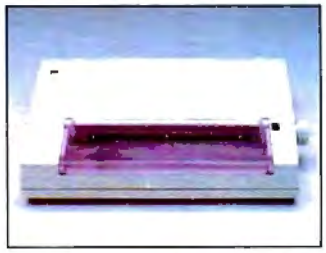

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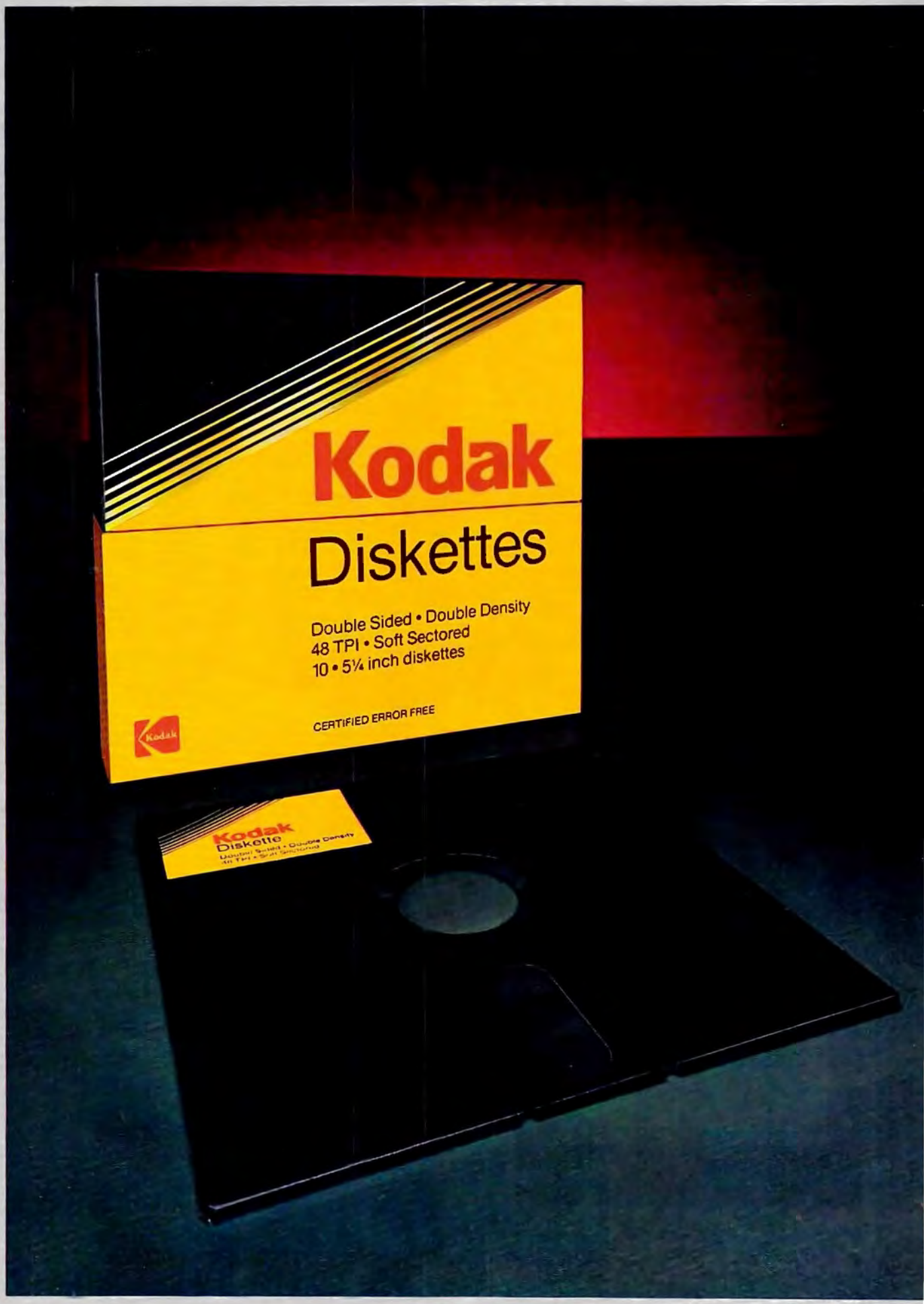
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March 1985 Vol. 7, No. 3

FEATURES

REVIEWS

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THE JOURNAL

NOTE: See page 141 before typing in programs.

GUIDE TO ARTICLES AND PROGRAMS

AP Apple, **Mac** Macintosh, **AT** Atari, **V** VIC-20, **64** Commodore 64, **+4** Commodore Plus/4, **16** Commodore 16, **P** PET/CBM, **TI** Texas Instruments, **PC** IBM PC, **PCjr** IBM PCjr, **CC** Radio Shack Color Computer. *All or several of the above.

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EDITOR'S NOTES

(This month's Editor's Notes are written by Richard Mansfield, Senior Editor of COMPUTE! Publications—Robert Lock, Editor In Chief.)

While we can't say that the long, dark night of the personal computer industry is over, there is a glow on the horizon.

The recent Consumer Electronics Show in Las Vegas surprised some industry watchers as Jack Tramiel's Atari threw down a challenge to the rest of the personal computer industry. Low prices and high power were the theme of several Atari announcements:

A $399 15-megabyte hard disk which can be used with most personal computers. A $150, 3½-inch, 250K floppy disk drive. A $300, 3½-inch, 500K floppy. Fast, inexpensive, mass storage.

The new ST line of Atari computers, $599 for 512K RAM, 192K ROM, 512 colors, powerful 68000 microprocessor chip, mouse, MIDI music interface, GEM operating system, and more. Dubbed the "Jackintosh," the price/performance ratio of this machine will not go unnoticed in the board rooms of IBM and Apple.

Oddly enough, at this, the biggest consumer show, the two current giants of the consumer computer industry were nowhere to be found. IBM never intended to come; Apple reserved space, but later pulled out.

Commodore, although last year's introduction of their Plus/4 and 16 models caused no stampedes in the marketplace, remained unbowed. At CES, they announced the new Commodore 128, a more powerful version of the Commodore 64. Company PR claimed that the 128 is totally compatible with the 64, can run CP/M with no problems, and has a 40/80 screen column switch. Based on the venerable 6502, it also includes a Z80 chip for the CP/M.

Everyone, though, was really waiting to hear about the legendary Amiga Lorraine which has power and capabilities comparable to Atari's new ST models. Commodore was aggressively silent on this topic. There was a hint, though, that they will have something to say in a few weeks.

While not part of CES, IBM's new AT sets another standard of power and performance in the high-end market. Like Atari's ST, the IBM AT is huge, fast, and still flexible. In their market niches, these two machines will establish standards toward which other companies must strive. Both computers represent a significant technological advance—giving the consumer more megabytes per buck than anyone would have thought possible a few years ago.

It's the ST and the AT and the Mac that are now pulling the entire industry forward, toward that long-waited dawn.

SpeedScript 3.0 On Disk

This month COMPUTE! is trying an experiment. We're offering a disk containing all the Commodore 64 programs in the issue. It includes a new, enhanced Commodore 64 version of *SpeedScript*, the word processor written by Charles Brannon of our staff. *SpeedScript* has proven to be one of the most popular programs ever published by COMPUTE! Publications since an earlier version first appeared in COMPUTE!'s GAZETTE more than a year ago.

This word processor is easy to use, fast, logical, and also powerful. Comments from users and reviewers have compared it favorably with commercially available word processors.

Because of its excellence and because of its length, we are offering the readers who own Commodore 64s this issue's 64 programs on disk. This is a trial to see what kind of response a companion disk will generate.

For details on how the disk can be ordered, please see the instructions within the text of the *SpeedScript* article.

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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.

Computer Counting

I don't understand the difference between ASCII, hexadecimal, and decimal numbers.

Don Lyles

ASCII (pronounced "as-key") is an acronym for American Standard Code for Information Interchange. *It is a standard code used for communication between computers. Among other things, it lets different types of computers communicate with each other using telephone modems.*

Each ASCII number stands for a character. For instance, the ASCII code 65 stands for the uppercase letter A. Because an ASCII number consists of one byte containing eight bits, there are 256 possible code numbers (2 to the eighth power). But only the first 128 characters are defined by ASCII, while the remaining 128 characters are different on each computer. Some computers tinker with the first 128 codes, too, creating their own version of ASCII—such as PETASCII (Commodore ASCII) or ATASCII (Atari ASCII). Departures from regular ASCII can cause compatibility problems when these computers try to communicate with other computers.

The figure below shows the 128 standardized characters which make up the ASCII character set:

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0000000 NUL ^@ 0	0000001 SOH ^A 1	0000010 STX ^B 2	0000011 ETX ^C 3	0000100 EOT ^D 4	0000101 ENQ ^E 5	0000110 ACK ^F 6	0000111 BEL ^G 7	0001000 BS ^H 8	0001001 HT ^I 9	0001010 LF ^J 10	0001011 VT ^K 11	0001100 FP ^L 12	0001101 CR ^M 13	0001110 SO ^N 14	0001111 SI ^O 15
1	0010000 DLE ^P 16	0010001 DC1 ^Q 17	0010010 DC2 ^R 18	0010011 DC3 ^S 19	0010100 DC4 ^T 20	0010101 NAK ^U 21	0010110 SYN ^V 22	0010111 ETB ^W 23	0011000 CAN ^X 24	0011001 EM ^Y 25	0011010 SUB ^Z 26	0011011 ESC 27	0011100 FS 28	0011101 GS 29	0011110 RS 30	0011111 US 31
2	0100000 SPACE 32	0100001 ! 33	0100010 " 34	0100011 # 35	0100100 $ 36	0100101 % 37	0100110 & 38	0100111 ' (apos.) 39	0101000 (40	0101001) 41	0101010 * 42	0101011 + 43	0101100 (comma) , 44	0101101 - 45	0101110 . 46	0101111 / 47
3	0110000 0 48	0110001 1 49	0110010 2 50	0110011 3 51	0110100 4 52	0110101 5 53	0110110 6 54	0110111 7 55	0111000 8 56	0111001 9 57	0111010 : 58	0111011 ; 59	0111100 < 60	0111101 = 61	0111110 > 62	0111111 ? 63
4	1000000 @ 64	1000001 A 65	1000010 B 66	1000011 C 67	1000100 D 68	1000101 E 69	1000110 F 70	1000111 G 71	1001000 H 72	1001001 I 73	1001010 J 74	1001011 K 75	1001100 L 76	1001101 M 77	1001110 N 78	1001111 O 79
5	1010000 P 80	1010001 Q 81	1010010 R 82	1010011 S 83	1010100 T 84	1010101 U 85	1010110 V 86	1010111 W 87	1011000 X 88	1011001 Y 89	1011010 Z 90	1011011 [91	1011100 \ 92	1011101] 93	1011110 ^ 94	1011111 _ 95
6	1100000 ` 96	1100001 a 97	1100010 b 98	1100011 c 99	1100100 d 100	1100101 e 101	1100110 f 102	1100111 g 103	1101000 h 104	1101001 i 105	1101010 j 106	1101011 k 107	1101100 l 108	1101101 m 109	1101110 n 110	1101111 o 111
7	1110000 p 112	1110001 q 113	1110010 r 114	1110011 s 115	1110100 t 116	1110101 u 117	1110110 v 118	1110111 w 119	1111000 x 120	1111001 y 121	1111010 z 122	1111011 { 123	1111100 ¦ 124	1111101 } 125	1111110 ~ 126	1111111 DEL 127

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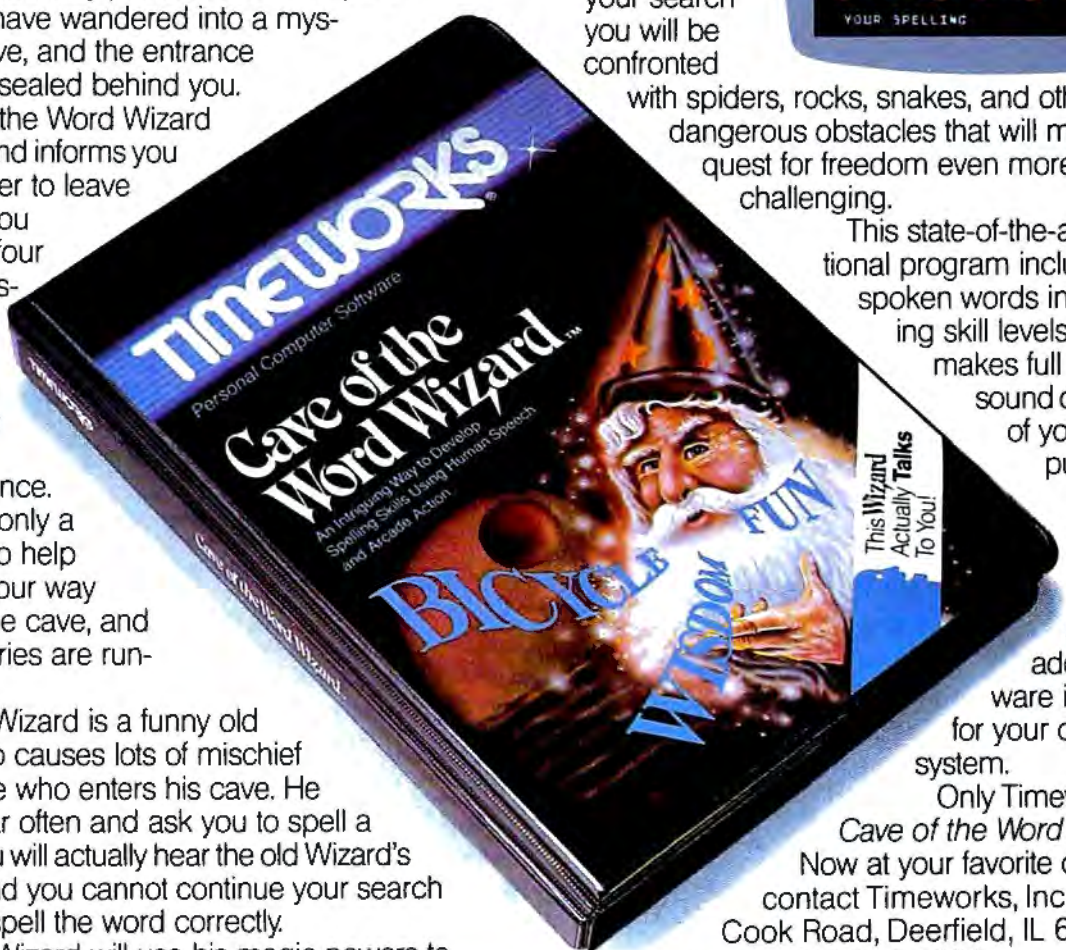
The Wizard is a funny old fellow who causes lots of mischief for anyone who enters his cave. He will appear often and ask you to spell a word—you will actually hear the old Wizard's voice!—and you cannot continue your search until you spell the word correctly.

The Wizard will use his magic powers to replenish the energy in your flashlight if you spell the word correctly, but each time you are wrong he will draw energy from your light. When your flashlight runs out of energy you will be doomed to roam through the cave in darkness forever.

During your search you will be confronted with spiders, rocks, snakes, and other dangerous obstacles that will make your quest for freedom even more challenging.



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As you examine the figure, you'll notice some rather unusual designations. Not all ASCII numbers stand for characters you would normally recognize. These are control codes *and are considered to be nonprinting machine instruction characters. In other words, instead of printing a character on the screen, they perform some function—such as clearing the screen, moving the cursor, or forcing a carriage return or linefeed.*

To answer the second part of your question, decimal *and* hexadecimal *are just two different numbering systems, not coding systems like ASCII. Decimal is the system we normally use, sometimes called base 10 because it's based on 10 digits—0 through 9. Hexadecimal is base 16 and uses 16 digits—0 through 9 plus A, B, C, D, E, and F (any symbols could have been chosen to represent the extra six digits, but A–F were selected because they're commonly available on keyboards).*

When counting in hexadecimal, just as in decimal, you don't start using two-digit numbers until you've run out of one-digit numbers. For example, in decimal you count 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, and then 10. In hexadecimal, you would count 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F, and then 10. Notice that A in hexadecimal equals 10 in decimal, B equals 11, C equals 12, and so on. Therefore, hexadecimal 10 equals decimal 16. In any numbering system, the first two-digit number—represented as 10—always equals the base of that system. (Incidentally, we might be using the hexadecimal system for everyday counting if humans were born with 16 fingers instead of 10.)

It's not too important to learn hexadecimal unless you want to write programs in machine language. Machine language programmers use the hexadecimal numbering system (and sometimes the base 8 system, called octal) because it's a more compact way of writing binary *numbers and a more efficient way of visualizing binary patterns. Binary, in turn, is the base 2 numbering system—it uses only the digits 0 and 1. Computers "think" in binary and are programmed that way on the machine language level. But binary numbers take up lots of space when written down, and they are difficult to read. For instance, the binary number 11010010 is eight digits long and is hard to interpret at a glance. Expressed in decimal, 11010010 equals 210—a three-digit number that obscures the binary pattern. Expressed in hexadecimal, 11010010 equals D2, a more compact number which an experienced programmer can break down into two parts—D = 1101 and 2 = 0010. This can be very important in machine language programming.*

Because machine language programmers are likely to encounter decimal, hexadecimal, and binary numbers in books, magazines, and program listings, special symbols have been agreed upon to keep the different systems from being confused with each other. Otherwise, the number 100 could be interpreted to have a decimal value of 100 in decimal, 64 in hexadecimal, or 4 in binary. Needless to say, this could result in a programming snafu that would leave the computer pretty confused, too. Many programmers use the dollar sign ($) to denote hexadecimal and the percent sign (%) to denote binary. So $FF means hexadecimal FF, which equals 255 in decimal. Other programmers use the letter H to represent hexadecimal, so $FF would be written FFH. A number with no special symbol is assumed to be decimal.

For a more thorough discussion of these numbering systems, consult a programming book, such as Machine Language for Beginners, Programming the VIC, Programming the 64, *or* Programming the PET/CBM *from* COMPUTE! Books.

Commodore 64 Unblinker

This program will remove the blink from the cursor on the Commodore 64 without affecting anything else. The program is a BASIC loader for an interrupt-driven machine language program. It will remove itself from memory when you run it, so be sure to save it first.

```
10 REM NO-BLINK                          :rem 127
20 CK=0:FORX=688TO722:READA:CK=CK+A:POKEX
   ,A:NEXT                               :rem 52
30 IFCK<>4197THENPRINT"ERROR IN DATA STAT
   EMENTS":STOP                          :rem 146
40 SYS688:NEW                            :rem 45
50 DATA 120,169,189,141,020,003,169,002
                                         :rem 117
60 DATA 141,021,003,088,096,032,234,255
                                         :rem 121
70 DATA 072,165,203,201,064,208,008,165
                                         :rem 122
80 DATA 207,240,004,104,076,097,234,104
                                         :rem 121
90 DATA 076,052,234                      :rem 168
```

Hitting RUN/STOP–RESTORE will enable the normal cursor blink. SYS 688 will restore the Unblink routine.

Jim Bernard

Thank you for the contribution.

BASIC Compilers

Is there a program to convert BASIC programs to machine language?

Jeff Crystal

The easiest way to speed up BASIC programs is to use a sophisticated utility program called a compiler. *Generally speaking, a compiler converts a program written in a high-level language like BASIC or Pascal into a form which is similar to regular machine language. There are two main types of compilers:* native-code compilers *and*

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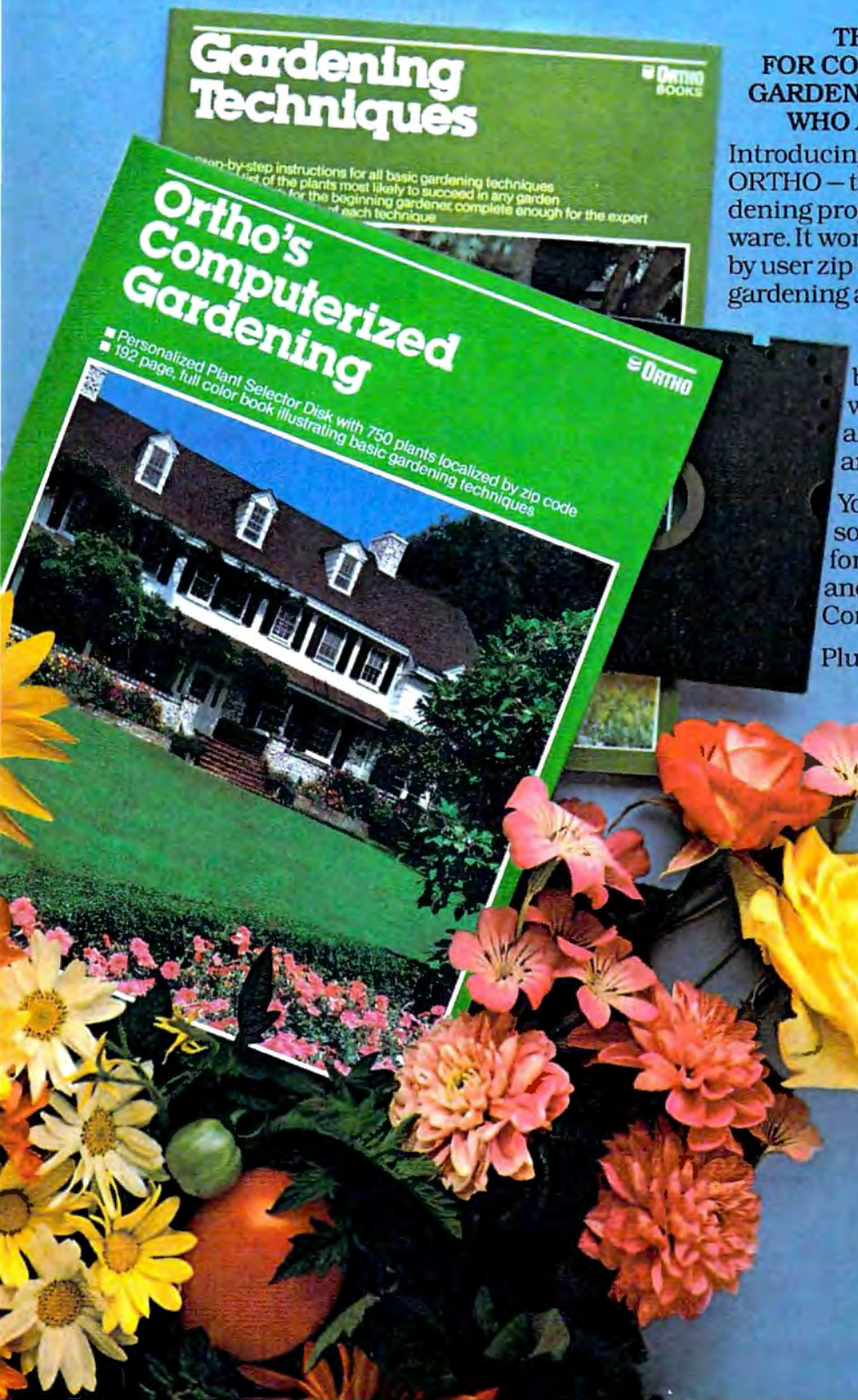

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p-code (pseudo-code) compilers. *The output of a native-code compiler closely resembles ML object code; a P-code compiler produces output which is not quite ML, but nevertheless much faster than the original source code.*

However, using a compiler is rarely as simple as just loading up your BASIC program and running it through the compiler. Most compilers work only with a subset of BASIC (that is, certain BASIC commands cannot be compiled). There are other restrictions, too. Sometimes a compiler requires your BASIC source code to be structured in a certain way. For instance, any DATA statements may have to be grouped together at the end of the program.

Like other software, compiler programs vary in efficiency. Some compilers shrink your programs in addition to speeding them up, while others actually expand the amount of code. Still others let you choose whether you prefer compacted code or speedy execution. Compilers usually claim to speed up BASIC programs by a factor of 10 to 50 times. In practice, the lower figure is more common. Compilers can't make your BASIC programs run as fast as a program written in machine language in the first place, but they can yield significant gains.

Because the compiled object code is much more difficult to interpret and modify than BASIC (or regular ML), compiled code can give some measure of program protection.

Some compilers produce code that will run on any compatible computer, even if the other user doesn't own the compiler. But many compilers require a runtime package *to run the compiled code. Sometimes the runtime package is appended to the compiled program automatically, while other times the only way a user can obtain the runtime package is to buy the compiler. You should be aware of these differences if you intend to give or sell your compiled programs to others. In addition, many companies which make compilers require you to obtain a license or include a notice if you sell compiled programs to other people.*

Compilers usually require a fair amount of memory and at least one disk drive to operate. For that reason, there are no compilers for the Commodore VIC-20 that we are aware of. However, there are several fine compilers available for the Commodore PET, 64, Atari, Apple, and IBM computers. Check with your local dealers or the advertisements in computer magazines.

COMPUTE! *is working on a Tiny BASIC Compiler that will work with a subset of BASIC on various computers. Watch for it in future issues.*

IBM Archimedean Spirals

Here's a short routine that will draw Archimedean spirals on your screen. When run, the program asks for the number of degrees it should turn after each line, usually a number between 45 and 190. It really shows off when somebody asks what your PC or PCjr can do.

Eric S. Kramer

Thank you for the contribution. (The program requires a PCjr with Cartridge BASIC or a PC with BASICA and the color/graphics adapter.)

```
ME 50 SCREEN 1:CLS
IC 105 LINE INPUT"DEGREES=";D$:D=VAL(D$)
BP 106 CLS
GH 140 D=D/57.29578:'CONVERT DEGREES TO R
      ADIANS
OC 150 PSET (130,96),1
JP 160 FOR R=0 TO 100 STEP D
MM 170 X=R*COS(R):X=X+130:Y=R*SIN(R):Y=Y*
      .7+96
IO 210 LINE -(X,Y),3
CG 220 NEXT R
LD 230 PAINT (100,1),3
```

Atari Memory Map

Is there a book that explains the memory locations for Atari computers?

Dan Lguyen

There are several books you may find useful. When the original Atari 400 and 800 were introduced in 1979, none of their advanced features were documented and Atari kept the information secret. Shortly afterward, however, Atari changed its policy and several volumes were released containing much detailed information for advanced programmers. These include the Atari 400/800 Hardware Manual, *the* Atari 400/800 Operating System Manual, *the* Atari 400/800 Operating System Source Listing, *and* De Re Atari. *These books are heavy reading, but together they reveal almost everything there is to know about the Atari 400 and 800 (most of the information is applicable to the newer XL models as well). The books can still be obtained from some local Atari dealers, user groups, and from Atari itself.*

If you're interested mainly in a memory map, the most detailed one is published in Mapping the Atari *from* COMPUTE! Books. *Although this book was written for the Atari 400/800, more than 90 percent of the locations are compatible with the XL computers. Other* COMPUTE! Books *you might want to investigate are* The Atari BASIC Source Book, *which contains the complete source code for Atari BASIC;* Inside Atari DOS, *which contains the complete source code for the Atari Disk Operating System (version 2.0S);* COMPUTE!'s Third Book of Atari, *which has a 1200XL memory map; and* The Atari Collection, *which includes a section explaining the most useful memory locations in Atari computers.*

Translating BASIC

Can any of the programs published in COMPUTE! be used on an Osborne I computer?

Bertrand Kushner

The articles accompanying all the programs we publish state which computers the programs have been tested on, as well as the hardware requirements for each computer.

Beyond that, the only way to know for sure if a certain program is compatible with a different computer is to actually try it out. However, as a general rule, a program will not run on a different computer unless it is written in very plain BASIC, with no PEEKs, POKEs, CALLs, machine language subroutines, graphics, or sound. Even clearing the screen in text modes is handled differently on various computers.

Your best bet is to pick a program which is written in very straightforward BASIC and try to fix the lines which cause errors on your machine. Unfortunately, the best programs are also the most complex and machine-specific. If you're a skilled programmer, it's often easier to rewrite the program from scratch, borrowing only the original concept.

Joystick TV Interference

I have a VIC, and whenever I plug in my joystick, the TV screen gets all fuzzy. What causes this?

Enrique Sanchez Vivar

Probably the joystick cord is acting as an antenna and broadcasting radio frequency (RF) interference generated by the computer, thereby affecting the TV picture. Try positioning the TV differently and keeping the joystick cord as far away from the set as possible.

The ground to your computer may be poor as well, causing the ground track to act as an antenna. If your VIC power supply has a three-prong plug, avoid using an adapter to plug it into a two-prong socket. It's also possible that a ground track on the circuit board inside the computer has been broken if the computer was dropped or jolted.

All computers generate RF interference. If you have an early VIC, it emits more "noise" than recent models. Newer computers generally have more shielding to keep these stray signals from escaping. For more information, a booklet entitled How to Identify and Resolve Radio-TV Interference Problems *is available from the Federal Communications Commission. Write to the U.S. Government Printing Office, Washington, D.C. 20402 and ask for Stock No. 004-000-00345-4.*

Atari Rumors

I bought an Atari 800XL, and heard recently that Atari was going out of business. If this is true, will other companies continue to make hardware and software for the Atari computers?

Ernest Madrazo

It's too early to count Atari out of the fight yet. Not only does Atari have every intention to stay in business, it even plans to introduce some new, more advanced home computers in 1985 (see "The New Atari: Q & A With Sigmund Hartmann, Atari Software President," COMPUTE!, *February 1985).*

The rumors started when Atari lost more than $450 million in 1983 and was sold by Warner Communications to Jack Tramiel in July 1984. Tramiel, of course, is the founder of Commodore Business Machines and left that company in January 1984 after a management dispute. Tramiel is currently attempting to rebuild Atari and pay off its debts.

Although the prices for the 800XL and its peripherals were cut drastically in late 1984, Atari denies that the line will be dropped. In fact, Atari had plans to introduce an upward-compatible 128K version of the 800XL at the Winter Consumer Electronics Show.

Some software manufacturers are delaying distribution of new Atari software while they wait to see what happens, both at Atari and in the home computer market in general. Indications are that prices are dropping, and we've heard that some good software in the $8–$12 range may be sold in department stores and drugstores to encourage impulse purchases, as with records and books.

Even if the worst happens and Atari folds up or drops its current line, independent manufacturers will continue supporting the machines as long as their stocks last and demand exists. The installed base is just too large to ignore.

Comparing IBM DOS Versions

Is there any difference between machine language written for PC-DOS 2.0 and machine language written for PC-DOS 2.1?

Kevin Menningen

PC-DOS 2.1 was introduced with the PCjr. It has exactly the same features as version 2.0, but works on all IBM PC-series computers. DOS 2.0 is recommended only for the PC, PC-XT, and Portable PC. There should be no significant differences in machine language programs written for either DOS, especially if the programmer intends to keep the software compatible with all computers in the IBM PC family.

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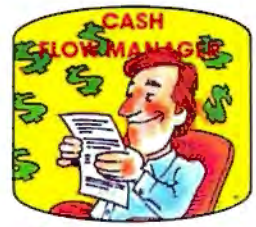

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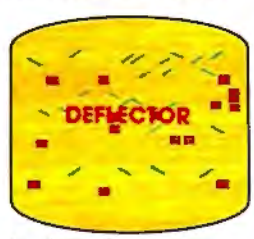

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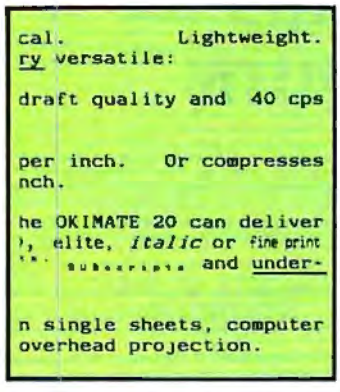

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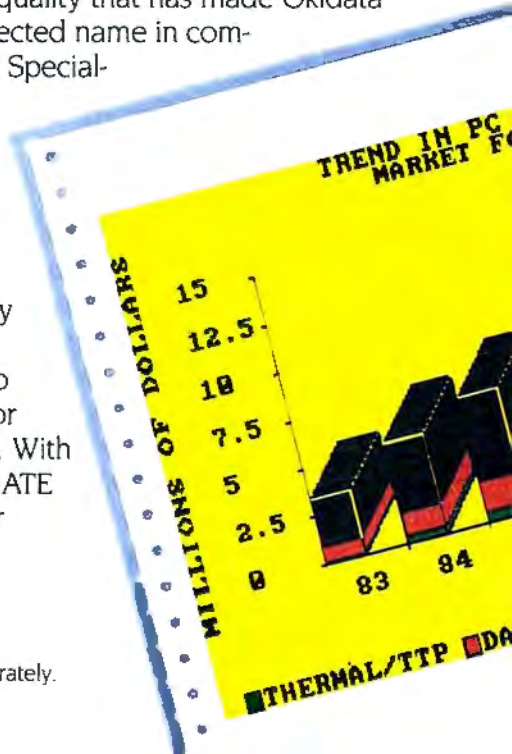

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Commodore 1541 Up In Lights

I have a Commodore 64 and a 1541 disk drive. This system worked perfectly for several months, but recently, whenever I turn on the 1541, both lights—the red and the green—come on and stay on. The motor starts spinning, and the drive accepts no commands from the 64. The only way out is to turn off the drive. What can I do?

Le'lis du Couto

The problem could lie with either your 64 or 1541. The best solution is to consult a service technician, but you might want to try some simple troubleshooting first. Hook up the 64 to a different 1541 if you can, and see if the problem persists. If so, the fault probably lies in the computer's operating system—it may not be initializing the disk drive properly. If the other drive works fine, you can assume your own drive is defective.

In this case, your problem is probably in the Read Only Memory of the 1541. You'll have to deliver the drive to Commodore or an authorized service center.

Apple To Commodore 1525 Printer

Is it possible to interface an Apple IIe to a Commodore 1525 printer?

Everett Condit

With the price of Commodore peripherals as low as they are, that's a tempting idea. However, it's not generally feasible. Commodore uses what is known as intelligent peripherals. *In other words, the peripherals contain their own microprocessor, ROM and RAM, and thus are small microcomputers in their own right. The peripheral carries out its task under its own control, rather than being entirely controlled by the main computer. This allows for a very rudimentary form of parallel processing, freeing the computer for some other work while the peripheral is busy. Apple II-series machines, on the other hand, are designed to use so-called* dumb peripherals *which must be controlled by the computer. All instructions for the device are contained in memory, and the operation must be completed before the next step in the program can be executed.*

Furthermore, Commodore serial peripherals (such as the 1525 printer) are not set up to operate with true RS-232 interfaces—the voltage levels are slightly different. That's why it's important to use an interface to generate the proper RS-232 voltage levels when using a non-Commodore peripheral on a Commodore computer.

Conversely, an Apple using a Commodore printer would need an interface to generate the levels that the Commodore printer is looking for, and a program to handle the interchanges of data between the computer and the printer.

Interfacing a Commodore printer to an Apple isn't impossible—in fact, early Apples were interfaced to almost everything imaginable. It's just extremely difficult without an extensive technical background.

Commodore Baud Rates

I own a 64 and am interested in purchasing a modem. It seems the only modems available are 300 baud modems. Why is this? Can the 64 only operate at 300 baud?

Ki Jeong Yun

When using ordinary telephone lines, a communications rate of 300 baud (more properly, 300 bits per second—bps for short) is the most reliable. In addition, 300 bps modems are much more affordable than faster modems, and the 64 is a low-cost computer aimed at the home market. A 1200 bps modem would easily cost more than the computer itself.

The problem is that higher transmission rates pack the data more densely and therefore are more susceptible to errors from line noise. At 300 bps, only about 30 characters per second are transmitted. At 1200 bps, about 120 characters per second are sent, and a short burst of noise could cause a significant loss of data.

Also, it's important to remember that both ends of any telecommunications link must operate at the same speed. If you have a 1200 bps modem while most other 64 owners have the more common 300 bps modems, you'll be able to use the higher speed to communicate with only a limited number of other users.

The Commodore 64 is actually capable of exchanging data at up to 2400 bps through its serial port. By using the proper interface, it is possible to attach any RS-232 compatible modem to a 64 and program the port for whatever rate you wish. The quality of the phone line will be the limiting factor.

If you're shopping for a faster modem, watch for prices to drop significantly on 1200 bps modems in 1985. Several companies also introduced 2400 bps modems at the Fall COMDEX computer show in Las Vegas last November, but they're priced in the $800 range.

Sprinting With A Modem

Is it possible to use MCI or Sprint with a modem?

Charles Solomon, Jr.

Any noise-free phone line between your computer and the remote computer will work for telecommunications. Many people have successfully used the alternative long-distance services, such as MCI and Sprint, for modem hookups. In fact, if you do a lot of telecomputing over long-distance lines,

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Commodore & Atari Cold Start Reset

Can using SYS 64738 hurt my 64 if I use it too much?

Christopher Vecchío

Not at all. In fact, it's much better for your computer than the alternative—flipping the power switch off and on.

Typing SYS 64738 and pressing RETURN on the Commodore 64 triggers what is called a cold start reset. *This has virtually the same effect as shutting off the power and turning it on again. Memory locations are reinitialized, and any data in Random Access Memory is erased. Control is then returned to BASIC. Note that this is quite different than pressing RUN/STOP–RESTORE to trigger a* warm start reset, *which does not erase data in RAM.*

Using SYS 64738 to reset the computer saves wear on the power switch and has no harmful side effects whatsoever. You can achieve the same results on a VIC-20 (with or without memory expansion) by entering SYS 64802, and on an Atari by typing POKE 580,1 and pressing the SYSTEM RESET button.

Computer Mail

What's the address for IBM? I'd like to ask them several questions and can't find an address.

Justin Karjala

You can write to IBM concerning personal computers at:

IBM Personal Computer Sales and Service
P.O. Box 1328-C
Boca Raton, FL 33432

Questions regarding Atari computers should be addressed to:

Atari Corp.
1265 Borregas Avenue
Sunnyvale, CA 94086

For information on Commodore computers, write:

Commodore Business Machines
1200 Wilson Drive
West Chester, PA 19380

Commodore MLX Tape To Disk

I have all your machine language programs which were entered using MLX stored on tape. Recently I purchased a disk drive, and am converting my tape programs to disk. Is there some way I can load the ML programs and save them to disk?

Bruce T. Livingston

Yes, and there are a couple of methods. The simplest way would be to use the "MLX" Load (SHIFT-L) and Save (SHIFT-S) commands to load the programs from tape and then save them back out to disk. Another way to transfer an ML program from tape to disk is by using a machine language monitor, such as "Supermon64." After entering the monitor, type:

.L "program name"

This loads your program into memory from the tape. Next, save the program on disk with:

.S "program name",08,starting address,ending address

Be sure to give an ending address which is actually one byte beyond the end of your program (the starting and ending addresses for programs listed in MLX format are specified in the articles).

If you don't have a monitor program, you can save an ML program on disk by first loading it into memory from tape, and then loading and running this short routine:

```
10 SA=49152: REM STARTING ADDRESS
20 EA=51000: REM END ADDRESS
30 INPUT"PROGRAM NAME",N$
40 OPEN1,8,1,N$
50 HI=INT(SA/256)
60 LO=SA-HI*256
70 PRINT#1,CHR$(LO);CHR$(HI);
80 FOR I=SA TO EA
90 PRINT#1,CHR$(PEEK(I));
100 NEXT
110 CLOSE1
```

This routine (which works on both the 64 and VIC) assumes that the ML program is already in memory, and that the ML program does not reside in the BASIC program area. The variables SA and EA in lines 10 and 20 should be changed to reflect the starting and ending address of the program you wish to save on disk. Again, if you're working with a program saved with MLX, you can use the addresses given in the articles which accompanied the programs.

Mystery Computers

I read your piece on the PCjr ["IBM's New & Improved PCjr," COMPUTE!, October 1984]. How *dare* you say that there will soon be computers with the processing power of the PC-XT for less than $500 *and not say what they are?* I was trembling on the verge of putting out $600 or $700 for an Atari 800XL system, and now I don't know what to do, and won't until your article entitled "Some Machines For Less Than $500 Which Offer More Processing Power Than A $4,000 PC-XT" appears—probably (as they say in the computer biz) sometime during the first quarter of 1985.

Norman Hartweg

Part of the answer to your question can be found in the August 1984 issue of COMPUTE! *within the*

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article entitled "Software Power! The Summer Consumer Electronics Show." That CES report included four paragraphs on the new Sinclair QL (Quantum Leap), which has been available in Britain for several months. Standard features of the Sinclair QL include: 128K of RAM (expandable to 640K); a Motorola 68008 microprocessor for the central processing unit; two built-in microdrives for mass storage; a full-size, 65-key, typewriter-style keyboard with special function keys; BASIC in ROM; an operating system in ROM that supports windowing and multitasking; built-in local area networking for up to 64 QLs; two RS-232 serial ports; TV and RGB video outputs; high-resolution color graphics; text modes up to 85 columns wide; joystick cursor control; and four bundled business programs (word processor, spreadsheet, data base manager, and graphics)—all in a three-pound package for a suggested retail price of $499.

As you can see, the Sinclair QL arguably has more processing *power than an IBM PC-XT. The PC-XT's CPU is the same chip found in the PC and PCjr: the Intel 8088, an 8/16-bit microprocessor. The Sinclair QL's 68008 is a 16/32-bit microprocessor, a version of the 68000 chip found in the Apple Macintosh. (However, the 8088 in the PC-XT is assisted by an 8087 math chip, which evens things out a little.)*

Does this mean that the Sinclair QL is a more powerful computer overall *than a PC-XT? Although it has a faster processor and can be expanded to the same amount of memory, probably not. Computer power is measured in other ways as well, including the amount of software available, the compatibility of the operating system, and the type of mass storage. The QL has a few factors working against it:*

1. The two built-in microdrives are not disk drives, but small endless-loop tape cartridges. Although these microdrives are reportedly as fast as some disk drives, they're not as fast as IBM floppy drives (or, of course, the PC-XT's built-in hard disk). Also, the microdrives can store only 100K per cartridge, versus 360K for an IBM floppy and ten megabytes for the hard disk.

2. The QL uses its own operating system (QDOS), not found on other computers. Therefore, it isn't compatible with any existing software. The PC-XT is compatible with thousands of PC and MS-DOS programs.

3. For now, Sinclair plans to market the QL in the U.S. by mail order only. Unless you know somebody who already owns a QL, you won't be able to examine a machine without buying it. There also won't be any local dealers to provide personal assistance for new owners.

Although Sinclair Research is one of the top personal computer companies in Britain and Europe, it is known in the U.S. mainly for small low-end home computers which have practically vanished from the marketplace. Sinclair has never marketed a business-oriented or high-end personal computer in the U.S.

The low price, ironically, may discourage some people from considering the QL as a business computer, no matter how much processing power it offers. A British computer magazine journalist recently told us that most QLs are being bought in Britain for home use, not business use.

Even if the innovative Sinclair QL is not a hit in the U.S. marketplace for these or other reasons, computers based on similar technology will soon be available at similar prices. In the first half of 1985, Atari plans to introduce both a 68000-based 16/32-bit computer and a full 32-bit machine—both retailing for under $1,000 (see "The New Atari: Q & A With Sigmund Hartmann," COMPUTE!, *February 1985). Commodore also hopes to release a 68000-based computer based on the prototype Amiga Lorraine for $1,000 or less (see the CES report in the August 1984* COMPUTE!*).*

Still, you may not need this much processing power, or you may prefer a computer which already has a large software library. In late 1984 Atari slashed the price of the 800XL you are considering to under $120 (with similar reductions for peripherals), and also was hoping to unveil a 128K RAM version of the 800XL at the Winter CES in January 1985. Commodore, too, had plans for a 128K RAM version of its popular Commodore 64. As always, there are numerous factors to consider when buying a computer, and the final decision is rarely an easy one.

PET Programs On IBM PC

I have had a Commodore PET for the last seven years. Recently I purchased an IBM PC. Is there any way I can use the PET programs on the PC without having to buy two modems?

Calvin E. Phillips

Even the purchase of two modems won't help, unless you plan to use one of the computers as a remote terminal while you run the programs on the other.

There are too many differences between the PET and IBM PC to expect the programs to be interchangeable. Of course, if the program in question is written in very plain BASIC, it is possible that it will run on either machine without modification.

As you mention, one popular technique for exchanging programs between two different brands of computers is to use a pair of modems to upload a program from one computer to the other, then modify each line as necessary to produce a working version. Of course, this only works for BASIC programs or other programs that you can easily edit, which excludes most commercial software.

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†This isn't *really* a footnote. Just a reminder that MURDER BY THE DOZEN is also available for the Macintosh computer.

VIC-20/Commodore 64 Compatibility

If I expand my VIC's memory, will I be able to run programs written for the 64?

Jeb Rickert

Only programs written in straightforward BASIC with few or no PEEKs, POKEs, machine language routines, sound effects, or graphics can be used on the VIC (which eliminates about 95 percent of Commodore 64 programs). There are numerous differences between the VIC and 64 that go far beyond memory size. The 64 has a 40-column by 25-line screen format (versus the VIC's 22-column by 23-line screen), the SID synthesizer chip (versus the VIC's tone generator), multicolor sprite graphics (not found on the VIC), and a different memory layout. The operating systems of the two computers also are not the same.

The same principles hold true for the new Commodore Plus/4 and 16. Neither of these computers is compatible with VIC and 64 software, except for very simple programs written in generic BASIC. However, the Plus/4 and 16 are generally compatible with each other, assuming the program is written to fit in the 16K RAM found in the Commodore 16. ©

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THE BEGINNER'S PAGE

Tom R. Halfhill, Editor

Two Kinds Of Logic

It's amazing how a few simple commands in a program can make a machine seem to think and act intelligently. In last month's column ("IF-THEN Intelligence") we discussed how a computer, using *conditional logic*, can examine a piece of information and make a decision. That capability is what sets computers apart from all other machines, even other programmable machines such as player pianos and many programmable calculators.

The main command in BASIC for this kind of decision making is the IF-THEN statement, and we promised that this month's column would cover two similar commands, ON-GOTO and ON-GOSUB. With IF-THEN, ON-GOTO, and ON-GOSUB, your programs can make another kind of decision called *conditional branching*. That means the computer can pass control to different parts of your program.

But before we delve deeper into conditional branching, there's a simpler concept that should be digested first—*unconditional branching*. As the term suggests, it's the opposite of conditional branching, and it's not as flexible or as powerful. Still, it plays an important part in computer programming. Often, conditional and unconditional branching work hand in hand to create the impression of computer intelligence that you seek in your programs. Together, these statements let you determine the pathways of the computer's thought.

Pathways Of Logic

Computers always execute their instructions (the program) in a certain order. That order is determined by you, the programmer, when you write the program and assign line numbers to the instructions. It's like jotting down directions so friends can find their way to your home: Take the freeway to the East 9th Street exit, turn right on Chester Avenue, and turn left at the park onto East 12th Street. Obviously, the directions won't do much good if they're followed in the wrong sequence.

Sometimes you need to modify your directions with an IF-THEN statement: IF Chester Avenue is blocked off for repairs, THEN turn right on Euclid Avenue instead. By applying conditional logic, your friends can decide between the two alternate routes.

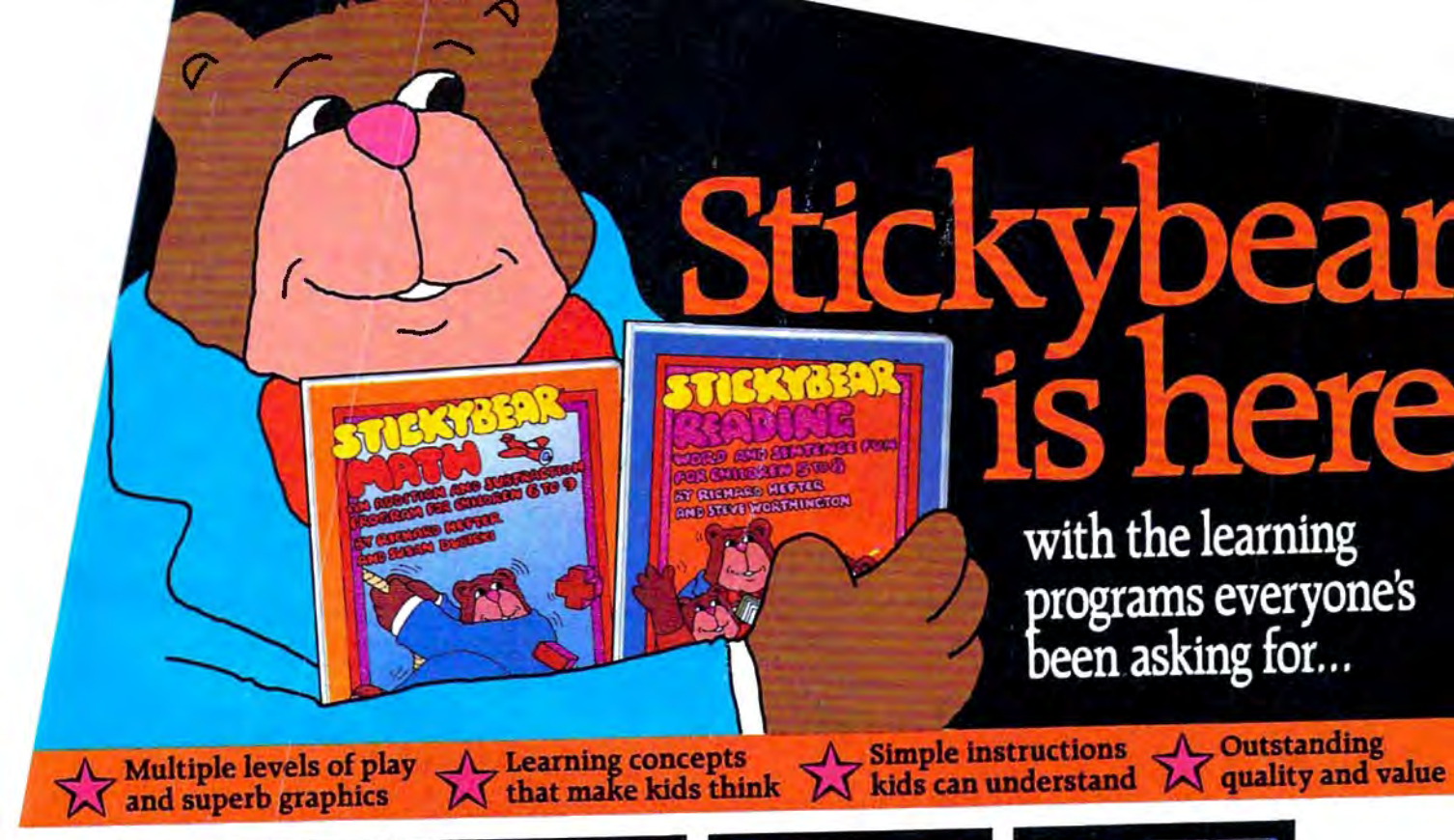
At other times, however, you need to change the order in which instructions should be followed for some reason. Often you want the computer to repeat a certain set of instructions. That's where unconditional branching comes in. It lets you build in a detour.

The GOTO Detour

Try entering the following program. (Note: This program requires Extended BASIC on the TI-99/4A. Also, the TI-99/4A requires that you replace the colons in lines 30 and 40 with a pair of colons.)

```
10 PRINT "Enter a number from 1 to 10 and press
   RETURN or ENTER."
20 INPUT A
30 IF A<1 THEN PRINT "Number too small":GOTO
   10
40 IF A>10 THEN PRINT "Number too big":GOTO
   10
50 PRINT "Thank you."
```

Now run the program and experiment by entering different numbers when the question-mark prompt appears on the screen. You'll find that if you enter a number from 1 to 10 as the program requests, the computer thanks you. Otherwise, the computer reports that your number is outside the allowable range and then asks you to enter another number. It never stops asking until you comply with its request (computers can be persistent).



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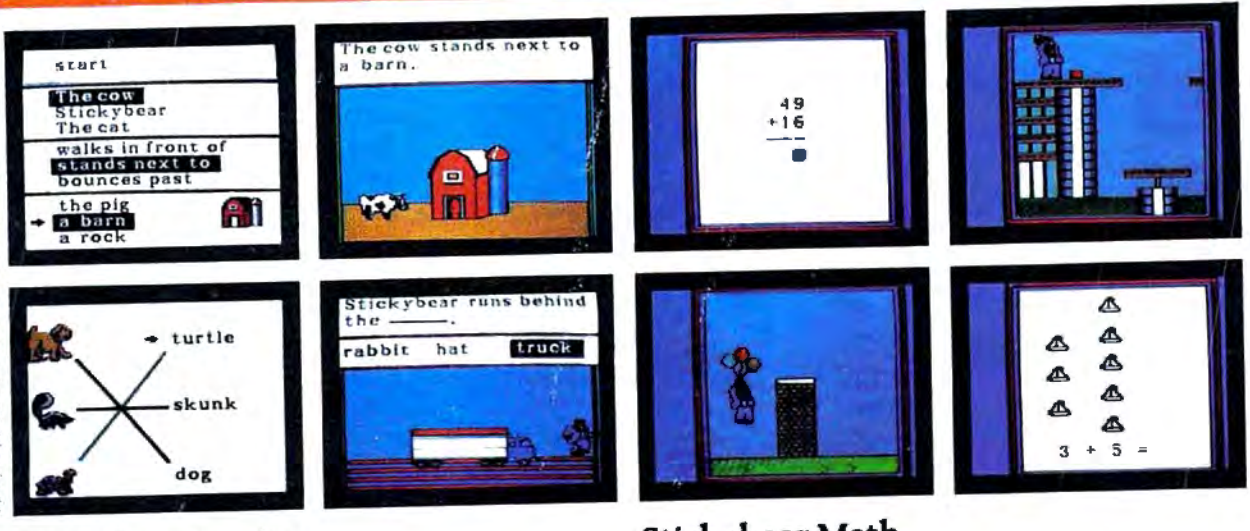

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Here's a line-by-line breakdown of how the program works:

Line 10 prints the program's request for a number between 1 and 10.

Line 20 is an INPUT statement (which we'll discuss in depth in a future column). Briefly, it prints a question mark on the screen as a prompt and waits for the user to enter a number. Then it stores the number in memory and assigns the variable A as a reference to that number. (If the user types something besides a number, it may cause an error message to appear.)

Line 30 is a multistatement line, with the two statements separated by the colon. The first statement uses conditional logic to evaluate the user's response. Remember, *only if the logical comparison proves true will the second part of the statement be executed.* So, if the number the user enters is less than 1, the comparison is true and the program prints "Number too small." Then the computer continues to the second statement in this line—the unconditional branch. It, too, is carried out only if the preceding comparison was true. Therefore, you could say its execution is conditional upon the previous statement, but the branch itself is *unconditional.* As long as A is less than 1, the program will *always* GOTO 10—return to line 10 and ask the question again.

Line 40 is just like line 30, except it checks to see if the user's response was too large instead of too small. If so, it returns to line 10 again.

Line 50 prints the thank-you message if the program "falls through" both IF-THEN statements—in other words, if neither IF-THEN comparison is found true because the user's response is between 1 and 10.

In a simple way, lines 30 and 40 demonstrate the synergism between conditional and unconditional statements. Notice how they work together to direct the pathways of the program's execution to achieve what we want. Study some BASIC listings in magazines and books and see how IF-THENs and GOTOs are frequently paired to steer the programs in various directions.

Eliminating IF-THENs

By now you can see why IF-THEN is probably the most powerful single statement in BASIC. Its ability to evaluate a piece of information and thereby change the flow of a program is what gives you control over the computer.

But it's easy to get carried away with IF-THEN. It's such a useful statement that your programs can quickly become bulging with IF-THENs, and like anything that's overweight, the programs will move a little slower as a result. If the program needs to run fast, you have a problem. You can't just put the program on a crash diet by removing some IF-THENs. Remember, IF-THENs are what gives your computer its intelligence; those are brain cells, not fat cells.

You could try trimming away other parts of the program, but it's those IF-THENs with all their comparisons that are really slowing things down.

In many cases, the solution is the ON-GOTO or ON-GOSUB statements. Let's see a typical example of how ON-GOTO can take the place of a whole pile of IF-THENs. Here's a program fragment (part of a much larger program) that shows how someone might design a menu of five choices:

```
10 PRINT "1. Create a new file."
20 PRINT "2. Load a previous file."
30 PRINT "3. Save a file."
40 PRINT "4. Erase a file."
50 PRINT "5. Edit a file."
60 PRINT "Enter the number of your choice and
   press RETURN";
70 INPUT A
80 IF A=1 THEN GOTO 1000
90 IF A=2 THEN GOTO 2000
100 IF A=3 THEN GOTO 3000
110 IF A=4 THEN GOTO 4000
120 IF A=5 THEN GOTO 5000
```

(This fragment assumes that lines 1000, 2000, 3000, 4000, and 5000 lead to additional programming which performs the functions described by the menu choices.)

Notice the stack of five IF-THENs. Imagine if the menu had ten choices. Or 15. All those IF-THENs look repetitive and redundant, don't they?

Fortunately, ON-GOTO gives us a way to eliminate those excess statements. In effect, ON-GOTO is a combination of IF-THEN and GOTO. Here's the same program fragment written another way:

```
10 PRINT "1. Create a new file."
20 PRINT "2. Load a previous file."
30 PRINT "3. Save a file."
40 PRINT "4. Erase a file."
50 PRINT "5. Edit a file."
60 PRINT "Enter the number of your choice and
   press RETURN";
70 INPUT A
80 ON A GOTO 1000,2000,3000,4000,5000
```

Impressive, eh? One ON-GOTO statement replaces five lines of IF-THENs. What's more, a larger menu of 10 or 15 choices could still be handled by a single ON-GOTO (up to the line-length limit of your computer's BASIC screen editor—see your manual). It's a very readable statement, too. If A equals 1, execution continues at the line number which is first on the list (line 1000). If A equals 2, execution continues at the line number which is second on the list (line 2000). And so on. If only you could trim extra bulk off *yourself* this easily.

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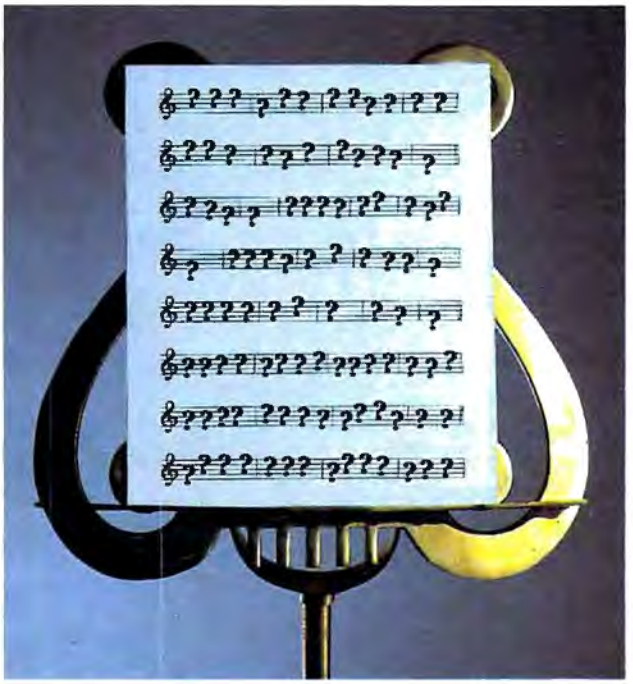

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Dummy Line Targets

ON-GOTO is useful for many applications in which a program must branch to several different places based on a single variable. But there's a catch. The line numbers in the ON-GOTO list must be sequential and must correspond to the variable that's being evaluated.

For instance, if for some reason the above menu choices were numbered 4 through 9 instead of 1 through 5, selecting the first choice (item No. 4) would cause the ON-GOTO statement to continue execution at line 4000, not line 1000. Selecting the third choice (item No. 6) would cause the program to stop with an error message, because there is no sixth line number in the ON-GOTO list. You have to make sure the list of line numbers in the ON-GOTO statement always corresponds to the variable you're testing. There have to be as many line numbers as the largest number which can result from the input.

Of course, who ever numbers a menu 4 through 9 instead of 1 through 5? Nobody, maybe, but there are other ways this can happen. A typical situation is with joystick input. On an Atari computer, for example, the STICK(*x*) function in BASIC doesn't return a value from 1 to 8—as you might expect it to do with an eight-position joystick—but instead a value from 5 to 14. (There's a logical reason for this, but we can't explain it now.)

Since joysticks are read differently on various types of computers, let's make the point by avoiding the joystick example and designing a menu that looks like this on the screen:

```
5. Create a new file.
6. Load a previous file.
8. Save a file.
9. Erase a file.
12. Edit a file.
Enter the number of your choice and press
RETURN
```

Of course, it's absurd to design a menu that's numbered like this, but you never know when you're going to have a bad day.

Now, your first urge might be to evaluate the input by the old method:

```
10 PRINT "Enter the number of your choice and
   press RETURN"
20 INPUT A
30 IF A=5 THEN GOTO 1000
40 IF A=6 THEN GOTO 2000
50 IF A=8 THEN GOTO 3000
60 IF A=9 THEN GOTO 4000
70 IF A=12 THEN GOTO 5000
```

(As before, lines 1000–5000 would contain additional programming to carry out the menu choices.)

Yuk—look at all those IF-THENs. It doesn't seem possible to replace them with ON-GOTO here, because the numbers don't fall into the neat range of 1 through 5.

But there *is* a way to use ON-GOTO. First, figure out which number returned is the lowest in the range. In this case, selecting menu choice 5 sets A equal to 5. All the other numbers are larger. Too bad the 5 isn't a 1, right? Well, let's make it a 1 by subtracting 4:

```
25 A=A-4
```

Now every number returned by the INPUT statement is reduced by 4, so menu choice 5 becomes a 1, choice 6 becomes a 2, choice 8 becomes a 4, choice 9 becomes a 5, and choice 12 becomes an 8. But there's still a problem because of gaps in the sequence of numbers; they still don't fall into a neat range of 1 to 5.

The solution is simple: Just insert dummy target lines in the ON-GOTO list—lines that don't do anything. Since they'll never be executed, they won't cause any errors. But they will fill out the ON-GOTO list so the other lines fall into the right positions:

```
10 PRINT "Enter the number of your choice and
   press RETURN"
20 INPUT A
25 A=A-4
30 ON A GOTO 1000,2000,3000,4000,5000,6000,
   7000,8000
1000 REM Create a new file
2000 REM Load a previous file
3000 REM Dummy line
4000 REM Save a file
5000 REM Erase a file
6000 REM Dummy line
7000 REM Dummy line
8000 REM Edit a file
```

Lines 3000, 6000, and 7000 will never be executed, because the INPUT statement never returns the values 7, 10, or 11, which are changed to 3, 6, and 7 after line 25 subtracts 4.

Of course, a user could trip up this program by selecting those numbers anyway, even though they aren't listed on the menu, but we'll show how to protect against invalid input in a future column. The point of this example is to show how odd patterns of numbers can be made to work with ON-GOTO. As an exercise, try designing menus with the choices numbered in unusual ways, and then find methods to convert those numbers into sequences for ON-GOTO. There's always a way to make them work.

ON-GOSUB is very much like ON-GOTO, but that discussion will have to be postponed until next month when we cover the general concept of *subroutines*. Together with IF-THEN and ON-GOTO, the GOSUB and ON-GOSUB statements can really make your programs efficient, versatile, and powerful. ©

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What's New In Computer Video

Kathy Yakal, Feature Writer

A computer monitor may be the last peripheral on your wish list. After all, an extra color or even black-and-white TV set works fine with most home computers. But lower monitor prices, new accessories, and combination TV/monitors are quickly changing the picture—for the better.

Until about a year ago, most computer owners didn't have to spend too much time deliberating over which computer display to buy. Color monitors cost more than brand-new color TV sets, so most people didn't buy a special display for their computers—they just used TV sets. Others used spare black-and-white sets, even for computers with color graphics.

But recently the options have widened. Thanks partly to Commodore's unexpected success with the 1701/1702 color monitors, manufacturers have spotted a niche in the market that was not being exploited, and now they're scrambling to fill it. In addition, TV manufacturers are finally realizing that TVs are being used for a lot more than just watching TV—people are plugging in home computers, videogame machines, videocassette recorders, stereo sound systems, and videodisc players.

The result is a wider variety of affordable color and monochrome monitors compatible with nearly all home computers, plus a new generation of combination TV/monitors equipped with an array of video and audio input/output jacks. There is even a combination TV/composite color/RGB color/monochrome monitor that sells for not much more than an old-fashioned color TV. And new low-priced accessories let you turn existing computer monitors into TV/monitors.

Since the display device is the most-used peripheral in a computer system (you're staring at the screen for up to hours on end), it's time to take a fresh look at what's happening in computer video.

Unlike many peripherals, a monitor will probably be compatible with a different computer if you ever upgrade your system. So it makes sense to take special care when selecting one. It's also important to understand all the technical terms and specifications (see the accompanying article, "RGB Versus Composite Video").

Resolution refers to how sharply the screen can display an image. The greater the resolution, the better. For several technical reasons, ordinary TV sets have trouble displaying computer text. That's why all home computers designed to work with TVs limit the width of their displays to no more than 40 characters. An 80-column display—standard on business computers—would be too fuzzy to read comfortably on the average TV.

You can quickly convert most home computers for 80-column text by plugging in a video adapter board or by running a special program. But to read the screen without suffering headaches, usually you must buy a *monochrome* (noncolor) monitor. Monochrome monitors are available with black-and-white, green, and amber displays (some studies suggest that green and amber displays are easier on your eyes). Why must you buy a monochrome monitor? Because even the most common type of color monitor—called a *composite color* monitor—has problems displaying 80 columns of text. People who spend lots of time staring at the screen, particularly writers and programmers, need the sharpest resolution possible to avoid eye fatigue.

Until recently, the only other alternative was to buy a much more expensive type of color monitor, an *RGB* (red-green-blue) monitor. But few home computers have RGB-compatible outputs, though

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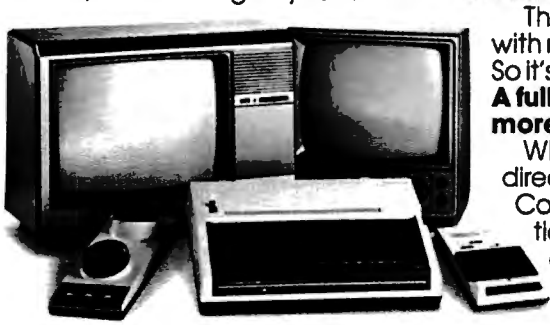

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sometimes one can be added at extra cost.

Fortunately, improved technology has drastically cut the price of RGB monitors and has made it possible for some composite color monitors to display sharp 80-column text as well as graphics. For instance, Teknika Electronics makes a 13-inch color monitor, the MJ-10, that has both composite and *separated* video, just like a Commodore 1701/1702. The separated video mode—which separates certain components in the video signal—can produce an acceptably sharp 80-column display on computers with separated video outputs. Although the only computers with such outputs are the Commodore 64, Plus/4, Commodore 16, and Atari 800, the Teknika MJ-10 also works in regular composite mode with the IBM PC and PCjr, Apple, Atari XLs, and Commodore VIC-20. The suggested retail price is $299.

Teknika's MJ-22 is also a 13-inch color monitor, but is switchable between composite video and RGB. Retailing at $439.95, it is several hundred dollars less than what RGB monitors used to cost and is compatible with the IBM PC and PCjr, Apple, Atari, Commodore, and Texas Instruments computers. Sakata Corporation, a Japanese electronics manufacturer, also makes a composite video/RGB monitor for under $500, the SC-150.

Other companies are marketing color monitors with multiple display modes, too. Perhaps the most versatile to date is the Sears Total Video System. At the push of a button, you can use its 13-inch screen as a composite color monitor, RGB color monitor, green-screen monochrome monitor, or as an ordinary TV set. It even has a button that shrinks the screen image slightly to tighten the dot patterns for sharper text in RGB mode. The RGB jacks are directly compatible with the IBM PCjr, and an adapter makes it work with the PC, too. The monitor is also compatible with virtually all other microcomputers. Its suggested retail price is $349—about half as much as what comparable RGB-only monitors used to sell for.

General Electric has two multifunction models. Like the Sears Total Video System, the 13-inch GE Computer Monitor/TV has an input jack that allows a composite color video signal to bypass the TV's tuner circuits, resulting in a cleaner display. GE also offers a 12-inch black-and-white TV/monitor. (GE has no suggested retail prices; check your local dealer.)

Manufacturers are beginning to equip their TVs with video and audio input jacks because they also make it easier to connect other video devices, such as videocassette recorders. Watch for the next generation of TVs to have a complete set of input/output jacks as a standard feature, just like stereo receivers. These jacks add relatively little to the manufacturing cost of a TV and help eliminate tangles of wires and switchboxes. They also make the TVs a good buy for families who don't use their computer often enough to justify the cost of a dedicated computer monitor.

If you already have a computer monitor, and you live in a household where the arrival of the weekly TV viewing schedule is a springboard for major debates, new add-on tuners can convert your existing monitor into a combination TV/monitor, too. One example is the Cardco Monitor Tuner, which turns any composite color or monochrome monitor into a TV for $99.95. It has an audio output (which can be connected to a stereo system), a computer/TV switch, and a cable/antenna input. A slightly more expensive model has remote control.

You can also use a videocassette recorder to convert a monitor into a TV. Just run a cable from the VCR's video output

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RGB Versus Composite Video

Ottis Cowper, Technical Editor

Color video is similar in principle to monochrome video, the original black-and-white television technology. In a monochrome monitor (or black-and-white TV), the image is produced by spraying the screen with a beam of electrons from a hot filament (called a *gun*) at the back of the picture tube. The screen has a special phosphorescent coating that glows wherever the electrons strike. By carefully aiming the gun to illuminate certain phosphor dots on the tube, detailed images can be painted on the screen. Thus, four separate signals are required to create a monochrome video display: one to control which dots are illuminated, one to control the intensity (brightness) of the display, and one each for synchronizing the vertical and horizontal targeting of the beam.

The challenge in making the leap from monochrome to multicolor was to devise a simple method of generating all the subtle hues the human eye can distinguish. It's possible to make phosphors that will glow a particular color; witness the black-and-white, green, and amber monochrome monitor screens now available. But a color screen would seem to require thousands of different phosphors for all the desired colors. Fortunately, the process isn't quite that complicated.

According to optical physics, all visible colors can be created by mixing just three *primary colors* in various proportions. For color video, the primary colors are red, green, and blue. Any other colors you see on a computer display or color TV are combinations of these three.

On a monochrome display, each of the tiny spots that make up a figure consists of a single glowing dot of phosphor. On a color display, three closely spaced phosphor dots are required for each point—one red, one green, and one blue. As a result, the smallest element of any feature on the color display will be at least three times larger than the smallest element on a monochrome screen. This is one reason why color displays tend to be less sharp—to have lower *resolution*—than monochrome displays.

A color display, then, requires six separate signals: one each for red, green, and blue dots (replacing the single signal required for monochrome dots), plus the intensity, horizontal, and vertical control and synchronization signals. The differences between *composite video* and *RGB* (*red-green-blue*) color displays have to do with how these signals are sent to and processed by the monitor.

Composite video is the most common system because the circuitry is quite similar to that for a color TV, so the components are readily available and relatively inexpensive. As the name composite video implies, these monitors receive and process a *composite* signal—one in which all the separate signal elements for the display are combined into a single signal. The monitor divides the composite signal from the computer into its various parts to target the electron gun and illuminate the proper colored phosphor dots.

In an RGB color monitor, each of the different phosphor colors is illuminated by a separate gun—hence the name RGB. Rather than sending the monitor a composite signal, the computer sends each signal separately, and separate circuits in the monitor target each of the three electron guns. The colors are mixed more precisely and appear much sharper. The disadvantage is that the more specialized circuitry costs more.

At present, there is also one intermediate step between composite video and RGB. The Commodore 64, Plus/4, Commodore 16, and Atari 800 computers have video outputs that can separate the color portions of the composite signal from the intensity portion. The two signals are referred to as *chroma* (short for *chrominance*, or color) and *luma* (for *luminance*, or brightness). The Commodore 1701/1702 color monitors can accept these separated signals in addition to standard composite video. The chroma/luma separation yields a picture that, while still less sharp than RGB, is a distinct improvement over standard composite displays.

The choice between composite and RGB displays may be quite simple. If you have a computer that is designed to provide only composite video output—as is the case with most home computers—then the higher quality of an RGB display is unavailable to you. We know of no adapters to break a composite signal into its RGB components. If, however, you have an IBM PC with a color/graphics adapter, an IBM PCjr, or perhaps an Apple or Atari 800 with an RGB adapter card, you can compare the two systems and decide if the superior quality of RGB is worth the higher cost.

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jack to the monitor's video input jack, and then use the VCR's own tuner.

Another new accessory turns RGB color monitors into very sharp monochrome monitors. The GreenSwitch, from Future Products, changes the screen color to green-on-black. The switch has an IBM-compatible, nine-pin D-connector, installs easily with a screwdriver, and retails for $49.95.

Sakata Corporation caused a bit of a stir with a new monitor at last fall's COMDEX trade show in Las Vegas. Publicity Director Sandy Rodkin, of Rodkin & Associates, recalls seeing a cable TV crew pass by their display, stop, and stare. "Why is that picture better?" they asked.

The monitor they were looking at was a new flat-screen model, the Sakata SFS-200. It has a color liquid crystal display (LCD) that is not only extremely sharp, but more portable than a conventional cathode ray tube (CRT). Small monochrome LCD screens already are common on portable lap computers such as the TRS-80 Model 100. Large color flat screens are still relatively expensive and slow (the SFS-200 costs almost $1,000), but manufacturers expect that to change over the next year or two.

The quality of home computer displays has traditionally been limited by the most common type of display device, the living room TV. But as video technology improves, and prices drop, we can look forward to a new generation of home computers with the kind of high-resolution graphics and sharp 80-column text found today only on the most expensive high-end computers.

For more information, write:

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LEGEND PERIPHERAL PRODUCTS

Space Caverns

For Atari, Commodore 64, VIC-20, Apple, & IBM

Vince Valenti

Hostile aliens track you down with the tenacity of bloodhounds in "Space Caverns," an action game for multiple computers. Originally written for the Atari (16K RAM for tape or 24K RAM for disk), adaptations have been added for the Commodore 64, VIC-20 (with 8K expander), Apple II series, and IBM PC/PCjr (color or monochrome). The Atari, 64, VIC, and Apple versions also require a joystick.

The object of "Space Caverns" is to elude four maniacal aliens who relentlessly home in on your diamond-shaped ship. You can move the ship up, down, left, and right, but there is no escape from the dangerous caverns—you can only advance further into the depths, shooting the aliens before they clobber you.

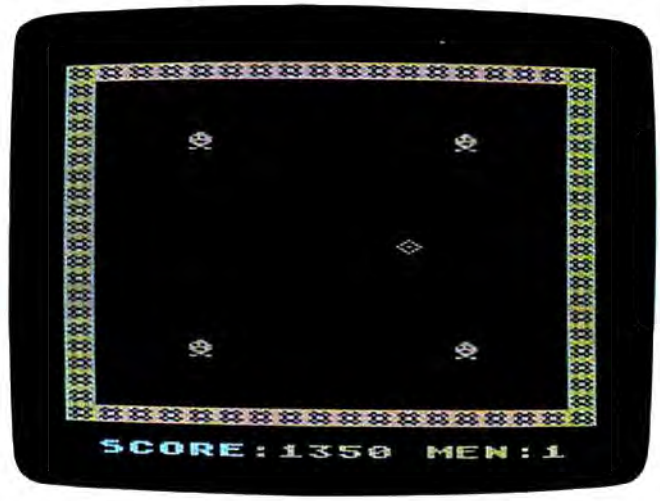
The aliens aren't dummies, either. They are fairly intelligent and will seek you out faster than you can run away. If you manage to defeat them in several successive rooms, you get a bonus round in which you stalk sedentary aliens that randomly appear around the screen. A countdown clock limits the amount of time you have to capture these aliens. When it runs out, you advance to a harder level within the caverns.

After each game, the three highest scores flash on the screen, challenging you to do better next time.

Atari Version

Plug a joystick into port 1. You can choose which level you'd like to start at by pressing the SELECT key. But be forewarned—the higher levels can be very frustrating if you're a beginner. The caverns keep shrinking, leaving less room to maneuver.

Pressing the joystick fire button or START key begins the game. To go back to the title screen at any time during the game, press either START, SELECT, or OPTION. The number of rooms increases on each level, and the number of points you get for capturing sedentary aliens during the bonus rounds is equal to the current value of the countdown clock. The fire button shoots the laser gun in the last direction the joystick was pointed.



Unfriendly aliens search out the diamond-shaped ship in "Space Caverns," Atari version.

If you don't want to type in the program, send a blank cassette, a self-addressed, stamped mailer, and a check or money order for $3 to:

Vince Valenti
3687 Hacienda
Las Vegas, NV 89120
(Atari version only.)

Commodore 64 And VIC-20 Versions

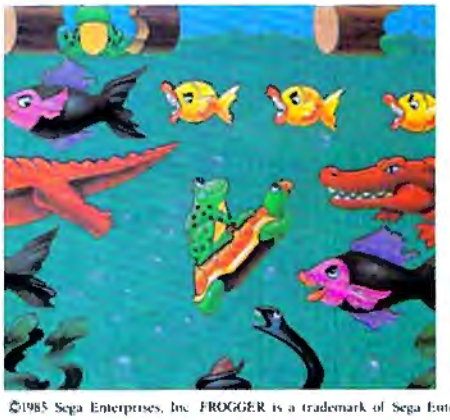
Before loading the VIC version of Space Caverns, be sure your 8K (or greater) memory expander is plugged in, and then enter the following line:

```
POKE 44,28:POKE 43,1:POKE 28*256,0:NEW
```

Then press RETURN, and load and run the program as usual.

Plug the joystick into port 2 on the Commodore 64. Press the joystick button to start the game.

SO YOU THINK YOU GOT THE BEST OF FROGGER AND ZAXXON? SORRY.



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Frogger II Threeee-Deep, a three-screen nightmare. Starting with an undersea battle against deadly creatures and the cruel undercurrent. If you do make it to the surface, it just gets worse. The only hope is to leap into the sky where even more frog-eating monsters lurk.

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And beyond the last electron barrier, the ultimate test. Zaxxon is now a killer dragon hurtling heat-seeking fireballs.

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Atari 2600	Atari 5200	Atari Computers Cartridge	Atari Computers Diskette	Commodore 64 Cartridge	Commodore 64 Diskette	ColecoVision & ADAM	Apple II's	IBM PC	✓ Sega Enterprises, Inc. ✓ Parker Brothers ✓ HesWare
✓	✓	✓	✓	✓	✓	✓	✓	✓	FROGGER II
		✓	✓	✓	✓		✓	✓	SUPER ZAXXON

INTRODUCING FROGGER II THREEEDEEP AND SUPER ZAXXON.

Both Commodore versions are similar in play—the number of rooms on a particular level is always twice the level number, and the points you gain for capturing stationary aliens during the bonus rounds correspond to the countdown clock. Also, each room has a small cave at the center of the screen. In the VIC version, your ship always appears within this cave. There's no exit, but you can shoot holes in the walls with your laser gun. The walls are no barriers to the aliens, however.

In the 64 version, your ship appears randomly when you begin each room—sometimes within the central cave, and sometimes not. If you appear inside the cave, you must escape quickly, because your laser won't work until you get out.

To fire, move the joystick to aim and press the fire button.

Apple Version

Plug in a joystick to control your ship and use the first fire button to activate the laser.

On higher levels, obstacles and a central cave appear on the screen, but you can shoot through them to defend yourself against the aliens.

During the bonus rounds, stationary aliens are worth 100 points each.

IBM Version

Space Caverns runs on any PCjr or PC with either the color/graphics or monochrome adapter. Since the program is formatted for 40 columns, however, the game occupies only half the screen on a monochrome PC.

Control your ship by pressing the I key to move up, K to move down, J to move left, and L to move right. (Press Caps Lock if the keyboard doesn't respond.) This upside-down "T" pattern might seem odd, but it's actually much handier than the usual diamond pattern found on cursor keypads. Simply rest the first three fingers of your right hand on J-K-L, just as you would when touch-typing. Then move your middle finger up and down to press I and K.

Pressing the space bar fires your laser gun in the last direction you moved. But a special twist has been added—you must load the laser each time before firing. To do this, press the R key. If you're playing on a PCjr or a PC with the color/graphics adapter, you'll notice that your ship is yellow when the gun is empty and white when it's loaded.

If you find the game too hard to play at first in this single-shot mode, modify it for continuous firing by changing line 360:

```
360 A$=INKEY$:POKE 1050,PEEK(1052):IF A$="" THEN 470
```

Program 1: Space Caverns For Atari

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

```
PN 10 GOTO 30
OD 20 POKE 756,PEEK(106)+2:RETURN
FL 30 POKE 106,PEEK(106)-4:GRAPHICS
      17:GOSUB 20:POSITION 5,9:? #6;
      "PLEASE WAIT"
GG 40 C=(PEEK(106)+2)*256
DL 50 FOR I=0 TO 511:POKE C+I,PEEK(5
      7344+I):NEXT I
FM 60 FOR I=C+8*3 TO C+8*9+7:READ A:
      POKE I,A:NEXT I
PM 70 DATA 0,8,20,34,73,34,20,8,0,0,
      8,20,42,20,8,0,24,60,106,126,1
      02,60,24,60
LL 80 DATA 24,60,86,126,102,60,24,10
      2,255,219,165,219,219,165,219,
      255
NH 90 DATA 136,33,0,148,1,72,2,16,8,
      8,8,8,8,8,8,8
EI 100 L=1:P=6
JG 110 ? #6;"{CLEAR}":POSITION 7,17:
       ? #6;"level:";L:POKE 708,170
FM 120 POSITION 0,0:? #6;" ";:FOR I=
       1 TO 8:? #6;CHR$(39);CHR$(167
       );:NEXT I:? #6;CHR$(39):POSIT
       ION 0,4:? #6;" ";
HK 130 FOR I=1 TO 8:? #6;CHR$(39);CH
       R$(167);:NEXT I:? #6;CHR$(39)
       :POSITION 0,23:? #6;" ";:FOR
       I=1 TO 8
LE 140 ? #6;CHR$(167);CHR$(39);:NEXT
        I:? #6;CHR$(167):FOR G=0 TO
       23 STEP 2:POSITION 1,G:? #6;C
       HR$(39)
AC 150 POSITION 18,G:? #6;CHR$(167):
       POSITION 1,G+1:? #6;CHR$(167)
       :POSITION 18,G+1:? #6;CHR$(39
       ):NEXT G
IE 160 POSITION 4,1:? #6;"space":POS
       ITION 9,3:? #6;"caverns"
OI 170 FOR G=1 TO 50:POKE 710,0:POKE
        708,170:GOSUB 230:POKE 710,1
       30:POKE 708,0:GOSUB 230:NEXT
       G
KM 180 GOSUB 300
BL 190 POSITION 3,2:? #6;" high scor
       es:":POSITION 5,7:? #6;H1:POS
       ITION 5,10:? #6;H2:POSITION 5
       ,13:? #6;H3
OC 200 FOR G=1 TO 50:POKE 710,0:POKE
        708,170:GOSUB 230:POKE 710,1
       30:POKE 708,0:GOSUB 230:NEXT
       G
KG 210 GOSUB 300
GE 220 GOTO 160
NM 230 IF PEEK(53279)=6 THEN 330
GB 240 IF STRIG(0)=0 THEN 330
GE 250 IF PEEK(53279)<>5 THEN RETURN

DK 260 L=L+1:IF L>5 THEN L=1
FP 270 POSITION 13,17:? #6;L
CD 280 IF PEEK(53279)<>7 THEN 280
HL 290 RETURN
GK 300 FOR G=1 TO 3:POSITION 2,G:? #
       6;"{16 SPACES}":NEXT G
KA 310 FOR G=5 TO 13:POSITION 2,G:?
       #6;"{16 SPACES}":NEXT G
```

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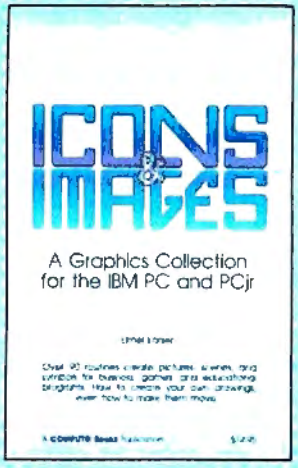

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Sheldon Leemon and Arlan Levitan

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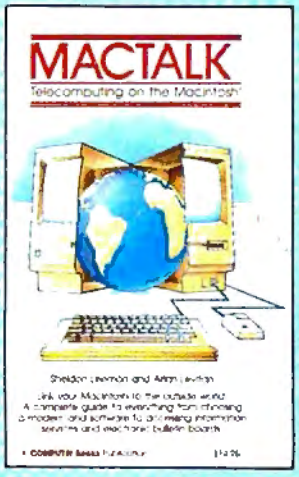
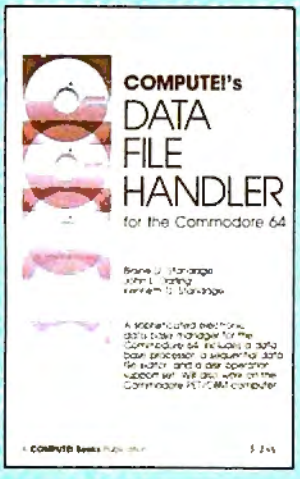
$14.95

ISBN 0-942386-85-X





COMPUTE!'s Data File Handler for the Commodore 64

Blaine D. Standage, John L. Darling, Kenneth D. Standage

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```
HF 320 RETURN
GL 330 GRAPHICS 17:GOSUB 20
HL 340 S=0:D=3:N=0:E=0:GOSUB 830
CI 350 T=STICK(0)
GL 360 IF PEEK(53279)<>7 THEN S=0:D=
       0:GOTO 1130
PP 370 SOUND 0,100,10,6
IN 380 IF T=14 AND Y>L THEN Y=Y-1:PO
       SITION X,Y+1:? #6;" ":POSITIO
       N X,Y:? #6;"$"
BJ 390 IF T=13 AND Y<20-L THEN Y=Y+1
       :POSITION X,Y-1:? #6;" ":POSI
       TION X,Y:? #6;"$"
IN 400 POKE 77,0
AM 410 IF T=7 AND X<18-L THEN X=X+1:
       POSITION X-1,Y:? #6;" $"
LA 420 IF S>9999 AND E=0 THEN E=1:D=
       D+1:POSITION 3,21:? #6;"e▒t▒a
        ▒h▒p▒!":FOR G=0 TO 120:GOTO 7
       40
KF 430 IF T=11 AND X>1+L THEN X=X-1:
       POSITION X,Y:? #6;"$ "
CL 440 IF TI>0 THEN 1540
JG 450 IF STRIG(0)=0 THEN 1160
AK 460 POSITION X1,Y1:? #6;CHR$(166):
       POSITION X2,Y2:? #6;"&":POSITI
       ON X3,Y3:? #6;CHR$(166):POSITI
       ON X4,Y4:? #6;"&"
PE 470 IF L>1 AND X=7 AND Y=6 THEN 99
       0
BP 480 IF L>1 THEN POSITION 7,6:? #6;
       CHR$(166)
AF 490 SOUND 0,220,10,6
EI 500 IF L>2 AND X=10 AND Y=14 THEN
       990
ON 510 IF L>2 THEN POSITION 10,14:? #
       6;"%"
BB 520 IF X>X1 AND X1<18-L AND A1=0 T
       HEN X1=X1+1:POSITION X1-1,Y1:?
        #6;" ";CHR$(165)
BF 530 IF X>X2 AND X2<18-L AND A2=0 T
       HEN X2=X2+1:POSITION X2-1,Y2:?
        #6;" %"
CB 540 IF X>X3 AND X3<18-L AND A3=0 T
       HEN X3=X3+1:POSITION X3-1,Y3:?
        #6;" ";CHR$(165)
CF 550 IF X>X4 AND X4<18-L AND A4=0 T
       HEN X4=X4+1:POSITION X4-1,Y4:?
        #6;" %"
HP 560 IF X<X1 AND X1>1+L AND A1=0 TH
       EN X1=X1-1:POSITION X1,Y1:? #6
       ;CHR$(165);" "
GC 570 POSITION X,Y:? #6;"#"
IE 580 IF X<X2 AND X2>1+L AND A2=0 TH
       EN X2=X2-1:POSITION X2,Y2:? #6
       ;"% "
JA 590 IF X<X3 AND X3>1+L AND A3=0 TH
       EN X3=X3-1:POSITION X3,Y3:? #6
       ;CHR$(165);" "
GD 600 SOUND 0,0,0,0
IN 610 IF X<X4 AND X4>1+L AND A4=0 TH
       EN X4=X4-1:POSITION X4,Y4:? #6
       ;"% "
EB 620 IF Y<Y1 AND Y1>L AND A1=0 THEN
        Y1=Y1-1:POSITION X1,Y1+1:? #6
       ;" ":POSITION X1,Y1:? #6;CHR$(
       165)
MG 630 IF Y<Y2 AND Y2>L AND A2=0 THEN
        Y2=Y2-1:POSITION X2,Y2+1:? #6
       ;" ":POSITION X2,Y2:? #6;"%"
FF 640 IF Y<Y3 AND Y3>L AND A3=0 THEN
        Y3=Y3-1:POSITION X3,Y3+1:? #6
       ;" ":POSITION X3,Y3:? #6;CHR$(
       165)
NK 650 IF Y<Y4 AND Y4>L AND A4=0 THEN
        Y4=Y4-1:POSITION X4,Y4+1:? #6
       ;" ":POSITION X4,Y4:? #6;"%"
NE 660 IF Y>Y1 AND Y1<20-L AND A1=0 T
       HEN Y1=Y1+1:POSITION X1,Y1-1:?
        #6;" ":POSITION X1,Y1:? #6;CH
       R$(165)
GA 670 IF Y>Y2 AND Y2<18-L AND A2=0 T
       HEN Y2=Y2+1:POSITION X2,Y2-1:?
        #6;" ":POSITION X2,Y2:? #6;"%
       "
OP 680 IF Y>Y3 AND Y3<18-L AND A3=0 T
       HEN Y3=Y3+1:POSITION X3,Y3-1:?
        #6;" ":POSITION X3,Y3:? #6;CH
       R$(165)
HE 690 IF Y>Y4 AND Y4<18-L AND A4=0
       THEN Y4=Y4+1:POSITION X4,Y4-1
       :? #6;" ":POSITION X4,Y4:? #6
       ;"%"
GF 700 SOUND 1,0,0,0
HB 710 IF A1=1 AND A2=1 AND A3=1 AND
        A4=1 THEN GOSUB 750
CM 720 IF X=X1 AND Y=Y1 OR X=X2 AND
       Y=Y2 OR X=X3 AND Y=Y3 OR X=X4
        AND Y=Y4 THEN 990
PK 730 FOR I=0 TO 3:SOUND I,0,0,0:NE
       XT I:GOTO 350
NO 740 SOUND 0,200,10,4:SOUND 0,G,10
       ,4:NEXT G:POSITION 3,21:? #6;
       "{11 SPACES}":GOTO 430
CD 750 POKE 710,130
PI 760 POSITION 6,Y-1:? #6;"▒next▒ roo
       m"
NK 770 FOR G=0 TO X:POSITION G,Y:? #
       6;"▒":FOR H=1 TO 6:SOUND 0,RN
       D(0)*50,10,5:NEXT H:NEXT G
EO 780 FOR G=X-1 TO 0 STEP -1:POSITI
       ON G,Y:? #6;"# ":FOR H=1 TO 6
       :SOUND 0,RND(0)*50,10,5:NEXT
       H:NEXT G
BH 790 SOUND 0,0,0,0:FOR G=0 TO 99:N
       EXT G
FE 800 FOR G=0 TO 23:POSITION 0,G:?
       #6;"{19 SPACES}":SOUND 0,G*8,1
       0,5:NEXT G
OL 810 P=P+16:IF P>217 THEN P=6
PP 820 S=S+(L*500+N*50):POSITION 5,1
       2:? #6;"▒bonus▒ : ";L*500+N*50
LE 830 IF L=5 THEN 850
OM 840 IF N=L*2 THEN L=L+1:N=0:GOTO
       1500
MC 850 IF N=200 OR N=400 OR N=800 TH
       EN 1500
ND 860 N=N+1
DK 870 POSITION 5,8:? #6;"level : ";
       L:POSITION 2,10:? #6;"
       {4 SPACES}room : ";N:L1=0
PH 880 POKE 708,P:POKE 710,P+32
IF 890 FOR G=6 TO 0 STEP -0.5:FOR H=
       200 TO 100 STEP -8:SOUND 0,H,
       10,G
OA 900 NEXT H:NEXT G
MF 910 X=INT(RND(0)*7)+6:Y=INT(RND(0
       )*6)+7
ND 920 X1=L+1:Y1=L:X2=L+1:Y2=20-L:Y3
       =20-L:X3=18-L:X4=18-L:Y4=L
```

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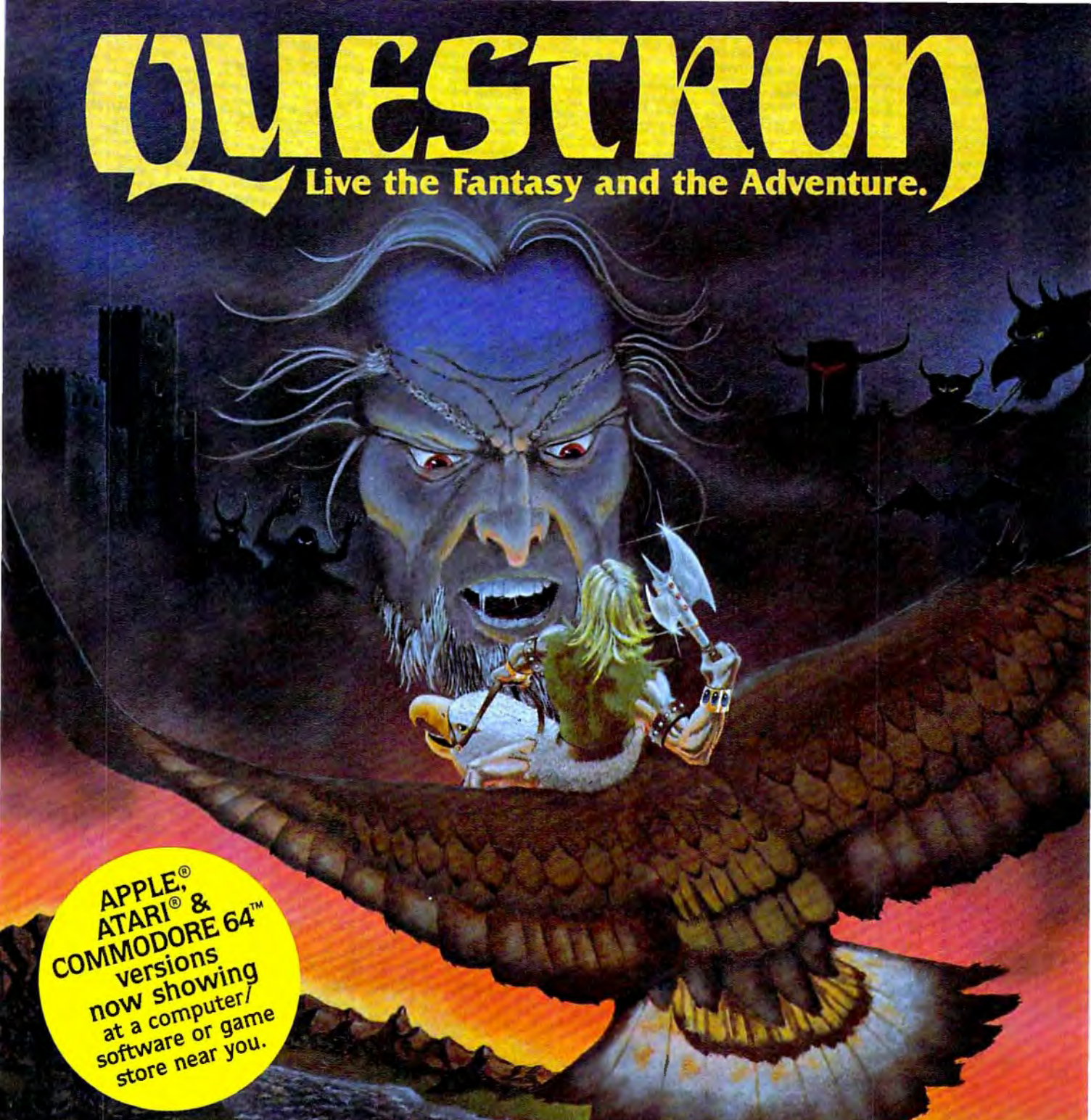

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```
MM 930 A1=0:A2=0:A3=0:A4=0
FB 940 POSITION 5,8:? #6;"
       {12 SPACES}":? #6:POSITION 2,1
       0:? #6;"{14 SPACES}":POSITION
       5,12:? #6;"{14 SPACES}"
CC 950 POSITION 2,22:? #6;"score:";S
       ;" MEN:";D
GO 960 FOR G=0 TO L-1:FOR H=1+G TO 1
       8-G:POSITION H,G:? #6;CHR$(16
       7):POSITION H,20-G:? #6;CHR$(
       167):NEXT H
KJ 970 FOR H=G TO 20-G:POSITION G+1,
       H:? #6;CHR$(39):POSITION 18-G
       ,H:? #6;CHR$(39):NEXT H:NEXT
       G
IB 980 RETURN
MF 990 D=D-1
HA 1000 XX=X:YY=Y:XL=X:YL=Y
DA 1010 FOR G=200 TO 90 STEP -4:POKE
        708,64-((G-80)/10):SOUND 0,
        G,8,9:NEXT G
IM 1020 FOR G=1 TO 12:SOUND 0,20*G,8
        ,G+3
PA 1030 XX=XX-1:IF XX<0 THEN XX=0
DD 1040 XL=XL+1:IF XL>18 THEN XL=18
PK 1050 YY=YY-1:IF YY<0 THEN YY=0
DB 1060 YL=YL+1:IF YL>23 THEN YL=23
OG 1070 POSITION X,Y:? #6;"(":POSITI
        ON XX,YY:? #6;"(":POSITION X
        L,YL:? #6;"("
DD 1080 POSITION XL,YY:? #6;"(":POSI
        TION XX,YL:? #6;"(":POSITION
         XL,Y:? #6;"("
JM 1090 POSITION XX,Y:? #6;"(":POSIT
        ION X,YL:? #6;"(":POSITION X
        ,YY:? #6;"("
JK 1100 POKE 708,64-G
FA 1110 NEXT G:SOUND 0,0,0,0
FE 1120 FOR G=1 TO 100:NEXT G
ML 1130 FOR G=0 TO 23:POSITION 0,G:?
         #6;"{19 SPACES}":NEXT G
PP 1140 IF D=0 THEN 1450
PB 1150 GOSUB 870:GOTO 350
HC 1160 IF T=14 THEN A=-1:W=L
NE 1170 IF T=13 THEN A=1:W=20-L
MN 1180 IF T=11 THEN A=-1:W=1+L
LA 1190 IF T=7 THEN A=1:W=18-L
ND 1200 IF T=13 OR T=14 THEN 1230
KG 1210 IF T=7 OR T=11 THEN 1340
CF 1220 FOR I=0 TO 3:SOUND I,0,0,0:N
        EXT I:GOTO 350
EN 1230 SOUND 0,7,4,6:FOR G=Y TO W S
        TEP A:POSITION X,G:? #6;"■":
        NEXT G
IN 1240 FOR G=Y TO W STEP A:POSITION
         X,G:? #6;" ":NEXT G
PF 1250 IF A=-1 AND Y>=Y1 AND X=X1 T
        HEN S=S+50:SOUND 1,50,8,5:X1
        =4:Y1=23:A1=1
FE 1260 IF A=-1 AND Y>=Y2 AND X=X2 T
        HEN S=S+100:SOUND 1,100,8,5:
        X2=5:Y2=23:A2=1
GF 1270 IF A=-1 AND Y>=Y3 AND X=X3 T
        HEN S=S+150:SOUND 1,150,8,5:
        X3=6:Y3=23:A3=1
GE 1280 IF A=-1 AND Y>=Y4 AND X=X4 T
        HEN S=S+200:SOUND 1,200,8,5:
        X4=7:Y4=23:A4=1
MF 1290 IF A=1 AND Y<=Y1 AND Y1<20 A
        ND X=X1 THEN S=S+50:SOUND 1,
        50,8,5:X1=4:Y1=23:A1=1
BM 1300 IF A=1 AND Y<=Y2 AND Y2<20 A
        ND X=X2 THEN S=S+100:SOUND 1
        ,100,8,5:X2=5:Y2=23:A2=1
CO 1310 IF A=1 AND Y<=Y3 AND Y3<20 A
        ND X=X3 THEN S=S+150:SOUND 1
        ,150,8,5:X3=6:Y3=23:A3=1
CN 1320 IF A=1 AND Y<=Y4 AND Y4<20 A
        ND X=X4 THEN S=S+200:SOUND 1
        ,200,8,5:X4=6:Y4=23:A4=1
FI 1330 POSITION 2,22:? #6;"score:";
        S;" MEN:";D:GOTO 460
IF 1340 SOUND 0,7,4,6:FOR G=X TO W S
        TEP A:POSITION G,Y:? #6;"■":
        NEXT G
IP 1350 FOR G=X TO W STEP A:POSITION
         G,Y:? #6;" ":NEXT G
PH 1360 IF A=-1 AND Y=Y1 AND X>=X1 T
        HEN S=S+50:SOUND 1,50,8,5:X1
        =4:Y1=23:A1=1
FG 1370 IF A=-1 AND Y=Y2 AND X>=X2 T
        HEN S=S+100:SOUND 1,100,8,5:
        X2=5:Y2=23:A2=1
GH 1380 IF A=-1 AND Y=Y3 AND X>=X3 T
        HEN S=S+150:SOUND 1,150,8,5:
        X3=6:Y3=23:A3=1
GG 1390 IF A=-1 AND Y=Y4 AND X>=X4 T
        HEN S=S+200:SOUND 1,200,8,5:
        X4=7:Y4=23:A4=1
MD 1400 IF A=1 AND Y=Y1 AND X<=X1 TH
        EN S=S+50:SOUND 1,50,8,5:X1=
        4:Y1=23:A1=1
CC 1410 IF A=1 AND Y=Y2 AND X<=X2 TH
        EN S=S+100:SOUND 1,100,8,5:X
        2=5:Y2=23:A2=1
DD 1420 IF A=1 AND Y=Y3 AND X<=X3 TH
        EN S=S+150:SOUND 1,150,8,5:X
        3=6:Y3=23:A3=1
DC 1430 IF A=1 AND Y=Y4 AND X<=X4 TH
        EN S=S+200:SOUND 1,200,8,5:X
        4=7:Y4=23:A4=1
JM 1440 GOTO 460
LB 1450 IF S>H1 THEN H3=H2:H2=H1:H1=
        S:GOTO 1480
EK 1460 IF S>H2 THEN H3=H2:H2=S:GOTO
         1480
KB 1470 IF S>H3 THEN H3=S
KO 1480 POSITION 5,13:? #6;"GAME OVE
        R"
GC 1490 FOR G=1 TO 100:NEXT G:GOTO 1
        00
MI 1500 TI=200+L*60:SOUND 0,0,0,0:PO
        SITION 3,23:? #6;"bonus YOUR
        ■":FOR G=0 TO 99:NEXT G:L1=L
        :L=1:X=10:Y=X:X1=X:Y1=15
OK 1510 POKE 708,170:POSITION 1,0:FO
        R I=1 TO 9:? #6;CHR$(167);CH
        R$(39);:NEXT I:? #6:FOR I=1
        TO 10
PM 1520 ? #6;" '{16 SPACES}■":? #6;"
        ■{16 SPACES}'":NEXT I:POSITIO
        N 1,20
DB 1530 FOR I=1 TO 9:? #6;CHR$(167);
        CHR$(39);:NEXT I
MO 1540 TI=TI-1:POSITION 12,21:? #6;
        TI;" ":? #6;"score :";S:IF T
        I=0 THEN L=L1:L1=1:GOTO 790
KL 1550 IF X=X1 AND Y=Y1 THEN SOUND
        0,12,4,8:S=S+TI:X1=INT(RND(0
        )*16)+2:Y1=INT(RND(0)*18)+1
```

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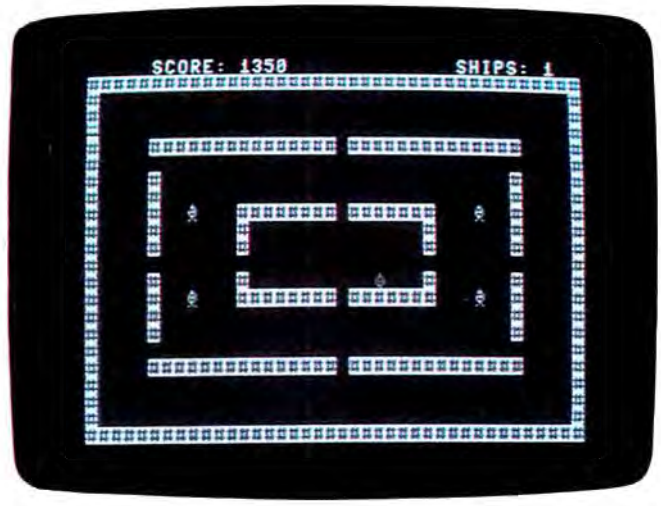
```
1560 POSITION X,Y:? #6;"#":POSITIO
     N X1,Y1:? #6;CHR$(166):SOUND
     0,TI/2,10,6:GOTO 350
```

Program 2: Space Caverns For Commodore 64

Version by Kevin Martin, Editorial Programmer

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

```
10 GOSUB 1300                          :rem 165
20 V=54272:POKEV+24,15:POKEV+5,0:POKEV+6,
   240:POKEV,100                       :rem 180
30 POKE53281,0:POKE53280,0             :rem 184
40 PRINT"{CLR}{8 DOWN}{13 RIGHT}{13}SPACE
   {SPACE}CAVERNS"                     :rem 200
50 PRINT"{3 DOWN}{14 RIGHT}{7}HIGH SCORES
   "                                   :rem 136
60 PRINTTAB(17)"{DOWN}{RED}"H1         :rem 109
70 PRINTTAB(17)"{DOWN}{PUR}"H2         :rem 239
80 PRINTTAB(17)"{DOWN}{GRN}"H3         :rem 115
90 PRINT"{YEL}{2 DOWN}{5 RIGHT}PRESS THE
   {SPACE}FIRE BUTTON TO PLAY"         :rem 212
100 IFPEEK(56320)AND16THEN100          :rem 144
110 L=1:S=0:R=0:SH=3:Q=0:W=33          :rem 176
120 IFR=L*2THENL=L+1:R=0:GOSUB1040:rem 49
130 PRINT"{CLR}{11 DOWN}"TAB(16)"{RED}LEV
    EL:{WHT}"L                         :rem 165
140 PRINT"{7 DOWN}"TAB(16)"{GRN}ROOM:
    {WHT}";R+1                         :rem 51
150 FORI=1TO1000:NEXT                  :rem 17
160 POKE53281,11:PRINT"{CLR}":POKE53281,0
                                       :rem 189
170 IFS>10000ANDQ=0THEN PRINT"{HOME}
    {15 RIGHT}{WHT}EXTRA SHIP":SH=SH+1:Q=
    1                                  :rem 191
180 Y1=L+1:X1=L:Y2=L+1:X2=39-L:X3=39-L:Y3
    =22-L:Y4=22-L:X4=L                 :rem 219
190 A1=1:A2=1:A3=1:A4=1                :rem 206
200 FORI=0TO39:POKEI+1064,37:POKEI+1904,3
    7:NEXT                             :rem 54
210 FORI=5TO34:POKEI+1224,37:POKEI+1744,3
    7:NEXT                             :rem 55
220 FORI=12TO27:POKEI+1384,37:POKEI+1584,
    37:NEXT                            :rem 113
230 POKE1244,32:POKE1404,32:POKE1764,32:P
    OKE1604,32                         :rem 116
240 FORI=1TO22:POKEI*40+1024,37:POKEI*40+
    1063,37:NEXT                       :rem 71
250 FORI=5TO18:POKEI*40+1029,37:POKEI*40+
    1058,37:NEXT                       :rem 90
260 FORI=9TO14:POKEI*40+1036,37:POKEI*40+
    1051,37:NEXT                       :rem 82
270 POKE1509,32:POKE1516,32:POKE1538,32:P
    OKE1531,32                         :rem 126
280 X=INT(RND(1)*10)+15:Y=INT(RND(0)*6)+8
                                       :rem 33
290 PRINT"{HOME}{40 SPACES}"           :rem 127
300 POKE1024+X+40*Y,W:POKE55296+X+40*Y,1
                                       :rem 7
310 IFX=X1ANDY=Y1THEN910               :rem 253
320 IFX=X2ANDY=Y2THEN910               :rem 0
330 IFX=X3ANDY=Y3THEN910               :rem 3
340 IFX=X4ANDY=Y4THEN910               :rem 6
350 W=W+1:IFW=35THENW=33               :rem 205
360 POKE1024+X1+40*Y1,W+2:POKE55296+X1+40
    *Y1,5                              :rem 50
370 POKE1024+X2+40*Y2,W+2:POKE55296+X2+40
    *Y2,5                              :rem 55
380 POKE1024+X3+40*Y3,W+2:POKE55296+X3+40
    *Y3,5                              :rem 60
390 POKE1024+X4+40*Y4,W+2:POKE55296+X4+40
    *Y4,5                              :rem 65
400 PRINT"{HOME}";:POKE211,5:PRINT"SCORE:
    ";S;:POKE211,30:PRINT"SHIPS:";SH
                                       :rem 201
410 IF(A1+A2+A3+A4)=0THEN850           :rem 253
420 J=PEEK(56320):D=JAND15:B=JAND16
                                       :rem 14
430 IFD=15THEN680                      :rem 218
440 IFX>12ANDX<27ANDY>9ANDY<14THEN460
                                       :rem 41
450 IFB=0THEN540                       :rem 159
460 POKE1024+X+40*Y,32                 :rem 182
470 XA=0:YA=0                          :rem 226
480 IFD=14ANDY>L+1THENYA=-1            :rem 135
490 IFD=13ANDY<22-LTHENYA=1            :rem 141
500 IFD=11ANDX>LTHENXA=-1              :rem 31
510 IFD=7ANDX<39-LTHENXA=1             :rem 95
520 IFPEEK(1024+(X+XA)+(Y+YA)*40)=32THENX
    =X+XA:Y=Y+YA                       :rem 147
530 GOTO680                            :rem 111
540 POKEV+4,129:FORI=100TO10STEP-10:POKEV
    +1,I:NEXT:POKEV+4,128              :rem 57
550 IFD=14THENJ=X:FORI=Y-1TO1STEP-1:GOSUB
    600:IFBTHENNEXT                    :rem 178
560 IFD=13THENJ=X:FORI=Y+1TO22:GOSUB600:I
    FBTHENNEXT                         :rem 73
570 IFD=11THENI=Y:FORJ=X-1TO1STEP-1:GOSUB
    600:IFBTHENNEXT                    :rem 177
580 IFD=7THENI=Y:FORJ=X+1TO39:GOSUB600:IF
    BTHENNEXT                          :rem 38
590 GOTO680                            :rem 117
600 B=-1                               :rem 115
610 IFJ=X1ANDI=Y1THENA1=0:X1=0:Y1=0:S=S+5
    0:B=0                              :rem 30
620 IFJ=X2ANDI=Y2THENA2=0:X2=1:Y2=0:S=S+1
    00:B=0                             :rem 81
630 IFJ=X3ANDI=Y3THENA3=0:X3=2:Y3=0:S=S+1
    50:B=0                             :rem 93
640 IFJ=X4ANDI=Y4THENA4=0:X4=3:Y4=0:S=S+2
    00:B=0                             :rem 96
650 IFPEEK(1024+I*40+J)<>32THENB=0
                                       :rem 155
660 POKE55296+I*40+J,3:POKE1024+I*40+J,39
    :FORK=1TO10:NEXT:POKE1024+I*40+J,32
                                       :rem 122
670 RETURN                             :rem 125
```



On the Commodore 64, you must maneuver your ship out of the central cave before your laser becomes operative.

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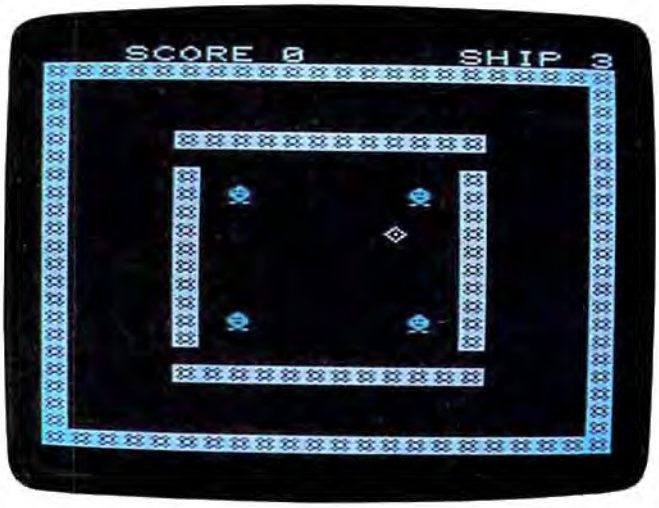
```
680 IFA1=0THEN720                          :rem 212
690 POKE1024+X1+40*Y1,32                   :rem 29
700 X1=X1+(X1>X)-(X1<X)                    :rem 28
710 Y1=Y1+(Y1>Y)-(Y1<Y)                    :rem 35
720 IFA2=0THEN760                          :rem 212
730 POKE1024+X2+40*Y2,32                   :rem 26
740 X2=X2+(X2>X)-(X2<X)                    :rem 36
750 Y2=Y2+(Y2>Y)-(Y2<Y)                    :rem 43
760 IFA3=0THEN800                          :rem 212
770 POKE1024+X3+40*Y3,32                   :rem 32
780 X3=X3+(X3>X)-(X3<X)                    :rem 44
790 Y3=Y3+(Y3>Y)-(Y3<Y)                    :rem 51
800 IFA4=0THEN840                          :rem 212
810 POKE1024+X4+40*Y4,32                   :rem 29
820 X4=X4+(X4>X)-(X4<X)                    :rem 43
830 Y4=Y4+(Y4>Y)-(Y4<Y)                    :rem 50
840 GOTO300                                :rem 104
850 N=N+1:PRINT"{HOME}{5 RIGHT}
    {10 SPACES}{WHT}NEXT ROOM{16 SPACES}"
                                           :rem 2
860 FORG=0TOX:POKE55296+G+40*Y,6:POKE1024
    +G+40*Y,38:NEXT                        :rem 82
870 FORG=X-1TO0STEP-1:POKE55296+G+Y*40,1:
    POKE1024+G+Y*40,33                     :rem 200
880 POKE1025+G+Y*40,32:NEXT                :rem 37
890 PRINT"{CLR}{11 DOWN}{14 RIGHT}{CYN}BO
    NUS:{RED}";L*500+R*50:S=S+L*500+R*50:
    R=R+1                                  :rem 250
900 FORI=1TO1500:NEXT:GOTO120              :rem 31
910 POKEV+1,50:POKEV+4,129:X1=X-1:X2=X+1:
    Y1=Y-1:Y2=Y+1                          :rem 204
920 FORI=1TO20                             :rem 62
930 POKE1024+X1+40*Y1,38:POKE55296+X1+40*
    Y1,2                                   :rem 233
940 POKE1024+X2+40*Y1,38:POKE55296+X2+40*
    Y1,2                                   :rem 236
950 POKE1024+X1+40*Y2,38:POKE55296+X1+40*
    Y2,2                                   :rem 237
960 POKE1024+X2+40*Y2,38:POKE55296+X2+40*
    Y2,2                                   :rem 240
970 IFX1>0THENX1=X1-1                      :rem 2
980 IFX2<39THENX2=X2+1                     :rem 62
990 IFY1>0THENY1=Y1-1                      :rem 7
1000 IFY2<22THENY2=Y2+1                    :rem 89
1010 NEXT:POKEV+4,128                      :rem 230
1020 SH=SH-1:IFSH=0THEN1250                :rem 92
1030 GOTO120                               :rem 144
1040 T=200+L*60:X=20:Y=11                  :rem 82
1050 POKE53281,11:PRINT"{CLR}":POKE53281,
    0                                      :rem 236
1060 PRINT"{HOME}{14 RIGHT}{GRN}BONUS ROU
    ND"                                    :rem 110
1070 FORI=1064TO1103:POKEI,37:POKEI+21*40
    ,37:NEXT                               :rem 141
1080 FORI=1064TO1064+40*21STEP40:POKEI,37
    :POKEI+39,37:NEXT                      :rem 203
1090 POKEV+1,5:POKEV+4,33:FORI=10TO100STE
    P2:POKEV+1,I:NEXT:POKEV+4,32           :rem 30
1100 X1=INT(RND(0)*40)                     :rem 183
1110 Y1=INT(RND(0)*20)+1:IFPEEK(1024+X1+Y
    1*40)<>32THEN1100                      :rem 224
1120 POKE55296+X1+Y1*40,6:POKE1024+X1+Y1*
    40,36:GOTO1140                         :rem 76
1130 IFPEEK(1024+X+Y*40)=36THENS=S+T:GOTO
    1100                                   :rem 146
1140 POKE55296+X+Y*40,1:POKE1024+X+Y*40,W
                                           :rem 58
1150 W=W+1:IFW=35THENW=33                  :rem 252
1160 PRINT"{HOME}{PUR}SCORE:{WHT}";S;:POK
    E211,30:PRINT"{YEL}TIME:{WHT}";T;"
    {LEFT} "                               :rem 26
1170 J=PEEK(56320):D=JAND15:B=JAND16
                                           :rem 65
1180 POKE1024+X+40*Y,32                    :rem 230
1190 IFD=14ANDY>2THENY=Y-1                 :rem 88
1200 IFD=13ANDY<21THENY=Y+1                :rem 124
1210 IFD=11ANDX>1THENX=X-1                 :rem 74
1220 IFD=7ANDX<38THENX=X+1                 :rem 86
1230 T=T-1:IFT=0THENRETURN                 :rem 162
1240 GOTO1130                              :rem 197
1250 IFS>H1THENH3=H2:H2=H1:H1=S:GOTO1280
                                           :rem 173
1260 IFS>H2THENH3=H2:H2=S:GOTO1280:rem 70
1270 IFS>H3THENH3=S                        :rem 159
1280 PRINT"{CLR}{14 DOWN}{15 RIGHT}{RED}G
    AME OVER"                              :rem 66
1290 FORI=1TO1500:NEXT:GOTO30              :rem 34
1300 PRINT"{CLR}{11 DOWN}{9 RIGHT}LOADING
     CHARACTER SET"                        :rem 95
1310 POKE56334,PEEK(56334)AND254:POKE1,PE
    EK(1)AND251                            :rem 230
1320 FORI=0TO511:POKE12288+I,PEEK(53248+I
    ):NEXT                                 :rem 20
1330 POKE1,PEEK(1)OR4:POKE56334,PEEK(5633
    4)OR1                                  :rem 182
1340 I=12552                               :rem 77
1350 READA:IFA=-1THEN1370                  :rem 197
1360 POKEI,A:I=I+1:GOTO1350                :rem 80
1370 POKE53272,(PEEK(53272)AND240)OR12
                                           :rem 96
1380 RETURN                                :rem 172
1390 DATA 0,8,20,34,73,34,20,8             :rem 183
1400 DATA 0,0,8,20,42,20,8,0               :rem. 61
1410 DATA 24,60,106,126,102,60,24,60
                                           :rem 213
1420 DATA 24,60,86,126,102,60,24,102
                                           :rem 218
1430 DATA 255,219,165,219,219,165,219,255
                                           :rem 246
1440 DATA 136,33,0,148,1,72,2,16           :rem 23
1450 DATA 0,0,0,24,24,0,0,0                :rem 4
1460 DATA -1                               :rem 67
```

Program 3: Space Caverns For VIC-20

Version by Kevin Martin, Editorial Programmer

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

```
10 GOSUB 1270                              :rem 171
20 POKE36878,15                            :rem 51
30 POKE 36879,8                            :rem 7
40 PRINT"{CLR}{6 DOWN}{4 RIGHT}{WHT}SPACE
    CAVERNS"                               :rem 37
50 PRINT"{3 DOWN}{5 RIGHT}{BLU}HIGH SCORE
   S"                                      :rem 8
60 PRINTTAB(8)"{DOWN}{RED}"H1              :rem 61
70 PRINTTAB(8)"{DOWN}{PUR}"H2              :rem 191
80 PRINTTAB(8)"{DOWN}{GRN}"H3              :rem 67
90 PRINT"{YEL}{2 DOWN}{2 RIGHT}PRESS FIRE
    TO PLAY"                               :rem 192
100 IFPEEK(37137)AND32THEN100              :rem 147
110 L=1:S=0:R=0:SH=3:Q=0:W=33              :rem 176
120 IFR=L*2THENL=L+1:R=0:GOSUB1000:rem 45
130 PRINT"{CLR}{11 DOWN}"TAB(7)"{RED}LEVE
    L:{WHT}"L                              :rem 117
140 PRINT"{7 DOWN}"TAB(7)"{GRN}ROOM:{WHT}
    ";R+1                                  :rem 3
150 FORI=1TO1000:NEXT                      :rem 17
160 PRINT"{CLR}"                           :rem 251
170 IFS>10000ANDQ=0THEN PRINT"{HOME}
    {6 RIGHT}{WHT}EXTRA SHIP":SH=SH+1:Q=1
                                           :rem 186
```



Apparently trapped, this player in the VIC version of "Space Caverns" is watching the oncoming aliens and holding his fire until he sees the greens of their eyes.

```
180 Y1=L+1:X1=L:Y2=L+1:X2=21-L:X3=21-L:Y3
    =22-L:Y4=22-L:X4=L                :rem 201
190 A1=1:A2=1:A3=1:A4=1               :rem 206
200 FORI=0TO21:POKEI+4118,37:POKEI+38422,
    1:POKEI+4580,37:POKEI+3884,1:NEXT
                                      :rem 129
210 FORI=5TO16:POKEI+4206,37:POKEI+38510,
    1:POKEI+4492,37:POKEI+38796,1:NEXT
                                      :rem 195
220 FORI=1TO22:POKEI*22+4096,37:POKEI*22+
    37888,1:POKEI*22+4117,37:POKEI*22+384
    21,1:NEXT                         :rem 248
230 FORI=5TO18:POKEI*22+4101,37:POKEI*22+
    38405,1:POKEI*22+4112,37:POKEI*22+384
    16,1:NEXT                         :rem 230
240 X=INT(RND(1)*10)+5:Y=INT(RND(0)*6)+8
                                      :rem 236
250 PRINT"{HOME}{22 SPACES}";         :rem 182
260 POKE4096+X+22*Y,W:POKE37888+X+20*Y,1
                                      :rem 29
270 IFX=X1ANDY=Y1THEN860               :rem 6
280 IFX=X2ANDY=Y2THEN860               :rem 9
290 IFX=X3ANDY=Y3THEN860              :rem 12
300 IFX=X4ANDY=Y4THEN860               :rem 6
310 W=W+1:IFW=35THENW=33              :rem 201
320 POKE4096+X1+22*Y1,W+2:POKE37888+X1+22
    *Y1,5                             :rem 65
330 POKE4096+X2+22*Y2,W+2:POKE37888+X2+22
    *Y2,5                             :rem 70
340 POKE4096+X3+22*Y3,W+2:POKE37888+X3+22
    *Y3,5                             :rem 75
350 POKE4096+X4+22*Y4,W+2:POKE37888+X4+22
    *Y4,5                             :rem 80
360 PRINT"{HOME}{3 RIGHT}SCORE";S;:POKE21
    1,16:PRINT"SHIP";SH               :rem 190
370 IF(A1+A2+A3+A4)=0THEN790           :rem 5
380 POKE37154,127:S3=-((PEEK(37152)AND128
    )=0):POKE37154,255:P=PEEK(37137)
                                      :rem 42
390 S1=-((PAND8)=0):S2=((PAND16)=0):S0=((
    PAND4)=0)                         :rem 233
400 XA=S2+S3:YA=S0+S1                 :rem 227
410 IFXA=0ANDYA=0THEN620              :rem 203
420 IF(PAND32)=0THEN480                :rem 54
430 POKE4096+X+22*Y,32                :rem 191
440 IFY+YA<1ORY+YA>21THENYA=0          :rem 72
450 IFX+XA<1ORX+XA>21THENXA=0          :rem 68
460 IFPEEK(4096+(X+XA)+(Y+YA)*22)=32THENX
    =X+XA:Y=Y+YA                      :rem 162
470 GOTO620                           :rem 108
480 FORWE=255TO128STEP-5:POKE36877,WE:NEX
    T:POKE36877,0                      :rem 97
490 IFS0THENJ=X:FORI=Y-1TO2STEP-1:GOSUB54
    0:IFBTHENNEXT                     :rem 86
500 IFS1THENJ=X:FORI=Y+1TO21:GOSUB540:IFB
    THENNEXT                          :rem 228
510 IFS2THENI=Y:FORJ=X-1TO1STEP-1:GOSUB54
    0:IFBTHENNEXT                     :rem 80
520 IFS3THENI=Y:FORJ=X+1TO20:GOSUB540:IFB
    THENNEXT                          :rem 231
530 GOTO620                           :rem 105
540 B=-1                              :rem 118
550 IFJ=X1ANDI=Y1THENA1=0:X1=0:Y1=0:S=S+5
    0:B=0                             :rem 33
560 IFJ=X2ANDI=Y2THENA2=0:X2=1:Y2=0:S=S+1
    00:B=0                            :rem 84
570 IFJ=X3ANDI=Y3THENA3=0:X3=2:Y3=0:S=S+1
    50:B=0                            :rem 96
580 IFJ=X4ANDI=Y4THENA4=0:X4=3:Y4=0:S=S+2
    00:B=0                            :rem 99
590 IFPEEK(4096+I*22+J)<>32THENB=0
                                      :rem 170
600 POKE37888+I*22+J,3:POKE4096+I*22+J,39
    :FORK=1TO10:NEXT:POKE4096+I*22+J,32
                                      :rem 147
610 RETURN                            :rem 119
620 IFA1=0THEN660                     :rem 209
630 POKE4096+X1+22*Y1,32               :rem 35
640 X1=X1+(X1>X)-(X1<X)                :rem 31
650 Y1=Y1+(Y1>Y)-(Y1<Y)                :rem 38
660 IFA2=0THEN700                     :rem 209
670 POKE4096+X2+22*Y2,32               :rem 41
680 X2=X2+(X2>X)-(X2<X)                :rem 39
690 Y2=Y2+(Y2>Y)-(Y2<Y)                :rem 46
700 IFA3=0THEN740                     :rem 209
710 POKE4096+X3+22*Y3,32               :rem 38
720 X3=X3+(X3>X)-(X3<X)                :rem 38
730 Y3=Y3+(Y3>Y)-(Y3<Y)                :rem 45
740 IFA4=0THEN780                     :rem 218
750 POKE4096+X4+22*Y4,32               :rem 44
760 X4=X4+(X4>X)-(X4<X)                :rem 46
770 Y4=Y4+(Y4>Y)-(Y4<Y)                :rem 53
780 GOTO260                           :rem 112
790 N=N+1:PRINT"{HOME}{6 SPACES}{WHT}NEXT
     ROOM{7 SPACES}";                 :rem 175
800 FORG=0TOX:POKE37888+G+22*Y,6:POKE4096
    +G+22*Y,38:NEXT                    :rem 95
810 FORG=X-1TO0STEP-1:POKE37888+G+Y*22,1:
    POKE4096+G+Y*22,33                :rem 213
820 POKE4097+G+Y*22,32:NEXT            :rem 43
830 FORI=128TO255STEP5:POKE36875,I:NEXT:P
    OKE36875,0                        :rem 137
840 PRINT"{CLR}{11 DOWN}{4 RIGHT}{CYN}BON
    US:{RED}";L*500+R*50:S=S+L*500+R*50:R
    =R+1                              :rem 211
850 FORI=1TO1500:NEXT:GOTO120          :rem 35
860 X1=X-1:X2=X+1:Y1=Y-1:Y2=Y+1        :rem 62
870 FORI=1TO13                         :rem 68
880 POKE4096+X1+22*Y1,38:POKE37888+X1+22*
    Y1,2                               :rem 0
890 POKE36877,128+I*8                 :rem 124
900 POKE4096+X2+22*Y1,38:POKE37888+X2+22*
    Y1,2                              :rem 251
910 POKE4096+X1+22*Y2,38:POKE37888+X1+22*
    Y2,2                              :rem 252
920 POKE4096+X2+22*Y2,38:POKE37888+X2+22*
    Y2,2                              :rem 255
```

```
930 IFX1>0THENX1=X1-1                :rem 254
940 IFX2<22THENX2=X2+1               :rem 50
950 IFY1>0THENY1=Y1-1                :rem 3
960 IFY2<22THENY2=Y2+1               :rem 55
970 NEXT:POKE36877,0                 :rem 179
980 SH=SH-1:IFSH=0THEN1220           :rem 55
990 GOTO120                          :rem 110
1000 T=200+L*60:X=20:Y=11            :rem 78
1010 PRINT"{CLR}{5 RIGHT}{GRN}BONUS ROUND
     "                               :rem 228
1020 FORI=4118TO4139:POKEI,37:POKEI+21*22
     ,37:NEXT                        :rem 151
1030 FORI=4118TO4118+22*21STEP22:POKEI,37
     :POKEI+21,37:NEXT               :rem 195
1040 PRINT"{HOME}{21 SPACES}";       :rem 228
1050 FORI=150TO250STEP2:POKE36875,I:NEXT:
     POKE36875,0                     :rem 167
1060 X1=INT(RND(0)*22)               :rem 188
1070 Y1=INT(RND(0)*20)+1:IFPEEK(4096+X1+Y
     1*22)<>32THEN1060               :rem 246
1080 POKE37888+X1+Y1*22,6:POKE4096+X1+Y1*
     22,36:GOTO1100                  :rem 96
1090 IFPEEK(4096+X+Y*22)=36THENS=S+T:GOTO
     1060                            :rem 168

1100 POKE37888+X+Y*22,1:POKE4096+X+Y*22,W
                                     :rem 73
1110 W=W+1:IFW=35THENW=33            :rem 248
1120 PRINT"{HOME}{PUR}SCORE{WHT}";S;:POKE
     211,13:PRINT"{YEL}TIME{WHT}";T;"
     {LEFT} "                        :rem 163
1130 POKE37154,127:S3=-((PEEK(37152)AND12
     8)=0):POKE37154,255:P=PEEK(37137)
                                     :rem 84
1140 S1=-((PAND8)=0):S2=((PAND16)=0):S0=(
     (PAND4)=0)                      :rem 19
1150 POKE4096+X+22*Y,32              :rem 239
1160 IFS0=-1ANDY>2THENY=Y-1          :rem 141
1170 IFS1=1ANDY<21THENY=Y+1          :rem 143
1180 IFS2=-1ANDX>1THENX=X-1          :rem 141
1190 IFS3=1ANDX<20THENX=X+1          :rem 143
1200 T=T-1:IFT=0THENRETURN           :rem 159
1210 GOTO1090                        :rem 199
1220 IFS>H1THENH3=H2:H2=H1:H1=S:GOTO1250
                                     :rem 167
1230 IFS>H2THENH3=H2:H2=S:GOTO1250:rem 64
1240 IFS>H3THENH3=S                  :rem 156
1250 PRINT"{CLR}{13 DOWN}{6 RIGHT}{RED}GA
     ME OVER"                        :rem 41
1260 FORI=1TO1500:NEXT:GOTO30        :rem 31
1270 PRINT"{CLR}{8 DOWN}{BLK}LOADING CHAR
     ACTER SET"                      :rem 189
1280 POKE36879,25                    :rem 158
1290 FORI=0TO511:POKE5120+I,PEEK(32768+I)
     :NEXT                           :rem 225
1300 I=5384                          :rem 30
1310 READA:IFA=-1THEN1330            :rem 189
1320 POKEI,A:I=I+1:GOTO1310          :rem 72
1330 POKE36869,205                   :rem 201
1340 RETURN                          :rem 168
1350 DATA 0,8,20,34,73,34,20,8       :rem 179
1360 DATA 0,0,8,20,42,20,8,0         :rem 66
1370 DATA 24,60,106,126,102,60,24,60
                                     :rem 218
1380 DATA 24,60,86,126,102,60,24,102
                                     :rem 223
1390 DATA 255,219,165,219,219,165,219,255
                                     :rem 251
1400 DATA 136,33,0,148,1,72,2,16     :rem 19
1410 DATA 0,0,0,24,24,0,0,0          :rem 0
1420 DATA -1                         :rem 63
```

Program 4: Space Caverns For Apple

Version by Rob Terrell, Editorial Programmer

```
10  DIM AH(3),AV(3),XH(3),XV(3): POKE 2
    30,64: HCOLOR= 3: HPLOT 0,0: CALL
     - 3082: POKE 230,32
20  GOSUB 1150: GOTO 1610
30 RD = 1:NS = 3:BL = 1:BR = 40:BZ = 1:
    BB = 20
40  CALL 62450: HGR : HOME : GOTO 260
50  VTAB Y + 1:P =  PEEK (( PEEK (40) +
     PEEK (41) * 256) + X) - 128: RETURN

60 ST = 0:JX =  INT ( PDL (0) / 85): ON
    JX GOTO 90,80,80
70 DX =  - 1:DY = 0: RETURN
80 DX = 1:DY = 0: RETURN
90 JY =  INT ( PDL (1) / 85): ON JY GOTO
    120,110,110
100 DY =  - 1:DX = 0: RETURN
110 DY = 1:DX = 0: RETURN
120 DX = 0:DY = 0:ST = 1: RETURN
130  ON BF GOTO 150
140  VTAB 22: PRINT "ALIENS: ";AC; TAB(
    28);"SCORE: ";SC: PRINT  TAB( 16)"
    SHIPS: ";NS: RETURN
150  VTAB 22: PRINT "SCORE: ";SC; TAB(
    29);"TIME: ";CT;"  ": PRINT  TAB(
    17);"SHIPS: "NS: RETURN
160 EX(0) = DH:EX(1) = DH:EX(2) = DV:EX
    (3) = DV: POKE  - 16302,0: POKE  -
    16299,0: FOR W = 1 TO 30: NEXT W: POKE
     - 16300,0: FOR I = 1 TO 9
170 EX(0) = EX(0) - 1: IF EX(0) < 1 THEN
    EX(0) = 1
180 EX(1) = EX(1) + 1: IF EX(1) > BR THEN
    EX(1) = BR
190 EX(2) = EX(2) - 1: IF EX(2) < BZ THEN
    EX(2) = BZ
200 EX(3) = EX(3) + 1: IF EX(3) > BB THEN
    EX(3) = BB
210  HTAB EX(0): VTAB EX(2): PRINT "*":
     HTAB EX(0): VTAB EX(3): PRINT "*"

220  HTAB EX(1): VTAB EX(2): PRINT "*":
     HTAB EX(1): VTAB EX(3): PRINT "*"

230  IF I / 2 =  INT (I / 2) THEN  POKE
     - 16299,0: FOR W = 1 TO 10: NEXT
    W: POKE  - 16300,0
240  POKE 865,90 - 10 * I: POKE 864,1: CALL
    866: POKE  - 16336,0: POKE  - 1633
    6,0: NEXT I:LE = LE - 1
250 NS = NS - 1: IF NS = 0 THEN 1580
260 LE = LE + 1: IF RD + 2 = (LE) THEN
    CT = 200 - (RD + 2) * 10:BF = 1: GOTO
    1040
270  HOME : TEXT : VTAB 10: PRINT  TAB(
    16);"LEVEL "RD: VTAB 14: PRINT  TAB(
    16);"ROUND "LE: FOR W = 1 TO 500: NEXT
    W:LB = LE
280  POKE 230,32: CALL 62450: GOSUB 910

290 DX = 0:DY = 0
300 BL = LB + 1:BR = 40 - LB:BZ = 1 + L
    B:BB = 20 - LB
310  IF RD <  = 5 THEN AH(0) = BL + 3:A
    V(0) = BZ + 3:AH(1) = BL + 30:AV(1
    ) = BZ + 3:AH(2) = BL + 30:AV(2) =
    BB - 2:AH(3) = BL + 5:AV(3) = BB -
    4
320 NA = 3:AC = 0:DH = 20:DV = 10:LV =
    3:LH = 20
```

Obstacles begin appearing on higher-level rooms in the Apple version of "Space Caverns."

```
330  IF BF THEN  RETURN
340  GOSUB 130
350  GOSUB 60
360 PC = 75 - PC
370 ST = 0
380  IF DX = 0 AND DY = 0 THEN ST = 1
390 DH = DH + (DX = 1) - (DX =  - 1) +
     (DH = BL AND DX =  - 1) * 1 - (DH =
     BR AND DX = 1) * 1
400 DV = DV + (DY = 1) - (DY =  - 1) +
     (DV = BZ AND DY =  - 1) * 1 - (DV =
     BB AND DY = 1) * 1
410 X = DH - 1:Y = DV - 1: GOSUB 50: IF
     P = 36 THEN H = 1
420  IF P = 35 THEN ST = 1:DH = DH - DX
     :DV = DV - DY
430  HTAB DH: VTAB DV: PRINT  CHR$ (PC)
440  ON ST GOTO 460
450  HTAB LH: VTAB LV: PRINT  CHR$ (32)
460 LV = DV:LH = DH
470  ON BF GOTO 1060
480  IF H = 1 THEN H = 0: GOTO 160
490  ON ST GOTO 530
500  ON ( PEEK ( - 16287) > 127 AND  NOT
     BF) GOTO 520
510  GOTO 530
520 MH = DH:MV = DV:MH(1) = MH:MV(1) =
     MV: GOSUB 660
530  ON (AC = 4) GOTO 550
540  GOTO 560
550  GOSUB 750: GOTO 260
560  FOR RA = 0 TO NA
570  ON (AH(RA) = EE) GOTO 640
580 XH(RA) = AH(RA):XV(RA) = AV(RA)
590 AH(RA) = AH(RA) + (DH > AH(RA)) - (
     DH < AH(RA))
600 AV(RA) = AV(RA) + (DV > AV(RA)) - (
     DV < AV(RA))
610  IF AH(RA) = DH AND AV(RA) = DV THEN
     160
620  HTAB AH(RA): VTAB AV(RA): PRINT "$
     "
630  HTAB XH(RA): VTAB XV(RA): PRINT  CHR$
     (32)
640  NEXT RA
650  GOTO 350
660 MH = MH + DX:MV = MV + DY
670  IF MH + 2 = BL OR MH - 2 = BR OR M
     V + 2 = BZ OR MV - 2 = BB THEN  RETURN
680  FOR TA = 0 TO NA
690  IF MH = AH(TA) AND MV = AV(TA) THEN
     SC = SC + 50 * (TA + 1): GOSUB 840
     :AC = AC + 1: GOSUB 130:AH(TA) = 0
700  NEXT TA
710  HTAB MH: VTAB MV: PRINT  CHR$ (34)
720  HTAB MH - DX: VTAB MV - DY: PRINT
     " "
730  HTAB DH: VTAB DV: PRINT "%"
740  GOTO 660
750  VTAB DV: HTAB DH: PRINT "%": FOR B
     U = 1 TO DH
760  FOR W = 1 TO 10: NEXT W
770  VTAB DV: HTAB BU: PRINT "?"
780  NEXT BU
790  VTAB DV: HTAB DH: PRINT " "
800  FOR BU = DH TO 1 STEP  - 1
810  FOR W = 1 TO 10: NEXT W
820  VTAB DV: HTAB BU: PRINT " % "
830  NEXT BU: RETURN
840  FOR ES = 1 TO 5
850  POKE 865, INT ( RND (ES) * 3) + 1
860  POKE 864,1: CALL 866
870  NEXT ES
880  RETURN
890 LE = 1:LB = 1
900  IF LE > 5 THEN LB = 5
910  HGR : HOME : POKE 54,0: POKE 55,3:
      CALL 1002: POKE 6,0: POKE 7,141
920  IF LB =  > 4 THEN LB = 4
930  FOR V = 1 TO LB: FOR I = 1 TO 40: PRINT
     "#";: NEXT I: NEXT V: HTAB 1
940  FOR C = LB TO 19 - LB: FOR I = 1 TO
     LB: PRINT "#";: NEXT I
950  HTAB 42 - I: FOR I = 1 TO LB: PRINT
     "#";: NEXT I: NEXT C
960  FOR V = 1 TO LB: FOR I = 1 TO 40: PRINT
     "#";: NEXT I: NEXT V
970  IF RD > 3 THEN  FOR I = 1 TO RD: HTAB
      INT ( RND (8) * (39 - (2 * LB)) +
     1): VTAB  INT ( RND (9) * (19 - (2
      * LB))) + 1: PRINT "###": NEXT I
980  IF RD > 4 THEN  FOR I = 1 TO 7: VTAB
     6: HTAB I + 16: PRINT "#": NEXT I:
      FOR I = 1 TO 6: HTAB 16: PRINT "#
     "; SPC( 7);"#": NEXT I: FOR I = 1 TO
     7: VTAB 13: HTAB I + 16: PRINT "#"
     : NEXT I: IF BF THEN  HTAB 20: VTAB
     13: PRINT  SPC( 1)
990  IF RD > 5 THEN AH(0) = 15:AV(0) =
     5:AH(1) = 25:AV(1) = 5:AH(2) = 15:
     AV(2) = 14:AH(3) = 25:AV(3) = 14
1000  RETURN
1010  GOSUB 890
1020  GOSUB 60
1030 DH = DH + DX:DV = DV + DY
1040  TEXT : HOME : VTAB 12: PRINT  TAB(
     15)"BONUS ROUND": FOR W = 1 TO 600
     : NEXT W: IF CT < 20 THEN CT = 20
1050 TB = LB:LB = 1: GOSUB 280: GOTO 10
     90
1060 CT = CT - 1: IF CT > 0 AND P <  >
     33 THEN 340
1070  IF CT = 0 THEN RD = RD + 1:LE = 0
     :BF = 0: GOTO 260
1080 SC = SC + 100
1090 BX =  INT ( RND (JX) * 36) + 2:BY =
      INT ( RND (JY) * 16) + 2: IF BX =
     DH OR BY = DV THEN BX = BX + 3:BY =
     BY + 2
1100  IF BX = 1 OR BX = 40 THEN 1090
1110  IF BY = 1 OR BY = 20 THEN 1090
1120  POKE 865,60: POKE 864,1: CALL 866
     : POKE 865,60: POKE 864,1: CALL 86
```

```
    6: POKE 865,60: POKE 864,1: CALL 8
    66
1130  HTAB BX: VTAB BY: PRINT "!"
1140  GOTO 350
1150  TEXT : HOME : VTAB 22: INVERSE : HTAB
    14: PRINT "PLEASE WAIT": NORMAL
1160  GOSUB 1200: REM  DATA
1170  VTAB 9: PRINT  TAB( 17);"SPACE": GOSUB
    1340
1180  VTAB 14: PRINT  TAB( 16);"CAVERNS
    ": GOSUB 1510
1190  FOR I = 1 TO 1000: NEXT : RETURN
1200  FOR I = 768 TO 855: READ A:X = X +
    A: POKE I,A: NEXT
1210  IF X <  > 8158 THEN  PRINT "ERROR
     IN DATA": STOP
1220  RETURN
1230  DATA  216,120,133,69,134,70,132,7
    1
1240  DATA  166,7,10,10,176,4,16,62
1250  DATA  48,4,16,1,232,232,10,134
1260  DATA  27,24,101,6,133,26,144,2
1270  DATA  230,27,165,40,133,8,165,41
1280  DATA  41,3,5,230,133,9,162,8
1290  DATA  160,0,177,26,36,50,48,2
1300  DATA  73,127,164,36,145,8,230,26
1310  DATA  208,2,230,27,165,9,24,105
1320  DATA  4,133,9,202,208,226,165,69
1330  DATA  166,70,164,71,88,76,240,253
1340  FOR I = 36192 TO 36864: POKE I,0:
     NEXT
1350 X = 0: FOR I = 36096 TO 36192: READ
    A:X = X + A: POKE I,A: NEXT
1360  IF X <  > 4993 THEN  PRINT "ERROR
     IN DATA": STOP
1370  RETURN
1380  DATA  0,0,0,0,0,0,0,0
1390  DATA  136,156,162,227,162,156,136
    ,128
1400  DATA  73,42,8,127,8,42,73,0
1410  DATA  28,34,65,65,65,65,34,28
1420  DATA  62,65,85,65,34,28,54,119
1430  DATA  8,20,34,73,34,20,8,0
1440  DATA  0,8,20,42,20,8,0,0
1450  DATA  130,160,136,130,160,136,162
    ,128
1460  DATA  128,128,128,128,128,128,128
    ,128
1470  DATA  0,0,0,0,0,0,0,0
1480  DATA  0,0,0,0,0,0,0,0
1490  DATA  0,0,0,0,0,0,0,0
1500  DATA  0
1510 X = 0: FOR ML = 864 TO 891
1520  READ A:X = X + A: POKE ML,A: NEXT
    ML
1530  IF X <  > 3815 THEN  PRINT "ERROR
     IN DATA": STOP
1540  RETURN
1550  DATA  0,115,172,97,3,174,97,3,232
    ,208,253,169
1560  DATA  4,32,168,252,173,48,192,136
    ,208,239,206
1570  DATA  96,3,208,231,96
1580  HOME : TEXT : VTAB 12: HTAB (15):
     PRINT "GAME OVER": FOR W = 1 TO 1
    000: NEXT : FOR I = 0 TO 2
1590  IF SC > HS(I) AND  NOT FF THEN HS
    (I + 1) = HS(I):HS(I) = SC:FF = 1
1600  NEXT I
1610 FF = 0: TEXT : HOME : VTAB 4: PRINT
     TAB( 13);"SPACE CAVERNS": VTAB 8:
     PRINT  TAB( 14)"HIGH SCORES"
1620  FOR I = 0 TO 2: VTAB 10 + I * 2: PRINT
     TAB( 17);HS(I): NEXT I:
```

A yellow ship in the IBM version of "Space Caverns" indicates this player must reload his laser gun before shooting.

```
1630  VTAB 18: PRINT  TAB( 5)"PRESS THE
     FIRE BUTTON TO PLAY"
1640  IF  PEEK ( - 16287) < 128 AND  PEEK
    ( - 16384) < 128 THEN 1640
1650  POKE  - 16368,0:SC = 0:LE = 0:PC =
    37: GOTO 30
```

Program 5: Space Caverns For IBM PC/PCjr

Version by Kevin Martin, Editorial Programmer

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

```
JI 10 DEF SEG=0
QI 20 WIDTH 40:KEY OFF
OH 30 CLS:COLOR 7:LOCATE 9,13,0:PRINT"Spa
      ce Caverns"
CG 40 LOCATE 12,14:PRINT"High Scores"
PM 50 PRINT:PRINT SPC(17)H1
AF 60 PRINT:PRINT SPC(17)H2
CO 70 PRINT:PRINT SPC(17)H3
AA 80 LOCATE 20,10:PRINT"Press SPACE to p
      lay"
JD 90 IF INKEY$<>" " THEN 90
IA 100 L=1:S=0:R=0:SH=3:Q=0
JB 110 IF R=L*2 THEN L=L+1:R=0:GOSUB 970
NF 120 CO=14
OH 130 CLS:COLOR 7:LOCATE 9,16:PRINT"Room
      :"R+1
IB 140 LOCATE 12,16:PRINT"Level:"L
ID 150 FOR I=1 TO 1000:NEXT I
EA 160 Y1=L+1:X1=L+1:Y2=L+1:X2=40-L:X3=40
      -L:Y3=22-L:Y4=22-L:X4=L+1:A1=1:A2=
      1:A3=1:A4=1
MC 170 CLS:COLOR 4:FOR I=1 TO 23:LOCATE I
      ,1:PRINT CHR$(177):LOCATE I,40:PRI
      NT CHR$(177):NEXT I
IG 180 FOR I=5 TO 17:LOCATE I,5:PRINT CHR
      $(177):LOCATE I,35:PRINT CHR$(177)
      :NEXT I
ME 190 FOR I=9 TO 13:LOCATE I,10:PRINT CH
      R$(177):LOCATE I,30:PRINT CHR$(177
      ):NEXT I
KE 200 IF S>10000 AND Q=0 THEN LOCATE 24,
      15:PRINT"EXTRA SHIP";:SH=SH+1:Q=1
```

```
OE 210 LOCATE 1,1:PRINT STRING$(40,177):L
       OCATE 5,5:PRINT STRING$(30,177):LO
       CATE 9,10:PRINT STRING$(20,177)
GH 220 LOCATE 22,1:PRINT STRING$(40,177):
       LOCATE 17,5:PRINT STRING$(30,177):
       LOCATE 13,10:PRINT STRING$(20,177)
OH 230 X=INT(RND(1)*10)+15:Y=INT(RND(1)*6
       )+8:IF SCREEN(Y,X)<>32 THEN 230
HK 240 LOCATE 11,5:PRINT STRING$(31,32):L
       OCATE 5,20:PRINT" ":LOCATE 9,20:PR
       INT" ":LOCATE 13,20:PRINT" ":LOCAT
       E 17,20:PRINT" "
HN 250 COLOR CO:LOCATE Y,X:PRINT CHR$(1);
FA 260 IF X=X1 AND Y=Y1 THEN 830
HB 270 IF X=X2 AND Y=Y2 THEN 830
JC 280 IF X=X3 AND Y=Y3 THEN 830
LD 290 IF X=X4 AND Y=Y4 THEN 830
EC 300 COLOR 3:LOCATE Y1,X1:PRINT CHR$(23
       4);
IB 310 LOCATE Y2,X2:PRINT CHR$(234);
KA 320 LOCATE Y3,X3:PRINT CHR$(234);
MP 330 LOCATE Y4,X4:PRINT CHR$(234);
GE 340 COLOR 7,0:LOCATE 25,5:PRINT"Score:
       ";S;:LOCATE 25,30:PRINT"Ships:";SH
       ;
JG 350 IF (A1+A2+A3+A4)=0 THEN 780
DI 360 A$=INKEY$:POKE 1050,PEEK(1052):IF
       A$=" " AND CO=15 THEN 470
FC 370 IF A$="" THEN 610
MG 380 IF A$="i" THEN YA=-1:XA=0
GE 390 IF A$="k" THEN YA=1:XA=0
NJ 400 IF A$="j" THEN XA=-1:YA=0
GG 410 IF A$="l" THEN XA=1:YA=0
MA 420 IF A$="r" THEN CO=15
BJ 430 IF XA=0 AND YA=0 THEN 610
JB 440 LOCATE Y,X:PRINT" ";
CI 450 IF SCREEN(YA+Y,XA+X)=32 THEN X=X+X
       A:Y=Y+YA
FI 460 GOTO 610
OJ 470 FOR I=170 TO 200:SOUND I,.11:NEXT
FD 480 CO=14:IF YA=-1 THEN J=X:FOR I=Y-1
       TO 1 STEP -1:GOSUB 530:IF B THEN N
       EXT I
LF 490 IF YA=1 THEN J=X:FOR I=Y+1 TO 22:G
       OSUB 530:IF B THEN NEXT I
CD 500 IF XA=-1 THEN I=Y:FOR J=X-1 TO 1 S
       TEP -1:GOSUB 530:IF B THEN NEXT J
OL 510 IF XA=1 THEN I=Y:FOR J=X+1 TO 40:G
       OSUB 530:IF B THEN NEXT J
EB 520 GOTO 610
MM 530 B=-1:IF J=X1 AND I=Y1 THEN A1=0:X1
       =1:Y1=24:S=S+50:B=0
GF 540 IF J=X2 AND I=Y2 THEN A2=0:X2=2:Y2
       =24:S=S+100:B=0
QM 550 IF J=X3 AND I=Y3 THEN A3=0:X3=3:Y3
       =24:S=S+150:B=0
OC 560 IF J=X4 AND I=Y4 THEN A4=0:X4=4:Y4
       =24:S=S+200:B=0
LC 570 IF SCREEN(I,J)<>32 THEN B=0
DP 580 IF SCREEN(I,J)=177 THEN RETURN
FK 590 LOCATE I,J:PRINT CHR$(249);:FOR K=
       1 TO 10:NEXT K:LOCATE I,J:PRINT" "
       ;
MA 600 RETURN
AG 610 IF A1=0 THEN 650
PL 620 LOCATE Y1,X1:PRINT " ";
CB 630 X1=X1+(X1>X)-(X1<X)
HE 640 Y1=Y1+(Y1>Y)-(Y1<Y)
GD 650 IF A2=0 THEN 690
BA 660 LOCATE Y2,X2:PRINT " ";
GJ 670 X2=X2+(X2>X)-(X2<X)
LM 680 Y2=Y2+(Y2>Y)-(Y2<Y)
BE 690 IF A3=0 THEN 730
CC 700 LOCATE Y3,X3:PRINT " ";
IO 710 X3=X3+(X3>X)-(X3<X)
NB 720 Y3=Y3+(Y3>Y)-(Y3<Y)
GO 730 IF A4=0 THEN 770
EH 740 LOCATE Y4,X4:PRINT " ";
LG 750 X4=X4+(X4>X)-(X4<X)
BJ 760 Y4=Y4+(Y4>Y)-(Y4<Y)
FB 770 GOTO 250
EI 780 N=N+1:LOCATE 24,15:PRINT"Next Room
       ";
CM 790 COLOR 1:FOR I=1 TO X:LOCATE Y,I:PR
       INT CHR$(205);:NEXT
NF 800 COLOR 14:FOR I=X TO 1 STEP -1:LOCA
       TE Y,I:PRINT CHR$(1);" ";:NEXT
OA 810 CLS:COLOR 7:LOCATE 12,14:PRINT"Bon
       us:";L*500+R*50:S=S+L*500+R*50:R=R
       +1
FB 820 FOR I=1 TO 1000:NEXT:GOTO 110
GJ 830 FOR I=200 TO 170 STEP -1:SOUND I,1
       :NEXT
JA 840 X1=X-1:X2=X+1:Y1=Y-1:Y2=Y+1
IM 850 FOR I=1 TO 20
DL 860 LOCATE Y1,X1:PRINT CHR$(177);
EN 870 LOCATE Y1,X2:PRINT CHR$(177);
FM 880 LOCATE Y2,X2:PRINT CHR$(177);
EO 890 LOCATE Y2,X1:PRINT CHR$(177);
AB 900 IF X1>1 THEN X1=X1-1
HA 910 IF X2<40 THEN X2=X2+1
DE 920 IF Y1>1 THEN Y1=Y1-1
KH 930 IF Y2<22 THEN Y2=Y2+1
ON 940 NEXT
DF 950 SH=SH-1:IF SH=0 THEN 1150
CL 960 GOTO 110
MI 970 T=200+L*60:X=20:Y=11
FI 980 CLS:LOCATE 24,14:COLOR 7:PRINT"Bon
       us Round";
IC 990 COLOR 4:FOR I=1 TO 23:LOCATE I,1:P
       RINT CHR$(177):LOCATE I,40:PRINT C
       HR$(177):NEXT I
LG 1000 LOCATE 1,1:PRINT STRING$(40,177):
        LOCATE 22,1:PRINT STRING$(40,177)
EH 1010 X1=INT(RND(1)*40)+1:Y1=INT(RND(1)
        *20)+1:IF SCREEN(Y1,X1)<>32 THEN
        1010
ID 1020 LOCATE Y1,X1:COLOR 1:PRINT CHR$(2
        34);:GOTO 1040
GC 1030 IF SCREEN(Y,X)=234 THEN S=S+T:GOT
        O 1010
CP 1040 LOCATE Y,X:COLOR 14:PRINT CHR$(1)
        ;
QP 1050 LOCATE 25,1:COLOR 7:PRINT"Score:"
        ;S;:LOCATE 25,30:PRINT"Time:";T;
OI 1060 A$=INKEY$:POKE 1050,PEEK(1052):IF
         A$="" THEN 1130
OB 1070 XA=0:YA=0
MN 1080 IF A$="i" THEN YA=-1
HB 1090 IF A$="k" THEN YA=1
KP 1100 IF A$="j" THEN XA=-1
FD 1110 IF A$="l" THEN XA=1
MM 1120 IF SCREEN(Y+YA,X+XA)<>177 THEN LO
        CATE Y,X:PRINT" ";:X=X+XA:Y=Y+YA
IF 1130 T=T-1:IF T=0 THEN RETURN
KL 1140 GOTO 1030
HO 1150 IF S>H1 THEN H3=H2:H2=H1:H1=S:GOT
        O 1180
HP 1160 IF S>H2 THEN H3=H2:H2=S:GOTO 1180
LA 1170 IF S>H3 THEN H3=S
EJ 1180 CLS:COLOR 4:LOCATE 12,15:PRINT"Ga
        me Over"
MK 1190 FOR I=1 TO 1000:NEXT I
HA 1200 GOTO 30
```

Intelligent Appliances, Canadian Showers, Toddlers, And Mice

Recently I was Science Guest of Honor at the ninth annual Rovacon science fiction convention in Roanoke, Virginia. Among my duties were presenting science scholarships to young people, sitting on panel discussions about computers, science, and technology, and delivering a speech. One of the things I talked about was the career opportunities for young people in the future world of intelligent appliances.

You don't hear much talk about intelligent appliances. Personal computers are currently the hot item. Computer software alone has turned into a major business. Four thousand companies now make almost 30,000 programs. Last year people bought more than $2.3 billion worth of software. Experts predict that by 1987 more than $11 billion worth of software will be sold. That would make the computer software industry larger than the book publishing industry!

But what some people may not realize is that not all of the software sold in 1987 will be for desktop computers. The desktop computer is only one star in a constellation of intelligent appliances that will soon be found in people's homes, offices, and classrooms.

The key to the future is not the personal computer; it is the computer *microchip*—the little flake of silicon with thousands of transistors embedded in its hair-thin surface. Most computers now use dozens of these little microchips, and they have allowed computers to shrink smaller and smaller. Like Alice in Wonderland, growing smaller has enabled computers to enter new worlds.

A Computer In Your Clothes

In the near future, all sorts of commonplace items will have microcomputers embedded inside them. And with computers come intelligence. We will have intelligent desks, intelligent walls, intelligent refrigerators, even intelligent clothes. With microcomputers inside our clothes we will be able to drape ourselves in intelligence.

We're already beginning to see microcomputers buried in people's bodies (in pacemakers and prosthetic limbs) or riding on a person's hip. Deaf people are using belt-mounted microcomputers to hear; people with impaired vision are using computers to see.

Intelligent appliances of the future will do more than just compute. They will also have sensors—electronic sense organs. Thus, they will be aware of the world around them. And they will have tiny voices to alert a person when something is wrong, or just to begin a conversation or give a status report.

Certainly there will be "computers" and "robots" (mobile computers with arms and/or wheels) in the future. But these will make up only a fraction of the crowd of intelligent ma-

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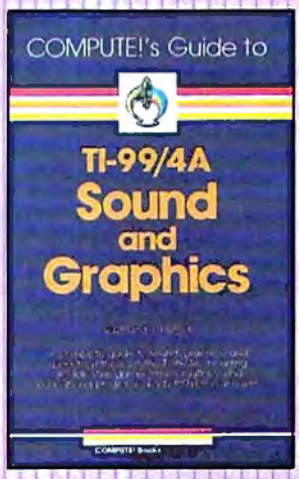

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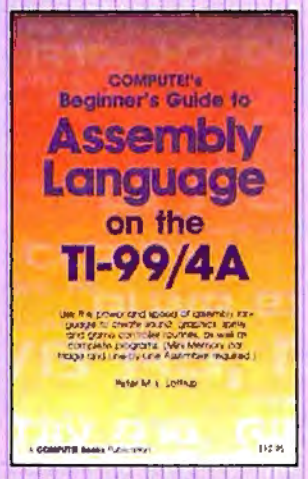

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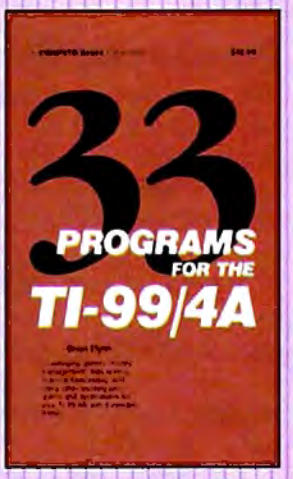

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chines that will move into our schools, offices, and homes.

Many of these machines still haven't been invented—or even imagined. Experts forecast a huge growth in the intelligent appliance industry. Intelligent appliances will open up tremendous career opportunities for young people entering the job market in the 1990s and the twenty-first century.

Opportunity Knocks

The opportunities will come in at least four areas. First, we'll need *inventors* to dream up these new appliances. Undoubtedly, there will be a new crop of millionaires in the late 1980s and 1990s who will get their start in basement and garage workshops.

Second, someone with business savvy and entrepreneurial abilities will have to *manufacture and market* these new intelligent appliances. As events in the personal computer industry have shown, this is the area where the biggest fortunes can be made.

Third, there is going to be a great need for *software developers* to program the appliances.

Fourth, there will be a need for *communicators and educators* who can make the appliances friendly, useful, and understandable to the average person.

The average person is already overwhelmed by talking cars, intelligent telephones, digital watches with 40 functions, and computerized bank tellers. But these machines are just the tip of the intelligent-appliance iceberg. We will soon be surrounded by babbling, rolling, and beeping intelligent machines.

To make matters worse, the machines will seem to be telepathic. They will be communicating at millions of bits a second by radio or infrared signals, and their conversations will be unseen and unheard. Human beings will rarely have a clue about what is going on within their own appliances' brains.

Older people, especially, will need help adjusting to this world. And this help can be turned into million-dollar careers for smart young people who can hold their elders' hands and gently lead them into the brave new world of intelligent appliances.

Bathroom Antics

In my column in the October 1984 COMPUTE!, I related a humorous anecdote about an experience I had while attending an educational computing conference in Toronto, Canada. I couldn't figure out how to turn off the shower in my hotel room. I wrote: "I clenched my teeth and coldly reasoned that if the shower didn't shut off by turning to the right, it must have a reverse screw in the handle. This made sense. I was in Canada, wasn't I? Canada is a foreign country. In Canada they probably used reverse screws for everything."

To turn off the water, I reasoned that I had to turn the handle to the left. I did this and got a blast of hot water. At this point I realized that I was not dealing with a left-right handle, but a *push-pull* handle. I immediately pushed the handle, and the shower turned off.

Since the article appeared, I have received numerous letters from readers in Canada who have complained about my anti-Canadian article and my bad-mouthing Canadian showers. Here is an example.

"Dear Fred: In your article that was published in the October issue of COMPUTE!, you said 'I was in Canada, wasn't I? Canada is a foreign country. In Canada they probably used reverse screws for everything.' Well, in Canada we don't have reverse screws for everything. We use screws with right threads. I hope you were not saying this to be insulting to Canadians. I am a Canadian and proud of it. You might have offended several Canadians by that quote. I hope that you said it as a joke. Please send a reply. I am only 14 years of age and enjoy reading COMPUTE! and your articles. Sincerely yours, David Kirsch, Chilliwack, British Columbia."

In response to David's letter and all the others I received from Canadian readers, I'm very sorry if I offended you. I was poking fun at *myself*, not Canadians. I definitely did not mean anything negative about Canada or Canadian showers. It's just that often, things are done *differently* (and perhaps better) in other countries—including Canada.

(Maybe in my next column, just to set things right, I'll tell everyone about the shower I used in New Orleans at the Softcon Conference that squirted *mud* at me when I turned it on!)

Of Mice And Kids

I was talking the other night with Owen Greeson of MicroStuf, Inc. MicroStuf makes some wonderful products, including *Crosstalk XVI* (a communications program), *InfoScope* (a playful data base manager), and *Remote* (a program that lets you call your office computer from home—or anywhere else—and run it remotely like a mainframe computer).

Greeson and I were talking about ways to improve software to make it more "user-accommodating" (Greeson's term). Our discussion reminded him of his experience with his four-year-old daughter, Mikalee. Greeson had brought home an Apple Macintosh computer recently and had taught Mikalee how to use *MacPaint* (the drawing program) and the

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Macintosh mouse.

Mikalee really took to the mouse and became so adept at using *MacPaint* that she even began helping her father. Greeson said he had previously introduced her to a computer without a mouse, but she had balked at using the computer keyboard. Now, with the mouse, there was no stopping her. She had no trouble rolling the mouse around on the table, pushing the buttons, pointing at little pictures on the screen (icons), pulling down menus, and selecting commands. According to Greeson, the experience was so dramatic that he has become a "born-again icon believer."

I've told you this story because I've found the same thing to be true around my house. We, too, have a Macintosh, and my eight-year-old daughter Catie and my five-year-old son Eric love it. And I think that they love it because they can use the mouse and avoid the keyboard.

What do *you* think? Have your children had a chance to play with a mouse on a computer? If so, how have they done? Do you think that mice are a shortcut to computer literacy for young children? Please write and tell me your experiences:

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Bearmath

Gary West & Jim Bryan

This program tests youngsters on any of the four mathematical operations and has three levels of difficulty. After each set of ten problems, the program calculates a score and gives the option of another round. The article also explains two useful programming techniques: detecting a keypress in response to a screen prompt, and page flipping on the PCjr. The program requires an IBM PC with BASICA and the color/graphics adapter or a PCjr with Cartridge BASIC.

"Bearmath" is a helpful math drill program if you have school-age youngsters, but the program also serves another purpose—it demonstrates a couple of handy programming techniques. It shows how to trap keystrokes in response to screen prompts (that is, menus), and how to instantly flip between two alternate screens on the PCjr. First we'll explain how to use the program for those who aren't interested in programming.

If you have a PCjr, type in Program 1. If you have a PC, type in Program 1 and add the changes shown in Program 2. The modifications are required because the PC lacks the special screen-flipping commands found in PCjr Cartridge BASIC.

When you run Bearmath, it first asks you (or the youngster) to type your name. Don't type in a long name (more than about nine characters), because later in the program the screen might scroll an extra line and mess up the screen formatting. Next, the program draws the face of a friendly bear on the screen. The picture is also copied to an alternate screen hidden in a safe place in memory. After you press the space bar to continue, a menu appears. By pressing a single key, you can choose to practice with addition, subtraction, multiplication, or division. Then the program offers a choice of three skill levels.

Once the drill begins, the problems are presented one by one. After each correct answer, the friendly bear appears. If the answer was wrong, you get a second chance. If the second response is also incorrect, the program gives the correct answer.

Bearmath continues in this way through a set of ten problems, maintaining the score at the top of the screen. After the tenth problem, the program presents three options: You can press the space bar for another set of ten problems; press E to end the program and return to BASIC; or press P to print a score report. Before pressing P, make sure a printer is connected, powered up, and on-line. Otherwise, the program ends and returns to BASIC. If you hit P by accident, you can exit the printing mode and return to the previous screen by pressing E.

If you press the space bar for another set of problems, the program restarts from the beginning.

Trapping Keystrokes

There are several parts of this program which may interest those who want to learn a few BASIC programming techniques. One of the most common techniques used by programmers is a routine which waits for the user to press a key to either continue the program or select a menu option.

The first menu in Bearmath is displayed by lines 32–48:

```
[Your name],
Press the number you want:
1 for addition
2 for subtraction
3 for multiplication
4 for division
```

IBM BASIC (and nearly any extensive Microsoft BASIC) offers two general ways to detect keypresses: INPUT and INKEY$. In this case, since each menu option can be selected with one keystroke, it's easier to process the response with INKEY$ instead of INPUT. With INKEY$ only

one keystroke is needed, while INPUT requires, at minimum, two keystrokes—the menu choice and the Enter key. INKEY$ simply takes the next key pressed (or the next key in the keyboard buffer, if you pressed several keys in succession) and goes on.

INKEY$ requires that you test for the *absence* of a keypress, too—because, if no key is pressed, the INKEY$ function allows the program to continue as though no INKEY$ were there.

Line 54 in Bearmath contains one example of trapping for the absence of a keypress so that only the keys you want will be accepted. The menu selections are numbered 1, 2, 3, and 4. If you press any other key, line 54 loops back to itself to prevent the program from continuing:

```
54 A$=INKEY$:IF A$<>"1" AND A$<>"2"
AND A$<>"3" AND A$<>"4" THEN 54
```

Let's translate line 54 into English. This is a two-statement line, separated by a colon. The first statement, A$=INKEY$, tells the computer to read the keyboard and store any keystroke in the string variable A$. (You could use any string variable, of course, as long as you modified the rest of the line to agree.)

The second statement tests for which key was pressed. Remember that <> is the BASIC symbol for inequality, the opposite of =. In other words, line 54 tests for the *negative*—keypresses which *aren't* allowed. If it detects such a key, line 54 sends control back to line 54—repeating itself endlessly until one of the proper keys is pressed. If the key is acceptable (1, 2, 3, or 4), the program continues.

Another example of a menu with the appropriate traps can be seen in lines 61 (the menu) and 69 (the trap).

Checking For Letters

A special example of trapping is seen in lines 300, 920, and 9230. Here, the program waits until the space bar is pressed before going on to the next part of the program. For example:

```
9230 Q$=INKEY$:IF Q$<>" " THEN 9230
```

Again, the first part of this multiple-statement line reads the keyboard with INKEY$ and stores the keypress in a string variable, Q$. The second statement in the line checks to see if the keypress was not equal (<>) to a space. If the space bar is not pressed, the program repeats line 9230 endlessly. When the space bar *is* pressed, the program continues.

There aren't many complications when trapping for numbers or spaces. However, when trapping for letters, you must be more careful in building your traps. An example can be seen in lines 299–305. Line 299 gives you the option of pressing the E key to end the program, after line

Using a special screen-flipping technique, "Bearmath" instantly displays the face of a friendly bear to reward correct answers.

296 gives you the option of pressing the space bar to continue. Line 300 accepts whatever key you press and compares it to the acceptable responses. If the pressed key is not a space bar or an E or a P, the program goes back to look for another key:

```
300 Z$=INKEY$:IF Z$<>" " AND Z$<>"E"
AND Z$<>"e" AND Z$<>"P" AND Z$<>"p"
THEN 300
```

Notice that the trap includes tests for both the uppercase and lowercase letters so that either will be accepted. That way, it doesn't matter if the user's keyboard is in Caps Lock or standard mode.

The proper use of menus and traps can allow others who have no knowledge of the program to use it with little difficulty.

Screen Flipping

One of the features of Bearmath is that it displays the bear's friendly face as a small reward after each correct answer. But normally it takes the computer a few seconds to draw that face. If you had to wait for it to be drawn each time, you could easily become bored with the program. So Bearmath uses a different technique.

When you first run Bearmath, you'll see the face being drawn (by lines 9000–9140). After it's drawn, it is copied onto another video page. On the PCjr, Cartridge BASIC has a command that can flip to the alternate screen page instantly so the bear's face can be displayed without redrawing it each time.

Since the equivalent command is missing from BASICA on the PC, a short machine language routine was written to do the same thing, except it takes a fraction of a second longer. That's why PC users need to add the modifications in Program 2 to Program 1. The machine

language routine is created in the subroutine starting at line 10000 in Program 2. Unfortunately, an explanation of how this routine works is beyond the scope of this article.

On the PCjr the technique is much easier and can be done entirely in Cartridge BASIC. First, to flip back and forth between two or more screens, the program must set aside enough video memory to hold the screens you want to use. In this particular graphics mode (SCREEN 1), each screen requires 16K of memory. (Some graphics modes require as much as 32K.) So to use a second page, Bearmath must tell the computer to set aside another 16K of video memory. Look at line 2 in Program 1:

```
2 CLEAR,,,32768!:GOTO 8000
```

The CLEAR statement reserves a total of 32K of video memory so the program can use two pages for displays. The next statement branches to line 8000, where a subroutine asks for the user's name and then draws the bear.

Active & Visual Screens

The PCjr has two types of screen pages—the *active* page and the *visual* page. The active page is the one affected by BASIC commands which output to the screen—such as PRINT, LINE, CIRCLE, and so on. The visual page is the screen you're seeing at any moment—the screen actually displayed on the monitor.

Most of the time, the active page and the visual page are the same. But they don't have to be. When they are separated, the program can print messages or draw graphics on the active page without tipping off the user. The commands are taking effect, but invisibly to anyone looking at the monitor.

By adding extra parameters to the SCREEN statement, you can designate the active and visual pages. Line 8002 in Program 1 is an example:

```
8002 SCREEN 1,0,0,0
```

This statement sets the screen to graphics mode 1 (as in SCREEN 1) and turns on the color (the first 0). The next two zeros set the active page equal to the visual page. Thus, you can see the bear's face as it's being drawn for the first time when the program starts.

After the face is drawn, line 9159 in Program 1 copies it from page 0 to page 1:

```
9159 PCOPY 0,1
```

The rest is simple. When a math problem is answered correctly, the PCjr version of Bearmath displays the bear's face by just copying page 1 back to page 0:

```
9300 PCOPY 1,0
```

The PCOPY command, by the way, is the one that's missing from Advanced BASIC (BASICA) on the PC.

Checking The Answer

Bearmath processes your answer to a math problem in line 170 and checks it in line 180. The correct answer was calculated and assigned to the variable Q earlier, in lines 500–820. Your answer, assigned to the variable E, is subtracted from the correct answer. If the difference between your answer and the correct one is no more than .01, you are given credit for the problem. Then the program branches to the routine which copies the bear's face from the alternate screen page. You're told your answer was right and are given the option of pressing the space bar to continue.

Here's a brief outline of Program 1:

Lines	Description
8000–8050	Input user's name.
9000–9240	Draw bear's face and copy it to other page.
2–30	Setup.
32–70	Print menus for operations and levels.
100–111	Set up work screen.
120–140	Make up problems.
150–153	Branch to routine for right answer.
500–520	Calculate addition answer.
600–630	Calculate subtraction answer.
700–720	Calculate multiplication answer.
800–820	Calculate division answer.
160–190	Display problem, accept and check answer.
191–201	Branch to routine for right answer.
9300–9350	Report that answer is correct.
202–215	Give a second chance if first answer was wrong.
241–250	Report if second answer was also wrong.
280–310	Report score and option to continue or end.
900–930	Print various prompts on the screen.

Program 1: Bearmath (PCjr Version)

```
JB 1 REM BEARMATH/JR
GE 2 CLEAR,,,32768!:GOTO 8000
LB 6 COLOR 1,3
DD 7 RANDOMIZE TIMER
HL 10 CLS
LK 20 BLANK$="
                ":REM 34 SPACES
JJ 30 LET F=0
IB 32 LOCATE 3,5:PRINT NME$;","
GG 35 LOCATE 5,5
BC 40 PRINT "Press the number you want
   :":PRINT
LD 45 PRINT TAB(5);"1 for addition"
MI 46 PRINT TAB(5);"2 for subtraction"
DB 47 PRINT TAB(5);"3 for multiplicati
   on"
HM 48 PRINT TAB(5);"4 for division"
LF 50 LINE (1,1)-(300,100),2,B
CI 54 A$=INKEY$:IF A$<>"1" AND A$<>"2"
    AND  A$<>"3" AND A$<>"4" THEN 5
   4
NJ 55 A=VAL(A$)
CM 60 LOCATE 16,5
```

```
CN 61 PRINT TAB(5);"Level 1, 2, or 3"
OL 64 LINE (1,105)-(300,140),1,B
IF 69 B$=INKEY$:IF B$<>"1" AND B$<>"2"
      AND B$<>"3" THEN 69
NP 70 B=VAL(B$)
JI 100 FOR N=1 TO 10
HH 101 CLS:LOCATE 2,10
KL 102 PRINT F;:PRINT " correct so far
      "
HK 103 LINE (1,1)-(300,20),2,B:PRINT
LM 104 LOCATE 5,15:PRINT "Problem ";N
QJ 105 LINE (1,23)-(300,43),1,B:PRINT
MM 106 LOCATE 17,2:PRINT NME$;","
NK 107 LINE (1,115)-(300,140),1,B
QI 110 LOCATE 20,2:PRINT "Type your an
      swer and press Enter."
LN 111 LINE (1,145)-(300,165),2,B
EJ 120 LET W=10^B
FO 130 LET C=INT(RND(1)*W)+1
GK 131 LET D=INT(RND(1)*W)+1
FG 135 TRY=1
DB 140 IF A>2 THEN LET D=(INT(D/10^(B-
      1)))+1
LO 150 IF A=1 THEN GOTO 500
NB 151 IF A=2 THEN GOTO 600
PE 152 IF A=3 THEN GOTO 700
BH 153 IF A=4 THEN GOTO 800
KO 160 LOCATE 10,10:PRINT C;" ";S$;" "
      ;D;" = ";
CP 170 INPUT " ",E
FK 180 IF ABS(Q-E)>.01 THEN GOTO 202
JC 190 PRINT
PC 191 GOTO 9300
GD 200 LET F=F+1
FM 201 GOTO 260
CJ 202 PRINT:PRINT:IF TRY=2 THEN 241
NE 203 PRINT TAB(15);"Incorrect"
HP 204 PRINT:PRINT:TRY=2
KC 205 LINE (1,90)-(300,108),1,B
CE 207 PRINT TAB(15);NME$;",":PRINT TA
      B(15);"try again."
PK 208 LINE (1,115)-(300,140),2,B
QJ 210 LOCATE 20,2:PRINT "Type your an
      swer and press Enter."
QM 212 LOCATE 10,2:PRINT BLANK$
FA 215 GOTO 160
NG 241 PRINT TAB(15);"Incorrect"
IH 243 PRINT:PRINT:PRINT TAB(2);BLANK$
      :PRINT TAB(2);BLANK$
CH 244 LOCATE 16,10:PRINT "The correct
       answer is":PRINT TAB(18);Q
LK 245 LINE (1,90)-(300,108),1,B
PM 246 LINE (1,115)-(300,140),2,B
JL 250 GOSUB 900
AG 260 NEXT N
BM 270 CLS
GN 275 LNTH=LEN(NME$):SPOT=20-(.5*LNTH
      ):LOCATE 2,SPOT:PRINT NME$
LP 280 LOCATE 3,12:PRINT "Your score i
      s"
KF 281 LOCATE 4,12:PRINT F;" OUT OF 10
      "
CK 282 LINE (1,1)-(300,40),1,B
PC 290 FOR M=1 TO 100
AF 291 NEXT M
DO 295 PRINT:PRINT:PRINT
LL 296 PRINT TAB(10);"Press space bar
      ":PRINT TAB(17);"for"
JO 297 PRINT TAB(10);"next 10 problems
      "
IM 298 LINE (1,50)-(300,85),2,B
MC 299 PRINT:PRINT:PRINT:PRINT TAB(10)
      ;"Press E to end.":LINE (1,95)-
      (300,120),1,B:PRINT:PRINT:PRINT
      :PRINT TAB(3); "Press P to prin
      t score report.":LINE (1,127)-(
      300,152),2,B
DB 300 Z$=INKEY$:IF Z$<>" " AND Z$<>"E
      " AND Z$<>"e" AND Z$<>"P" AND Z
      $<>"p" THEN 300
EH 305 IF Z$="e" OR Z$="E" THEN CLS:LO
      CATE 12,16:PRINT "Goodbye!":LOC
      ATE 22,20:END
HO 310 IF Z$=" " THEN RUN
JK 320 CLS:LOCATE 2,3:PRINT "Please be
       sure that printer is on.":LINE
       (1,1)-(300,20),1,B
FI 325 LOCATE 5,4:PRINT "Press P to co
      ntinue printing.":LOCATE 7,6:PR
      INT "Press E to exit printing."
      :LINE (1,25)-(300,65),2,B
GK 330 PT$=INKEY$:IF PT$<>"P" AND PT$<
      >"p" AND PT$<>"E" AND PT$<>"e"
      THEN 330
LN 335 IF PT$="E" OR PT$="e" THEN 270
CA 340 FOR X=1 TO 60:LPRINT "+";:NEXT
      X:LPRINT " ":LPRINT:LPRINT
HO 345 LPRINT TAB(SPOT+10);NME$:
PA 350 LPRINT TAB(20);"worked with ope
      ration ":LPRINT TAB(30-.5*LEN(O
      P$));OP$:LPRINT TAB(24);" at le
      vel ";B$
JL 360 LPRINT:LPRINT TAB(13);"and work
      ed ";F;" out of 10 problems.":L
      PRINT:LPRINT:LPRINT TAB(35);"Th
      e bear":LPRINT TAB(35);DATE$:LP
      RINT:FOR X=1 TO 60:LPRINT "+";:
      NEXT X:LPRINT " "
GD 370 GOTO 270
KA 500 LET S$="+"
PB 505 OP$="ADDITION"
XB 510 LET Q=C+D
EG 520 GOTO 160
ML 600 LET S$="-"
GH 605 OP$="SUBTRACTION"
DP 610 IF C<D THEN SWAP C,D
MM 620 LET Q=C-D
FJ 630 GOTO 160
JF 700 LET S$="*"
BN 705 OP$="MULTIPLICATION"
JH 710 LET Q=C*D
FI 720 GOTO 160
NH 800 LET S$="/"
BD 805 OP$="DIVISION"
NE 810 LET Q=C/D
BD 811 IF Q<>INT(C/D) THEN C=C+1:GOTO
      810
FJ 820 GOTO 160
JI 900 PRINT
DL 901 IF N<10 THEN LOCATE 20,2:PRINT
      "Press space bar for next probl
      em. "
JB 910 IF N=10 THEN LOCATE 20,2:PRINT
      "Press space bar for your score
      .    "
ON 915 LINE (1,145)-(300,165),3,B
FB 920 D$=INKEY$:IF D$<>" " THEN 920
NJ 930 RETURN
MG 8000 CLS
HP 8001 KEY OFF:STRT=0
```

```
DN 8002 SCREEN 1,0,0,0
QN 8010 LOCATE 10,4:PRINT "Type your n
        ame and press Enter."
IP 8020 LINE (1,50)-(300,100),1,B
DN 8030 LINE (1,105)-(300,125),2,B
NM 8040 LOCATE 15,3
MP 8050 INPUT " ",NME$
GM 9000 PI=3.141593
NN 9020 CLS
GK 9030 COLOR 1,3
OG 9040 CIRCLE (120,50),10,1:PAINT (12
        0,50),1
PB 9045 CIRCLE (120,52),5,3:PAINT (120
        ,52),3
LF 9050 CIRCLE (200,50),10,1:PAINT (20
        0,50),1
MB 9055 CIRCLE (200,52),5,3:PAINT (200
        ,52),3
NM 9060 CIRCLE (120,50),20
MP 9070 CIRCLE (200,50),20
EM 9075 FOR K=148 TO 152
AA 9080 CIRCLE (160,0),K,2,1.4*PI,1.6*
        PI
KJ 9085 NEXT K
MN 9090 CIRCLE (160,52),50,,-1.4*PI,-1
        .6*PI
NB 9100 CIRCLE (160,86),100:PAINT (160
        ,86)
QM 9110 CIRCLE (160,100),50:PAINT (100
        ,100)
PB 9120 CIRCLE (75,25),20:PAINT (75,25
        )
BJ 9125 CIRCLE (75,28),10,2:PAINT (75,
        28),2
GE 9130 CIRCLE (245,25),20:PAINT (245,
        25)
QM 9135 CIRCLE (245,28),10,2:PAINT (24
        5,28),2
MA 9140 CIRCLE (160,52),50,0,-1.4*PI,-
        1.6*PI
HH 9142 LOCATE 4,2:PRINT "B":LOCATE 6,
        2:PRINT "E":LOCATE 8,2:PRINT "
        A":LOCATE 10,2:PRINT "R"
FB 9143 LOCATE 12,2:PRINT "M":LOCATE 1
        4,2:PRINT "A":LOCATE 16,2:PRIN
        T "T":LOCATE 18,2:PRINT "H"
PB 9150 PAINT (160,100),0
JB 9155 LINE (1,1)-(300,170),2,B
DC 9156 LINE (20,1)-(20,170),2
MP 9159 PCOPY 0,1
JN 9160 FOR Q=1 TO 5
FI 9170 COLOR Q,Q:FOR P=1 TO 150:NEXT
        P
BK 9180 BEEP
NM 9190 NEXT Q
FF 9200 COLOR 1,3
LE 9210 IF N<10 THEN LOCATE 23,7:PRINT
         "Press space bar to go on.
        "
GC 9211 IF N=10 THEN LOCATE 23,7:PRINT
         "Press space bar for score.
        "
EC 9220 LINE (1,173)-(300,187),2,B
PH 9230 Q$=INKEY$:IF Q$<>" " THEN 9230
CA 9235 IF STRT=0 THEN STRT=1:GOTO 6
PJ 9240 GOTO 200
JD 9300 PCOPY 1,0
PE 9305 LOCATE 23,7:PRINT NME$;", you
        are right!"
FG 9306 LINE (1,173)-(300,187),2,B
JF 9310 FOR X=1 TO 2
QM 9320 BEEP
LM 9330 FOR Y=1 TO 150:NEXT Y
BO 9340 NEXT X
PD 9350 GOTO 9200
```

Program 2: Beamath (Modifications For PC)

```
NO 2 GOSUB 10000:GOTO 8000
GP 6 CLS:COLOR 1,3
IJ 30 CLS:LET F=0
DG 9020 CALL Z:CLS
PF 9159 REM
CE 9235 IF STRT=0 THEN STRT=1:CALL Z:G
        OTO 6
JB 9240 CALL Z:GOTO 200
BC 9300 CALL Z
CM 9305 LOCATE 23,7:PRINT NME$;"  you
        are right!          "
MH 10000 DEF SEG:ML$=SPACE$(39):V=VARP
        TR(ML$):DEF FNML!(DUMMY)=PEEK
        (V+1)+256*PEEK(V+2)
FL 10010 RESTORE 10040:Z=FNML!(0):FOR
        I=0 TO 38:READ A:CKSUM=CKSUM+
        A:POKE Z+I,A:NEXT
LE 10020 IF CKSUM=3842 THEN RETURN
HB 10030 SCREEN 0,0,0:COLOR 31:PRINT"E
        rror";:COLOR 7:PRINT" in DATA
         statements.":END
DN 10040 DATA 85,30,190,0,0,187,0,16,1
        42,219,139,4,187,0,184,142,21
        9,135,4,187,0,16,142,219
II 10050 DATA 137,4,70,70,129,254,0,64
        ,114,227,31,93,202,0,0
```

Solo Flight

Arthur Leyenberger

Requirements: Commodore 64 or Atari with at least 48K RAM, a disk drive, and a joystick.

Solo Flight is the latest creation of Sid Meier of Microprose. Previous Microprose flight games like *Hellcat Ace* and *Spitfire Ace* were good efforts, but do not approach the complexity and sophistication of *Solo Flight.*

Solo Flight is a first-person, realtime flight simulator which allows you to experience the thrill of flying a light airplane. In this simulation you must master takeoffs, landings, navigation, instrument flying, and emergency procedures. A 3-D view and full set of instruments help you fly your aircraft.

There are two parts to the simulation: flying and the Mail Pilot game. Flying is fun in itself, but there is no specific goal other than practicing your flying and landing skills. To be successful, you must learn the rudiments of instrument flight, although seat-of-the-pants flying is fun and will get you in the vicinity of various airports.

A Real Joystick

Once you're airborne, and imagining yourself in that left seat, you can use the cursor keys to look out of the cabin to your right, left, or rear. The views appear directly above your instrument panel. At your fingertips are all of the typical aircraft controls, including the joystick—from which videogame joysticks derived their name. You pull back on the stick to climb, push forward to descend, and move the stick left or right to bank into turns.

The instrument panel on the bottom of the screen contains all of the information necessary to fly the plane in either clear or bad weather. There are indicator lights for brakes, landing gear, and engine temperature status. Gauges keep track of your airspeed, throttle, fuel, pitch, and compass headings. The two VOR (very high frequency omnidirectional range) readouts indicate the directional bearing from the VOR stations, and the ILS (instrument landing system) shows whether your landing approach is high, low, or at the proper altitude relative to your distance from the runway. An altimeter and artificial horizon/attitude indicator round out the set of instruments.

You can choose to fly in Kansas, Washington, or Colorado, and each state's terrain affects the difficulty level. Kansas is the best place to hone your flying techniques since it's mostly flat. Colorado, with its mountain ranges and airports located at various elevations, is the most difficult. Washington's terrain is somewhere in between.

Once you've logged a few practice hours in the cockpit, you're ready for the fun. The Mail Pilot game is not only challenging but very realistic. Your assignment is to deliver five bags of mail to their destination airports in the shortest

amount of time. You get a map of the whole area, and you must decide how much mail and fuel to take aboard. When you're ready to begin, you taxi out to the runway, power up, and take off.

After successfully landing at a destination airport, you receive points for navigation accuracy, elapsed time, your landing, and the amount of mail delivered. The screen then shows the original state map and the route you flew to reach the destination. As the game progresses, the weather gradually deteriorates. High winds, clouds, and occasional turbulence test your flying mettle. At the higher difficulty levels your plane is also prone to mechanical and instrument failures. The engine may overheat and various instruments may stop operating.

Bargain-Basement Flying

Solo Flight has many other features as well, such as the capability to design your own instrument approach to any of the 21 airports in the Mail Pilot game. The 15-page manual is well-written and provides information on instrument flying, instrument approaches, VOR navigation, and flying tips. It also includes sample landing approaches: a low-altitude approach to Wichita, a high-altitude approach to Denver, and a box ILS-pattern approach to Portland.

As a simulation, *Solo Flight* is excellent. The graphics are not quite as good as those found in the *Microsoft Flight Simulator* for the IBM PC/PCjr, but that's hardly a problem. As a game, it is not only entertaining but also educational. After just a few flying lessons in a Cessna, I realized I couldn't afford to complete my pilot's license, so I found *Solo Flight* to be most appealing.

Solo Flight
Microprose
10616 Beaver Dam Road
Haunt Valley, MD 21031
$34.95

An Open Letter To The User Community

SPA

Software Publishers Association

Dear User Group President and Bulletin Board Sysop:

Although the microcomputer software industry receives ample coverage by the media, the focus is generally on software and hardware developers and vendors. We frequently forget that there is another group of heroes that gets insufficient credit for promoting the growth of our unique industry. The Software Publishers Association, the trade association of over one hundred publishers of microcomputer software, salutes you, the user group president and bulletin board sysop, as an unsung hero. Space prohibits us from detailing the extent of your contribution to the growth of the microcomputer industry. Suffice it to say, however, that without the growth of hundreds of user groups and electronic bulletin boards, the industry would not be where it is today.

Just as user groups and electronic bulletin boards have promoted the growth of the industry, these same groups hold the key to the solution of one of the most difficult problems now facing the software industry—the unauthorized duplication and distribution of microcomputer software. The problem is not new. What is new, however, is the extent of the lawlessness involved. The law is clear. It is a violation of U.S. Copyright Law to reproduce software (except for purely personal archive purposes) without authorization. The penalties are also clear. Violators are subject to fines of up to $50,000 and prison terms of up to five years. Since the violation of the copyright laws is a federal offense, the FBI has become increasingly involved in enforcing the law. The software industry has sought to deal with this problem in several ways. One has been an "arms race" of copy-protection systems. Another has been litigation against offending companies, user groups, and bulletin board operators.

There must be a better way for the software industry and the user group community to work together to protect everyone's rights. We seek a dialogue with leaders of user groups and bulletin board sysops. Let's hear from you.
Please direct your comments to:

Department P
Software Publishers Association
Suite 1200
1111 19th Street, N.W.
Washington, D.C. 20036

Sincerely,

Kenneth A. Wasch

Kenneth A. Wasch
Executive Director

About the Software Publishers Association

Formed in April 1984 by leading publishers of microcomputer software, the SPA has grown to include more than 100 firms, representing all of the major segments of the microcomputer software industry: business, home, entertainment, and education. The members of the SPA recognize that the future health and growth of the microcomputer industry depends on establishing a partnership among all segments of that industry, including the most important segment—the computer user.

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The Print Shop For Apple, Atari, And Commodore 64

Karen G. McCullough

System requirements: Apple II-series computer (or Apple III in emulation mode) with at least 48K RAM, a disk drive, DOS 3.3, and a printer; Atari computer with at least 48K RAM, a disk drive, and a printer; Commodore 64 with a disk drive and a printer.

Home computer software can be divided into two broad categories. One includes educational and entertainment software, generally featuring attention-grabbing graphics and animation. On the other side is home management and productivity software, like home accounting packages and word processors. *The Print Shop*, from Brøderbund, spans the two categories and can significantly enhance the usefulness of a home computer. Never before has a program this practical been so much fun to use.

The Print Shop turns your computer into a small printing press. It allows you to design and print your own signs, banners, greeting cards, and letterheads. It has a large selection of predrawn pictures and designs, a variety of border styles, and eight type fonts—all of which can be combined in various ways for different effects. Additional features include a graphics editor to let you create your own artwork, and kaleidoscope images which can be frozen, saved, and incorporated into other designs. You can load high-resolution pictures created with other graphics programs and print them out, and you can even save designs created with *The Print Shop* for use in your own programs.

Clear Instructions

The first page of the user's manual suggests that you don't need to read the manual to start using *The Print Shop*, and it's not an exaggerated claim. The program's menus and prompts give all the help you need. But before you can start printing you have to run a setup procedure, and for this we found the manual useful.

Although it is short (only 25 pages) the manual is well-organized, clearly written, and easy to use. The "Getting Started" section guides you through the setup procedure step by step. Like the rest of the program, this procedure is made as painless as possible. By moving the cursor over a series of choices and pressing RETURN when the correct one is highlighted, you tell the program what kind of printer and interface you are using, the slot number of the printer interface (for Apple II+ and IIe computers), and the number of disk drives you have. With that information, the program configures itself, and a test procedure lets you know immediately whether the setup is correct.

All of *The Print Shop* functions are explained in the same clear manner. The "Greeting Card" section serves as a tutorial as well. Most people will probably want to abandon the manual at this point and just start playing with the program. However, the last few pages give some creative ideas for using the program, printer tips, and some sample designs.

Even if you have no previous computer experience, you can probably sit down with *The Print Shop* and soon be creating your own signs, banners, and cards.

The program is pretty thoroughly error-proof. It ignores incorrect responses or keypresses, and there is little else you can do that the program can't handle. During our review, the combined efforts of a six-year-old and an eight-year-old, working on their own, could not crash *The Print Shop*. At the worst, we pressed the RESET button (on the Apple), which caused the program to reload and erase the project we were working on at the time.

Figure 1: A sample greeting card before folding

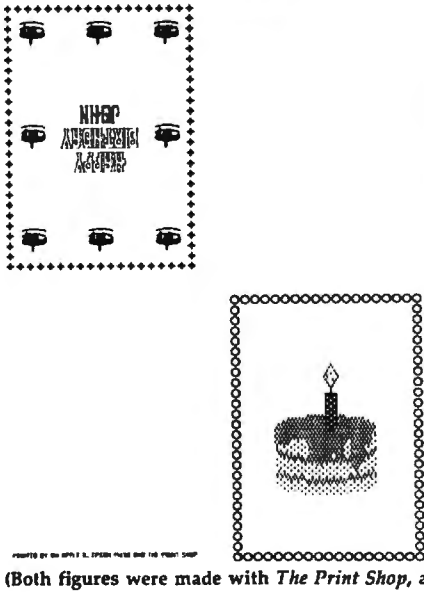
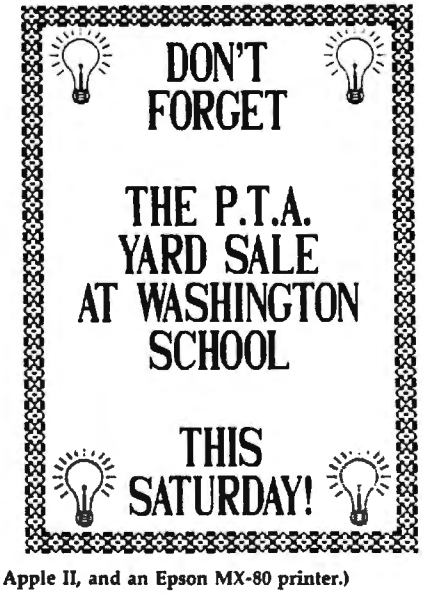


Figure 2: A sample sign



(Both figures were made with *The Print Shop*, an Apple II, and an Epson MX-80 printer.)

Computerized Greeting Cards

What makes this program so much fun is its amazing variety of design possibilities. You can endlessly combine pictures, text, background designs, and decorative borders. Some predesigned greeting cards are included, but designing our own cards and personalizing them is more satisfying. The flexibility of *The Print Shop* gives your imagination a great deal to work with.

Greeting cards are printed on an 8½ × 11-inch sheet, with the inside printed upside down in the upper-left corner and the front panel printed in the lower-right corner (Figure 1). You can use different graphics, borders, and type fonts for each part. You can even print a small credit line on the back flap, right where greeting card companies place their logos.

Signs are printed on the full 8½ × 11-inch sheet and include the same range of possibilities as the greeting card (Figure 2). A picture can be printed in three different sizes, placed in almost any position you wish. The graphics can also become a background design with superimposed text. In this case, enough of the background is blanked out to allow the text to stand out clearly.

Banners are printed sideways and can include only pictures and text. The height of the banner is the 8½-inch width of the paper. Text and pictures are both printed very large. A happy birthday banner with the birthday cake picture on either end is more than six feet long.

Stationery letterheads can include both pictures and text, positioned at either the top or bottom of the page (or both). To make a set of stationery for your word processor, you can design your form and print about 50 copies. Then insert the sheets when you're ready to print your letters, and adjust the page margins to avoid overprinting the letterhead.

Hardware Limitations

It seems like nitpicking to mention the flaws of a program that works so well and does so much; fortunately, the problems are minor, and mostly related to hardware limitations. The most noteworthy limitation is due to its complicated graphics—*The Print Shop* works only with certain printers and interfaces. Be sure to check the compatibility of your own system before buying the program.

Another hardware-imposed limitation is the inability to print in more than one color at a time. However, you can brighten things up by using colored paper (a small supply is included) and different-colored printer ribbons. The manual tells how to get multiple-color designs by exchanging ribbons.

There are a few other drawbacks as well. Although you can save a picture, you cannot save a complete card or sign. You can put multiple copies of the same picture on a sign, or repeat a pattern over the entire page, but you cannot include more than one picture on the same page.

Printing speed is a somewhat more serious limitation. If you need many copies of a sign, your best option is to create the design with *The Print Shop*, print one copy, and take it to a photocopier. Otherwise, a complicated card or sign can take several minutes each to print. One long banner took nearly half an hour.

The Print Shop package includes one copy-protected master disk which lets you make one backup copy. In addition, the program is covered by Broderbund's replacement policy. If the disk should fail within 90 days of purchase, it will be replaced free, unless the failure was due to physical damage (like spilled coffee). After 90 days, or if the disk is damaged,

Brøderbund will replace it for a fee of $5.00 plus $2.50 postage and handling.

The Print Shop can be a valuable part of a home computer software library. Consider how many greeting cards you buy in a year—the money you save on cards alone could more than pay for the program.

Brøderbund Software, Inc.
17 Paul Drive
San Rafael, CA 94903
$49.95 Apple
$44.95 Atari & Commodore

Run For The Money For PC & PCjr

Raymond Battaglini

Requirements: IBM PC with at least 64K RAM and a disk drive; PC-XT with at least 128K RAM and a disk drive; or Enhanced Model PCjr.

Run For The Money promises to be "a fast-paced arcade game to challenge strategy and business skills." This promise is largely kept. In addition to being an entertaining game, it is also educational.

The element that sets *Run For The Money* apart from other arcade-style games is the challenge to make meaningful decisions when faced with sometimes bewildering information. Players are forced to make choices they will either gain by or suffer for. The outcome of these choices is determined by realistic circumstances, not the flip of a coin or a roll of the die. When you know that your strategy, not some random event, is responsible for positive or negative results, you can plan accordingly. This is the concept that makes business challenging and this game interesting.

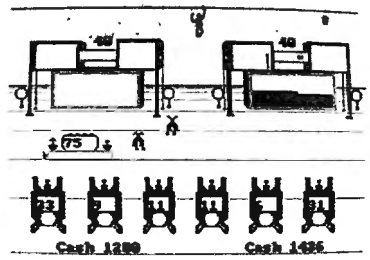
Bizlings On Simian

Run For the Money can be played against the computer or another person. Each player controls a character called a *bizling*. Bizlings are a business-oriented race of aliens who travel from planet to planet searching for trade partners. The two bizlings involved in this game have crash-landed on a planet called Simian. As a result of a Zinger Storm, the paint has been stripped off the shields of each ship. To return to their home planet, the bizlings must repaint these shields. That's the prime object of the game.

As luck would have it, there happens to be someone on Simian who sells paint to the highest bidder. Unfortunately for the bizlings, they don't have enough money to buy enough paint for their shields. Bizlings are resourceful, however, and discover they can make money by manufacturing a product called *synannas* from a mineral called *ruf*. Synannas are synthetic bananas, a prized delicacy for the Simians (the monkeylike creatures who inhabit the planet).

There are mines called rufhouses which produce rufs of varying price and quality. Bizlings can enter the mines and wait for the best price. Once it is set, the bizlings can buy rufs and use them to manufacture synannas on a one-for-one basis. The Simians will pay for your synannas at your set price if they sense a good bargain, quality product, or catchy advertising.

If you manage to make a profit, you can either buy more rufs to make more synannas, or more critically, buy paint. Whenever you buy paint you can return to your ship and begin to repair its shields. It's not possible to repaint the whole ship in one round of play (one Simian week), so a game usually takes several Simian weeks.



Run For The Money: *A Simian passes overhead while two bizlings (left center) try to maximize synanna production.*

The Bizling Spreadsheet

At the end of each round, players get a chance to review the past week and plan their strategy for the next. This part of the game includes such features as an animated graph showing profit or loss, a survey of the Simians' opinion of your synanna production, and most fascinating of all, a very simple spreadsheet.

The interesting part of the spreadsheet is that both bizlings' accounts appear on the same screen. This allows you to watch in fear as your opponent plans to undercut your price for synannas. Then, on another screen, you get one minute to raise or lower your final prices in a flurry of bid and bluff.

Finally, if either bizling thinks his spaceship's shield is adequately repaired (it need not be completely repainted), he can attempt to launch the ship for home. If both bizlings fail, another week of the game follows. The first player to successfully escape Simian is the winner.

The game does have arcade features. You must move your

bizlings around to get into the rufhouses, to pick up ruf, to bid on paint, and to repaint your shields.

However, the arcade action is not really the main feature of the game. The main feature is that you are constantly making decisions. Should you buy high quality rufs and charge more for your synannas? Should you wait in a rufhouse, hoping to get a lower price, while the other bizling is moving freely about? These are just two of a number of choices you must deal with. The animated graph helps you evaluate the prior week, and the spreadsheet helps you plan for the next week.

A Dozen Strategies

The most important tool for making decisions may be the list of 12 strategies in the user's manual. The strategies are presented in an entertaining manner, and are well written and well thought-out. The economic modules were designed by a professor at the Massachusetts Institute of Technology. Playtesting each strategy revealed that all 12 are somehow reflected in the game. Herein lies the educational aspect: Not only are these 12 strategies relevant to the game, but they are also relevant to the business world. It's hard to think of a more painless and graphic way of learning, at a simplified level, the concepts of business planning and forecasting.

Run For The Money has some other nice touches. The manual is well written and there's an onscreen tutorial in which you end up playing the computer-controlled bizling in a slowed-down version of the game. Another feature is that the package folds into an easel to display a command card. Also, the program has three levels, which helps sustain interest.

I have only two criticisms, but neither is directly related to the game. One problem is that there is no provision for making backup copies. This is significant in a game which might be handled by children. The other problem is the save-game feature. The manual does not make it clear that you should save an unfinished game at the beginning of a Simian week, not during the week. If the week is in progress, you will lose the game position.

PCjr Compatibility

Although the package doesn't say so, *Run For The Money* does work on the PCjr. However, the game runs painfully slow on the Junior. Compared to a PC-XT, about 20 to 50 percent slower, in fact.

Another drawback to playing on the PCjr is the player control for one of the bizlings. On the PC and XT, the game requires one player to use five keys on the numeric keypad (the cursor controls and the number 5). A player could use the cursor keys on the PCjr and the number 5 key on the top row, but this is cumbersome and puts one bizling at a disadvantage. It would be nice if a specific PCjr version were developed, because this is a fine game.

The author of *Run For The Money* is Tom Snyder, who also wrote *Snooper Troopers* and *In Search Of The Most Amazing Thing*. In *Run For The Money* he has written an interesting game for a broad age group. It is competitive for adults and fast-moving for children. The added bonus of encouraging children to plan and forecast in a simple business situation makes this a worthwhile effort. Computer games such as this one have the potential to become the modern-day equivalent of the sidewalk lemonade stand for lessons in economics.

Run For The Money
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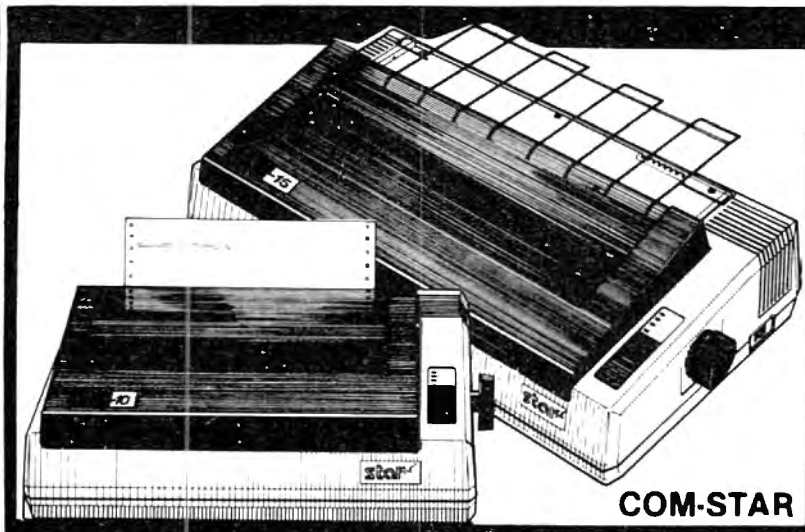

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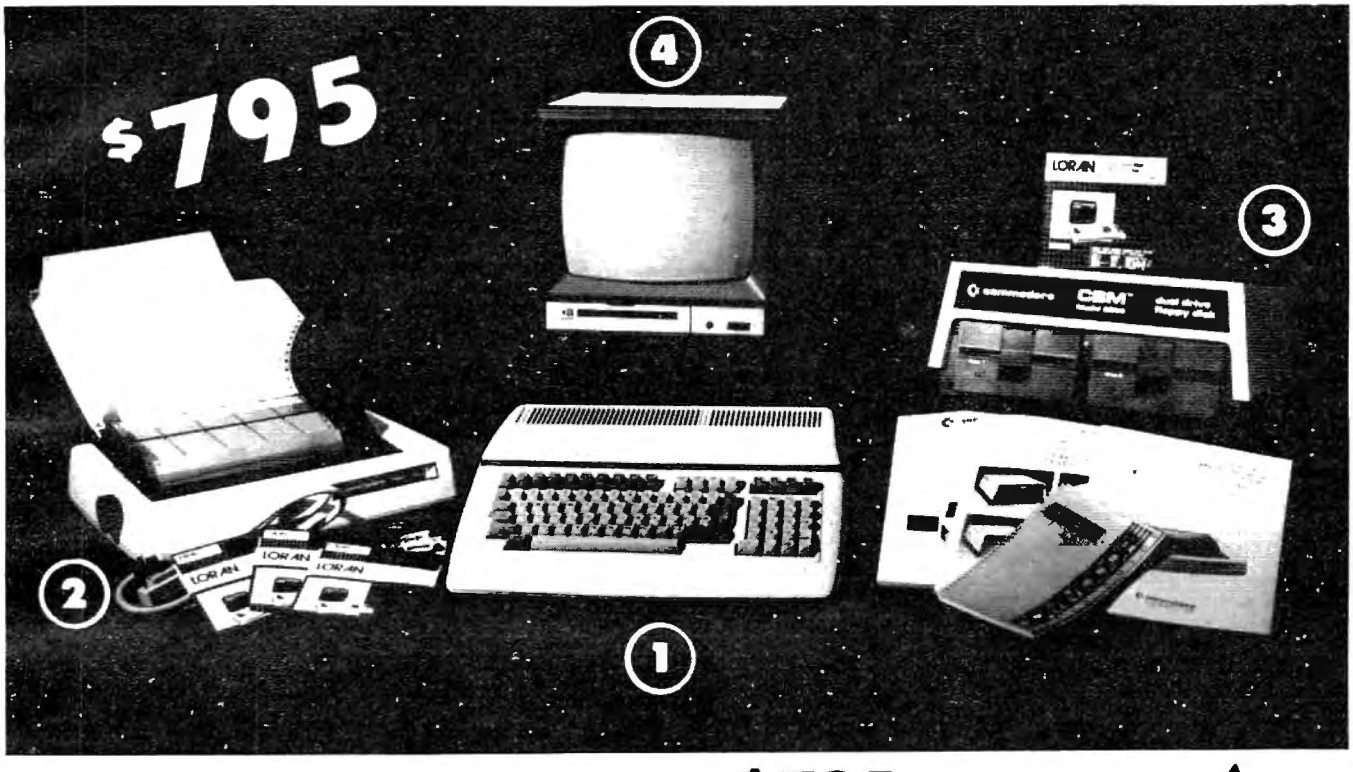

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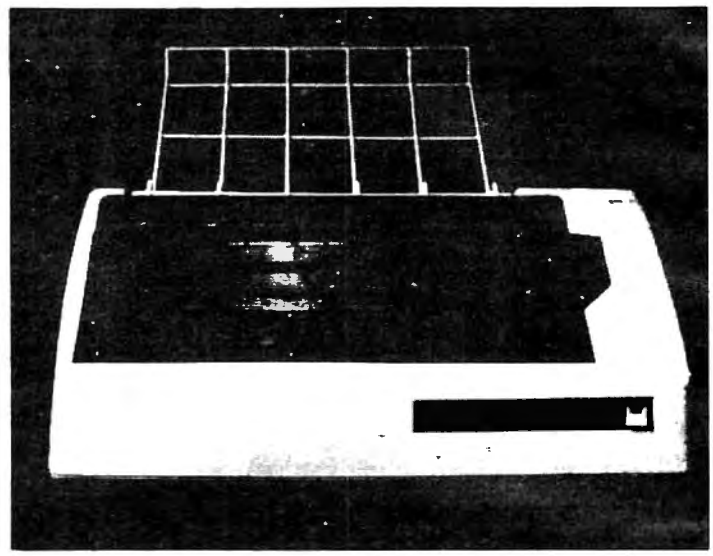

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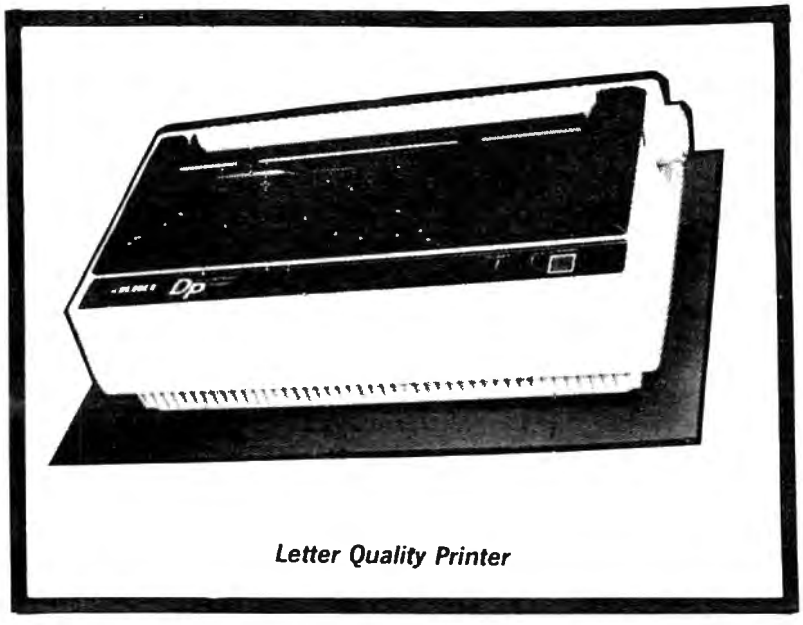

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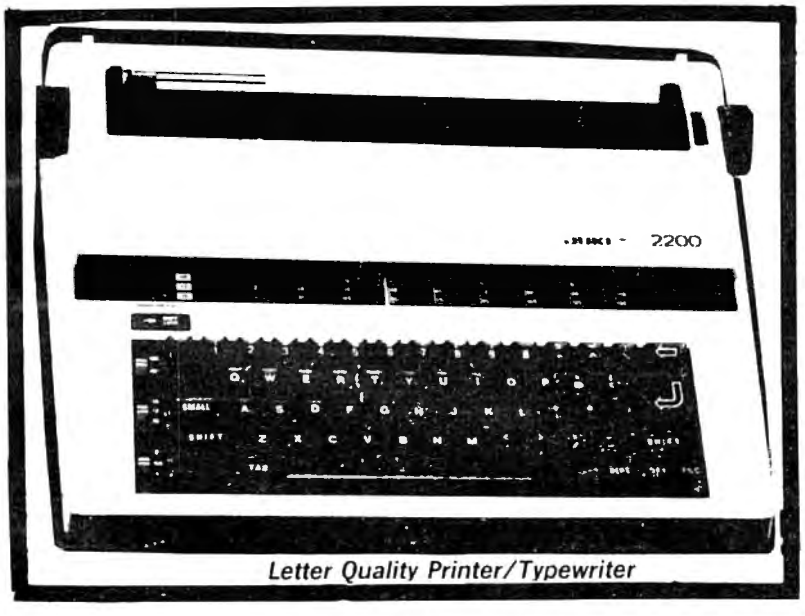

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Accounting Pack	$49.00	$39.00	$29.00
Practicalc	$59.95	$34.95	$29.95
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Programmers Helper (Disk)	$59.95	$39.95	$29.95
80 Column Screen (Disk)	$59.95	$39.95	$29.95
Flip & File Disc Filer	$39.95	$16.95	$14.95
Deluxe Tape Cassette	$89.00	$39.00	$29.95
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Computers And Society

David D. Thornburg, Associate Editor

Hit And Myth

The personal computing industry has never had to go for any long period of time without a rumor. Rumors regarding companies, products, applications, and personal fortunes are the stuff of which this industry seems to be made. But sometimes these rumors become firmly entrenched in our minds and take on the power (and longevity) of myths. For example:

Myth #1: The home computer industry is dying.

The home computer industry hasn't even started yet. Yes, I know that a large number of computers are ending up in people's homes (including 65 percent of the Macintoshes, according to one number I recently heard). But just because a computer is located in someone's home does not mean that it is a "home" computer. The personal computer market seems to have sorted itself out into several niches—business, education, entertainment, and hobby. If you see a computer in somebody's house, I'll bet it is being used in one of these four areas. Of course, we have been told by many pundits (and marketing organizations) that the personal computer will be the next "home appliance."

Home appliance? Let's see about that. If you go to someone's house and see a computer sitting in the den, I'll bet you say: "Hey, I see you're into computers. How about that!"

Have you ever gone into someone's house and said: "Hey! I see you're into refrigerators. Wow! Automatic ice cube maker too! I was going to get one of those myself—thought I'd get a 16-cube model, but then I heard that the 32-cubers were going to come out soon."

If the home computer was an appliance, we would talk about it like one.

David Thornburg is the author of eleven books, including The KoalaPad Book, Computer Art and Animation *(a Logo book available in versions for the TI, Radio Shack, Atari, and Commodore computers), and* Exploring Logo Without a Computer *(published by Addison-Wesley). His irreverent and whimsical look at computing (*101 Ways to Use a Macintosh*) has been published by Random House. Later this year, his first book on Logo as a tool for exploring topics like artificial intelligence (*Beyond Turtle Graphics*) will be published by Addison-Wesley.*

To see why the true home computer market hasn't been born yet, let's look at some home computer applications. First we were told that our home computer would help organize our Christmas card mailing list. Then we were told that it was a good place to store recipes. Need help with the old checkbook? No problem there—just use the computer. And, let's not forget the monthly letter to Aunt Elsinore—created on the home word processor, of course.

Give me a break.

Who has such a large Christmas card mailing list that you need to keep it on a computer? If so, why aren't I on it? And as for keeping recipes on a floppy disk, who has a kitchen large enough to house your computer? What about the effects of cake mix dripping down your keyboard? Not a pretty sight, is it? Checkbook balancing on the computer is a joke—unless you are wired in to your bank directly. While there are a few trendsetters who are embracing remote banking, many people are still skeptical of the automatic teller machines.

Cumbersome Computing

The only home application to date that makes any sense is using the computer as a word processor. But even here the need is marginal for most of us. Yes, I use a word processor all the time, but many of my personal notes are handwritten. You may use a word processor for your personal correspondence, but think about your Uncle Clevis down in Greater Tuna. Do you think he is going to rush out and invest a couple of grand in a personal computer and a printer just to write letters to the family at Christmas? Not on your life.

The home market has failed to materialize for two reasons. First, home computers are too hard to use. Second, there aren't enough serious home applications for these machines to make them a necessary part of people's lives.

For example, to use most word processing programs on anything but computers like the Radio Shack Model 100 and the Apple Macintosh, you have to type in about a half-dozen words just to load the word processor and the letter form you want to use. The process of turning on the computer, typing this stuff, and waiting for the machine to respond takes a few

minutes. In that same period of time, you could have written your note in longhand, stuffed it in an envelope, stamped it, and stuck it in the mailbox. There are exceptions to the cumbersome computer environment, of course, and when these exceptions become the norm, home word processing may become a reality.

With regard to the second reason that home computers haven't become appliances, think about this for a minute. Why should anyone want to have a computer as a home appliance? What essential task can it perform better than our other tools? The function of dishwashers and telephones is obvious. These have become home appliances for many of us. In order for the home computer to become an appliance, it will have to perform tasks that take advantage of the computer's power in new ways—to make the computer a lever for the mind. One area of research that opens the door to the possibility of a home appliance computer is expert systems. Tasks ranging from decision-assistance tools (which stereo should I buy?) to diagnosis (My car makes a funny sound whenever it goes over 45 m.p.h.) fall in this category. From where I stand, this arena is the one that promises to make the home computer a reality. If you have other ideas for computer applications that make the computer a necessity in the home rather than a toy, please send them to me in care of COMPUTE!. I am really interested in hearing your thoughts on this topic.

Until then, consumers who believed the hype and bought computers for the home will relegate them to the closet shelf along with their citizens band radio and other high-technology fads.

What a pity.

Myth #2: All the good software is available in the stores.

This one is a doozy. You walk into your local toy store and see a rich collection of educational, entertainment, and personal productivity software sitting on the shelf. Based on the size of the collection alone, you assume that the store has a good stock. In terms of sales volume, it probably has. But, in fact, any relationship betweeen what is carried in many stores and quality is purely accidental.

The consumer does not control the marketplace. The marketplace is controlled by a handful of buyers from the large chain stores who purchase software that they can sell quickly. While they can't be blamed for this attitude—they are in this business to make a profit—it is not at all clear that the criteria they use to choose software are the same criteria you would use as a customer.

For example, products whose utility is obvious from the box, or that can be explained in one short sentence, are preferred. Products that make use of licensed characters or games (Muppets, Snoopy, Q*bert, Strawberry Shortcake) are gobbled up into the retail channels. Actual utility to the customer is not an overriding concern for many of these marketing mavens. They look for metaphors ("This is like *VisiCalc*") rather than new ideas that may take some explaining.

An argument in their defense is that some software packages may take a few minutes to demonstrate or explain. This costs money and the store's margin may not be large enough to support that expenditure. Some of my favorite games (such as *Alien Gardens*) have been victims of this mentality. If this same game had made use of a licensed character, it would probably have gone off the charts. Instead, it is rarely to be found in the stores.

It is as if the people who determine the stock to be carried in their stores have no regard for you as a consumer. Their attitude seems to be that you cannot understand some of the more esoteric (and high-quality) programs, and you are only going to purchase a product through mass-merchandising ploys.

If you think this is hogwash, consider the fact that many stores are interested only in supporting the computers whose sales are currently "hot." Never mind the installed base. If a computer isn't selling at a good rate, it gets little or no support. Those of you who own TI-99/4 computers or any of the Atari models know what I am talking about.

Again, this attitude has its justifications, although they are a bit more complex. Most mass-market retailers are not used to selling capital equipment that has a long life, and for which there is a significant after-market sales potential. Most stereo stores, for example, don't sell records. Consequently, the mass-market computer distribution channels end up controlling the marketplace rather than responding to it. By deciding which titles to stock and which to avoid, this small group of buyers is determining the fate of many fragile (but good) software companies whose products you might buy, if only you had the chance.

Shop Around

What is the solution to this?

Direct your business to people who genuinely have your interests at heart. Shop at stores that have intelligent salespeople who know something about the technology they are selling.

Above all, when you find a store that puts you first, give them your business, even if it costs a few bucks more than the discount house down the street.

And don't forget the catalogs and magazine advertisers. Mail-order houses sometimes have a better variety than the stores, and you can find the right software if you look hard enough.

In fact, if we don't work hard at being good customers, we will become the nation of sheep that many buyers think we are.

And that's a baa-d way to be.

Counterpoint:

While many of David's points in this column are well-taken, I would like to offer a different perspective on this topic. COMPUTE! *strives to provide balanced coverage, and David's argument in this month's column is by no means the only point of view on this subject.*

Richard Mansfield
Senior Editor

David begins by noting that most home computers are used either for business, education, entertainment, or as a hobby. That would seem to cover the waterfront, to be about the only *possible* uses for a mass-market computer.

But he then sets up a straw man: Since some PR pundits have claimed that a home computer should be an "appliance," he judges computers against this strange standard. Home computers aren't like washing machines; therefore, they're useless around the house.

Who would want a computer as single-minded, as dead heavy as a washer? And who has ever seriously claimed that interaction with a computer could be reduced to simply pressing an ON button? Machine intelligence is supposed to handle information, to manipulate ideas, to imitate thought itself. It obviously has little to offer by way of thought amplification if there is no interaction with a thinking being, no input from the user. If using a computer meant simply pressing an ON button, how would it differ from TV?

David goes on to say that it's useless to keep a Christmas card mailing list on a computer. Since many people do just this, it must have value to them. For example, you can just insert envelopes into your printer and have envelopes addressed automatically. Also, the list can double as a birthday and anniversary list, a phone list, a memo pad to remind you when to send gifts, etc. It's far from useless.

He mentions that word processing is "marginally" useful. Yet anyone who has ever struggled through school, retyping essays and term papers, would argue that word processors are extraordinarily valuable. Not only do they produce perfect final drafts, they can also automatically create footnotes, check your spelling, and offer other kinds of assistance which writers of all levels of sophistication can appreciate.

As for his argument that most word processors are difficult to get started—what computers, what software is he talking about? Word processing on the IBM requires only that you insert the right disk and turn on the machine—a batch file brings you right up into the program. All you have to do is start typing. Ditto Atari, Commodores using cartridges, etc. A worst case would involve a computer that had no autobooting feature. But, even then, generally the only thing you have to do is type:

```
LOAD "WORDPROCESSOR"
RUN
```

or something similar and you're ready to type in text.

A word processor, after all, requires that you type words. Presumably, the act of getting it started by typing LOAD WORDPROCESSOR RUN won't represent a significant burden to most people.

But perhaps the most debatable of all David's assertions is that computers in the home are either essential or simply a toy. There are lots of things people use in their homes which fit into neither category: pianos, televisions, books, to name a few.

Certainly it would be nice if your computer could become the Amazing Genius: could tell you which stereo to buy, what's wrong with your car, and who to marry. It would also be nice if you could tell it to clean the bathroom and take the dog to the vet. However, the fact that computers aren't yet smart enough or mobile enough to help out around the house in quite these ways doesn't make them useless toys. They are assisting children with their homework, helping people write more clearly and correctly, storing copies of personal correspondence, providing sophisticated music and graphics tools, clarifying personal finances and taxes, and hundreds of other things in millions of homes.

Of course, better software and more powerful machines are coming. Nevertheless, even though technology hasn't yet given us the computer of David's dreams, there are many people who are regularly using and enjoying their machines. C

Arlan R. Levitan

The Race To Talk Fast

At last November's COMDEX (Computer Dealers Exposition), held in Las Vegas, new high-speed modems were more prevalent than high rollers at the baccarat tables. Hayes Microcomputer Products, Novation, U.S. Robotics, Racal-Vadic, Multitech Systems, CTS Datacomm, Anderson Jacobson, Cermetek, and Telenetics all announced new modems that work at 2400 bps (bits per second). These units are eight times faster than the 300 bps modems commonly used with home computers and twice as fast as the higher-end 1200 bps modems.

Some analysts predict that the close pricing-spread ($800 to $900) and almost identical features of the "CCIT V.22 bis" (say it five times fast) compatible units will lead to aggressive pricing by retailers. But there are indications that 2400 bps modems will be in short supply until fall of 1985. The reason? A shortage of the Quadrature Amplitude Modulation (QAM) logic chips used in just about every one of the newly unveiled speedsters. Loose talk in The Gulch's most popular watering holes maintain that Rockwell, the sole source for QAM chips at this time, will not be delivering the critical components in any kind of reasonable quantities until February or March 1985 at the earliest. While other major silicon shops are acquiring licenses to manufacture the logic chips, full production won't be ramped up until late this year.

Complicating matters further are large early orders for 2400 bps units from the major packet switchers and commercial information services. These orders caught almost everyone flat-footed, including most telecommunications pundits (such as yours truly) who predicted a cool wait-and-see attitude from the consumer and business-oriented data bases. It seems that one well-heeled service had secret plans to be the first of the pack to support 2400 bps connections in all of the major markets. Well, the only things that travel faster than secrets in this business are the locations of all the parties at trade shows that offer free food and beverages. The result? Everybody wants to get into the act with first overtures from most quarters in March and April. Keeping up with the Joneses (ahem) will be a tad expensive at first, with 2400 bps access costing three to four times the base hourly rate of most services.

What's New On-Line

With all this infighting going on, we can use a good laugh. Subscribers to The Source can read some of the funniest computer-oriented humor around by checking out "Comedy By Wire" in the User Publishing Area of that service. "Comedy By Wire" is the brainchild of Billiam "Yes, it's my real name" Coronel, a professional stand-up comedian based in New York City. It's outrageously good-natured computer humor, and several "back issues" are available for your perusal as well. Tyros who eschew menus can beam directly to "Comedy By Wire" by typing PUBLIC 153 DIRECT from The Source's command prompt.

In case you can't get enough exercise and lifestyle enhancement by hanging out at the health spa or watching aerobics on cable TV, you can now pump data on CompuServe's latest

special interest group, the Health Forum. Sysop Bob Walter (76703,647) moderates the discussions of fitness-related issues. To access the Health Forum, type GO HCM 660 at any ! prompt on CompuServe.

Merrill Millman's new American People/Link information service should be off and flying by the time you read this. The new service was about a month or so behind schedule at this writing, but December 29, 1984, was scheduled as opening day. In an effort to guarantee that there will be lots of folks to chat with on the service, People/Link has set up 20 special lines in the Chicago area. What's so special about them? Registered users who manage to get through to the special access number incur no hourly connect charges! The special lines will be in service until March 1, 1985.

People/Link's startup has generated more than its share of heat. It seems that Millman's future competitors didn't find it too amusing that he was drumming up business via their electronic mail and special interest group message facilities. CompuServe even notified the young upstart that People/Link should cease and desist from using wording that it felt left the impression the advertisements were from CompuServe itself. A further statement to the effect that "we have removed . . . such offending messages as we have identified them" was taken by People/Link to mean that much of its E-mail had been deleted. CompuServe maintains that while no E-Mail was or would be deleted, it did reserve the right to enforce its longstanding policy against commercial messages in its special interest group message systems.

Meanwhile, the brass at NewsNet aren't very pleased with People/Link, either. Quite by accident, People/Link's newsletter is a dead ringer for NewsNet's newsletter—it's printed on almost the same color stock with similar shades of ink in the same format. And People/Link's publication is called the *LinkLetter*, while NewsNet's is called the *ActionLetter*.

E-Mail Or J-Mail?

Many telecomputerists (myself included) are up in arms over the latest telecomputing phenomenon—electronic junk mail. In a lot of respects, electronic junk mail is just like paper junk mail, generally consisting of friendly offers to relieve you of excess currency in exchange for merchandise and services that no human being should be without. The big difference is that junk E-mail doesn't come in gaudy envelopes marked "Urgent! Open Immediately" along with the telltale bulk mail mark in the upper-right corner. A quick visual inspection is all that is generally needed before you consign such epistles to their appropriate final resting place.

Not so with junk E-mail. There are usually no warnings of the nature of an electronic mail message other than a short title, usually quite innocuous. Compounding the situation is the fact that I use an intelligent terminal program capable of unattended operation to automatically retrieve my E-mail, and I regularly find one or two junkers mixed in with the important stuff. The most irritating aspect of the whole thing is that you actually pay good money for the connect time it takes to retrieve such notices. No big deal until you get a five-page letter from some yahoo selling a computerized heraldry program. I'm just waiting for Reader's Digest and H&R Block (owners of The Source and CompuServe respectively) to notify me of my big chance to win a $25,000 sweepstakes or offer to help me out with my tax return. At least things haven't sunk to the level of "Just imagine the look on your neighbors' faces as the *[insert your name here]* family boots up your new 30-megabyte Whizzo hard disk." At least, not yet.

Surely, chain E-Mail can't be far behind: "This E-mail has been around the network 15 times. If you will send ten copies of it to your friends, it will bring you luck. Sonny Tufts of Winslow, Oklahoma, sent ten copies immediately upon receipt and is now vice president in charge of acronyms at IBM. Anglia Griffith of Salvo, North Carolina, deleted this message and forgot about it. Three days later her Apple IIc exploded, terminally frightening her parakeet, Bob."

On the other hand, the majority of my electronic mail is indeed welcome, coming from friends and readers of this column. Every three or four months, I'll reprint the most frequently asked questions I receive via E-mail or regular post. I'd also like to encourage readers to respond with help of their own to the questioners if they have anything to add. To that end, ID numbers are listed after names whenever applicable.

Too Fast For Phones

I have heard that it would be difficult for a modem to use a rate above 1200 bps on ordinary phone lines with minimal errors. Is the transmission protocol of 2400 bps modems too flaky to use on such lines?

Arthur Penn, CompuServe 75216,517

Until recently, 1200 bps was indeed considered the top speed for microcomputer communications over voice-grade lines without building expensive error detection and correction into the modem. Anderson Jacobson has marketed a fairly expensive 4800 bps modem for over a year that works on standard phone lines. The catch was that at

4800 bps the modem at each end of the telecomputing link had to be an Anderson Jacobson 4800. The new 2400 bps modems conform to the CCIT V.22 bis transmission standard, and actually operate at 600 baud, the same baud rate used by 1200 bps modems (See "Telecomputing Today," COMPUTE!, January 1985). While the method used to pack four bits into every baud may be slightly more susceptible to interference from very poor quality lines, my experience with 2400 bps units to date has been very positive. Most of the new 2400 bps units also have the ability to communicate at 1200 and 300 bps if conditions make higher data rates impractical.

How fast can we go on voice-grade lines? Extremely reliable sources report that Bell Labs has developed some rather pricey equipment that can push data rates all the way up to 57,600 bps on regular old telephone lines! But don't rush to the store looking for one yet—1990 is the earliest that the technology required to produce the so-called hyper-modems will be economical enough to yield reasonable prices for mass market consumption (under $2,000).

Atari JTERM Compatibility

*I have an Atari 800XL and Atari 835 modem. How can I get the JTERM terminal program (*COMPUTE!, *January 1985) to work with my equipment?*

No Name—CompuServe 73305,744

JTERM was written to work with Atari computers that use the Atari 850 Interface Module to connect a standard RS-232 modem. I am not aware of a version of JTERM designed to work with the Atari 835 or 1030 modems. Jim Steinbrecher, author of AMODEM, the other popular public domain terminal program for Atari computers, does market two inexpensive programs which allow uploading and downloading with the 835 and 1030. These programs are called "ETMODEM" and "AMODEM.835" and cost $15 each. You can get further details from Jim's ARCADE bulletin board at 313-978-8087, or write to 37220 Tricia Drive, Sterling Heights, MI 48077.

PCjr Internal Modem Commands

What is the dialing command prefix for the IBM internal modem for the PCjr? I am trying to set the dialing prefix within the PC-Talk III *terminal program to take advantage of the program's autodialing features.*

Glenn Fichter

The dialing command for the PCjr's internal modem is DIAL or D for short. All commands intended for the internal modem must be prefixed with a control character (CTRL-N is the default) to let the modem know that what follows is a command rather than plain old data. To set *PC-Talk III* for autodialing with the internal modem, go to the dialing menu (press ALT-D) and select R to revise the autodialer. Select M to change the modem command word. When prompted for the new dialing command, press CTRL-N. Then type an uppercase D and hit RETURN. If you have done everything right, the dialing command displayed at the top of the screen will consist of two characters: a musical note followed by a D. For complete information about PCjr internal modem commands and their use, refer to IBM's *PCjr Technical Reference Manual* ($35 at most dealers), pages 3-40 through 3-67.

Downloading With Mitey Mo

I have a Commodore 64 with a Mitey Mo modem. Is there any software for my system that will let me download programs? Do the modems on both ends of a telecomputing link have to be the same to successfully transfer files?

Richard Scoggins, CompuServe 75236,3354

USI, the company which originally sold the Mitey Mo, is no longer with us, another casualty of the home computer wars. Another firm, Computer Devices International, has picked up the product and informs me that owners of Mitey Mos who sent their warranty registration cards to USI have been notified of a new version of the *Smart64* terminal program which takes advantage of the special features of the Mitey Mo and supports uploading and downloading. If you have not already registered your modem, you can acquire the new software by returning the warranty card along with $17 to:

Computer Devices International
1345 A2 Doolittle Drive
San Leandro, CA 94577

The most recent release of CompuServe's *VIDTEX* terminal software for the Commodore 64 also supports your modem. You can contact CompuServe customer service on-line via FEEDBACK or by calling the customer service number in your CompuServe guidebooks.

Although the modems on both ends of a telecomputing link must transmit and receive at the same speed and adhere to the same rules for encoding and decoding data, identical modems are not required. Some terminal programs that use proprietary file transfer schemes do require that both computers run the same terminal program.

BCNU.

Arlan R. Levitan
Delphi: ARLANL
The Source: TCT987
CompuServe: 70675,463
People/Link: ALEVITAN
MCI/MAIL: ALEVITAN

INSIGHT: Atari

Bill Wilkinson

It's tidbit time again this month! I love saving up strange, exotic, or frustrating facts and then dumping them on you all at once.

Oops

Before I do anything else, though, let me quickly fix the big boo-boo in my January column or I will be inundated with threatening letters. In the *second* assembly language listing there, the one which purported to show you how to output a character to any channel, there are two lines in error. Lines 340 and 350 were given as using a STX instruction. The correct lines are as follows:

```
340     STA IOCBLEN,X ; zero both bytes
350     STA IOCBLEN+1,X ; of buffer length
```

I apologize now if I managed to destroy anyone's hard work. And since I goofed in January, it's only fair to show my ignorance this month.

Hide And Seek

The first of the tidbits this month came to me in the way of an innocent question from Roger Bocek of Campbell, California. He had stopped in at our office to pick up some software, happened to run into me, and said, "Say, I've been meaning to ask you. Why does DOS use three sectors for its boot area when it uses only about 200 bytes of boot code?"

Five minutes later, after rummaging through the listing in *Inside Atari DOS* (from COMPUTE! Books, of course), I came up with the brilliant answer: "I dunno." But I always like to find a use for everything, even my own ignorance.

As we have discussed in this column many times in the past, when you ask BASIC to do I/O (Input/Output) to or from most devices attached to your computer (particularly the disk drive), what actually happens is quite complex. BASIC interprets your request into a call to CIO (Central Input Output), which in turn determines what device you are using and vectors to the appropriate driver routine. We assume here that CIO accesses FMS, the File Management System for the disk, usually called DOS (Disk Operating System).

Finally, then, FMS makes a call to SIO (Serial Input Output), the routine which does the actual physical reading and writing to the device. In the case of the disk drive, this involves the actual transfer of a single sector of 128 bytes (or 256 bytes in non-1050 double density).

Most BASIC programmers seldom—if ever—have need to read or write a physical disk sector. Most avoid writing because it is dangerous, since disturbing the format of portions of a sector can destroy DOS's ability to manage the disk for you. (Reading a sector, though, can be informative, especially if you are trying to either understand DOS or find lost information.)

On the other hand, some programmers like to hide things on a disk. Perhaps high game scores, a password, or some sort of software protection. The best place to hide such information is someplace unknown to DOS.

An Extra Sector

Now, the fact that standard Atari DOS (version 2.0S and its derivatives, including OS/A+ and DOS XL versions 2) leaves sector number 720 available has been documented before: DOS manages sector numbers 0 to 719, but the disk drive understands only sectors 1 to 720. DOS has been fixed to think that sector 0 is always in use, but sector 720 remains outside its ken. Many programs, including some found in old issues of COMPUTE!, have read and written data directly to sector 720.

Lo and behold, thanks to a quirk which began who knows how and where, sector 3 is also free for this kind of use! It is the last sector of the traditional three-sector boot process. But for some reason lost in programming legend, it turns out that none of the disk boot code used by DOS is present in sector 3: sectors 1 and 2 contain all the boot that is needed. So, if you are looking for another 128 bytes of hidden disk space, you now know where to find it.

A word of warning, though: If you erase, write, modify, or rename the DOS.SYS file, sector 3 will automatically be rewritten by DOS (it thinks it needs to reestablish the boot code). So, if you choose to use sector 3 for your own purposes, be sure to do so on a disk which either never receives a DOS.SYS file or which has one that you feel is reasonably permanent.

I have not included a program here to access sectors directly because the technique has been shown many times, many places before. For example, *Mapping the Atari* (COMPUTE! Books) gives some helpful hints, and the Atari technical manuals go into SIO calls in some detail. If enough of you write and request a column on this topic, though, I may present more here in the future.

More Hide And Seek

Many game programmers like to hide their signatures in their work, often to the consternation of their employers, the game manufacturers. Famous examples include the message evoked from *Super Breakout* (the Atari home computer version) when you push CONTROL, SHIFT, and I at the same time. Or how about the power dot in the old Atari VCS *Adventure* game, which got you into an otherwise inaccessible room? In fact, the practice is so widespread that some players spend hours looking for these hidden messages in each new game, even the games that don't have any.

Well, it turns out that game programmers are not the only ones who like to get their ego stroked at the same time they put one over on management. Paul Laughton, the prime programmer behind Atari BASIC and Atari DOS (and Apple DOS and . . . but that's another story), told me of one signature that even got into some of Atari's operating system ROMs.

If you want to see this signature, you'll have to find a 1200XL and be patient. Simply remove all cartridges, disconnect all peripherals, and turn it on. Push the HELP key to get to the self-test program, and with SELECT, choose all tests before pushing START. Then wait. The self-test program will cycle through the ROM and RAM tests and the sound register tests before it gets to the keyboard test.

Now how the heck can you have a meaningful keyboard test which is self-running? Answer: You can't. To really test a keyboard, someone should hit at least *some* keys. Nevertheless, the program makes a valiant effort to pretend that it is hitting some random keys. Or does it? Aha! If you look fast and carefully, you will find that the keyboard taps out "Michael Colburn" every single time.

It goes without saying that Michael Colburn had a hand in writing the self-test code. You have to try this on a 1200XL because Atari discovered this signature and changed it when the 600XL and 800XL OS ROMs were produced. The message "Copyright 1983 Atari" is tapped out now, but that's not nearly so interesting as the original.

The Wrong Keyboard

More on the keyboard self-test: It seems kind of sad to me that Atari managed to find the energy and time to change that signature but couldn't see fit to fix the test itself.

If you try the manual mode of the keyboard test on a 600XL or 800XL, you will notice two things wrong: (1) The keyboard layout pictured on the screen is mixed up. The layout shown is actually the 1200XL scheme, including even the F1 to F4 function keys. (2) The display does *not* show you all legal keypress combinations. In particular, it shows no CONTROL+SHIFT combinations (that is, three-key combinations) at all. And it can't see CONTROL-1 or BREAK. On a 1200XL, the same key combinations are invisible *and* the CONTROL+function key combinations don't display properly.

Well, I always said I thought the self-tests were a waste of valuable ROM space, but it would have been nice if they did their jobs right. (My other objection: If you are going to have self-tests, then test *everything* you can. Like the serial bus, reporting all devices which respond. Like collision detection and other aspects of the GTIA. Like whether the joysticks and paddles work. We have an 800XL which thinks the joystick button is always pushed, but no self-test detects that fact.)

Streamlined Snails

This not-so-little tidbit is a dig at Tom Halfhill. Since he gets to edit my columns before you see them, the very existence of these paragraphs shows his senses of humor and fair play. (See, Tom, I told them you were a nice guy. *Now* will you leave this in?)

In the December 1984 and January 1985 issues of COMPUTE!, Tom wrote a pair of well-balanced and interesting articles on the new MSX computers. If you didn't read them at the time, I urge you to go back and do so. I'm not sure that I agree with all of Tom's conclusions (as you are about to see), but the articles give you the best info I have seen yet on most aspects of this possible new Japanese invasion.

Anyway, the only reason that I bring all this up is that Tom had Assistant Editor Philip Nelson run a simple benchmark program on all the computers that COMPUTE! regularly reports on. Tom then concluded that MSX BASIC showed "streamlined performance." Why'd you go do that? You *know* that I love to eat benchmarks alive. Here goes:

Aside from the fact that the benchmark sorts an array in perhaps the most inefficient way possible, there is nothing wrong with the program as presented. It isn't much good at measuring arithmetic performance, but it is at least as good as the classic *BYTE* Prime Number benchmark at showing efficiencies (or lack thereof) in logical and branching operations. And the timing numbers presented seem reasonable and correct. So what's my problem?

Well, first of all, I'm a bit tired of seeing little old 8K Atari BASIC pitted against 32K monsters like MSX BASIC. And I don't really like it

when documented, easy-to-use methods of speeding up Atari programs are ignored. Tom says that an Atari 800XL takes 8:55 (minutes:seconds) to run the little benchmark. True. But turn off the screen direct memory access which uses so much CPU time (via POKE 559,0 or with the F2 key on a 1200XL), and the timing immediately drops to 6:10. Which is *faster* than MSX BASIC's 6:20.

Let me play devil's advocate: Isn't this cheating? There are ways to speed up that program on other computers, too. For example, the Commodore 64 loses some time to screen DMA also, doesn't it? Answer: Okay, valid objection. But Atari computers, in general, pay the biggest penalty for text mode screens, and I think benchmark programs should at least include a footnote to this effect or maybe mention *effective* clock rates. (Would it be more legit if we just put a GRAPHICS 19 statement in? That helps almost as much. All right, all right, next subject.)

Faster BASICs

Well, then, how about trying a bigger, more competitive BASIC on that same Atari computer? Glad you asked. BASIC XL handles that program in *4:08*. That's two-thirds the time of MSX BASIC and more than a minute and a half faster than the IBM PC. (Just for the record, running the benchmark in FAST mode with the screen turned off gives a time of 2:42, more than twice as fast as the IBM PC. And all these times are *without* the Newell FastChip, which would make even more of a difference.)

I admit I am prejudiced towards BASIC XL. Also, it was handy so I used it first. But another timing of which I am proud is Cromemco 32K Structured BASIC, which handled that program in 4:33 (floating point mode) and 3:13 (integer mode) and which runs on the *same* Z80 processor at the *same* clock rate doing the *same* 14-digit BCD arithmetic as the MSX machine. (And if you count the Cromemco S-10 as a personal computer—which you should if you call an IBM PC or a Commodore 8032 by that name—then I will be glad to dispute Tom's claim that MSX BASIC "may be the most powerful BASIC on any personal computer.")

One more thing before I draw my conclusions: I would very much like to change that benchmark just a little bit. Add lines 1 through 99, each consisting of just a REMark statement, and change the names of the variables to VARIABLE1, VARIABLE2, etc. If MSX BASIC holds true to the standard Microsoft BASIC patterns, its speed will suffer considerably. And so will all the other derived-from-Microsoft times. (Atari BASIC will slow down from the extra lines, but not from the long variable names. BASIC XL in FAST mode and Cromemco BASIC will not change by even a second.)

So the question becomes: Why is MSX BASIC so doggoned *slow*? Here we have a 32K language running on a very fast 8-bit processor, and it really only shows off halfway decently when you run very small benchmark programs with one- or two-character variable names. Why? Because Microsoft has never significantly improved BASIC. The versions of the BASIC language used in all these machines (even the IBM PC with its so-called 16-bit processor) are still derived from the original Microsoft BASIC designed for an 8K Altair many years ago.

When you are trying to fit a computer language as complex as BASIC into 8K (and that includes Atari BASIC), you *have* to make sacrifices somewhere, and performance is usually the first thing to go. But why, when a computer manufacturer gives you 32K of room for a language, do you need to keep the same scheme? Isn't it time to rethink the methodology of the interpreter? Data General and Hewlett-Packard and Digital Equipment Corporation knew how to build superfast interpreters back before microcomputers were even dreamed of. But they usually ran those languages in 64K memory spaces, the same *total* size as most of today's 8-bit micros.

Optimizing A Language

When we started building Cromemco 32K Structured BASIC *back in 1978*, we had already written an 8K BASIC using many of the same techniques Microsoft used. But since this time we had 32K to work with, we studied the minicomputer languages and started from scratch with better methods. If we were to do it again today, we'd start from scratch *again* and get even more power and better times. Microsoft has never done this.

To be fair, BASIC is not exactly a hot item around Microsoft nowadays. Apparently Microsoft assigns higher priority to other languages, operating systems, operating environments, and word processors, than to redesigning BASIC. Why not leave "improvements" to BASIC to junior programmers, as a maintenance chore?

In his January article, Tom wondered if the hardware technology of the MSX might not be a little tired and boring compared to what other manufacturers will be showing soon. Somehow I can't help but wonder and hope if someday maybe—just maybe—BASIC users will get bored with tired *software* technology, too.

Boy, did I get on my soap box this month. Well, it's relaxing (for me, at least) once in a while, and I promise that next month will bring something different. ©

PROGRAMMING THE TI

C Regena

Drum Practice

My five children and I recently started to learn how to play the drums (yes, it gets noisy, but it's rhythmic noise). Probably the most important phase of learning to play the drums is learning rhythms—and very often other members of a band depend heavily on the drum. When we first began lessons, the younger children, who had no previous music training, started with quarter notes in 4/4 time. They soon learned to count and knew when the notes indicated a beat and when there was a rest. However, I noticed the counting was not always even.

The CALL SOUND command in TI BASIC specifies a duration, or how long a sound plays. Therefore, we could use the computer to play a drum rhythm and keep the timing exact (to the millisecond, in fact).

The program this month shows a drum rhythm or pattern consisting of four measures on the screen. The computer then plays the rhythm while showing the counting. The student can play the drum (or practice pad) with the computer. If you don't have a drum, you can clap along with the computer—or play another instrument with the computer beating the rhythm. Ten different patterns are shown.

How The Program Works

Line 180 sets a duration for a quarter note or quarter rest to be 300 milliseconds. You can change the tempo by changing this line. You may prefer to add some lines to let the student input a tempo or to choose among several tempos. For my youngest child, however, it was best to have no INPUTs or choices to make.

Lines 190–220 define graphics shapes using characters numbered from 97 to 117. The character definitions are in the DATA statements in lines 230–340. When you are typing these DATA statements, be sure not to add any extra commas. Each DATA statement except the one in line 340 has four definitions. These characters will draw the staff lines, the bass clef, the time signature, bar lines, and the notes and rests.

The program uses ten different patterns, and lines 360–380 READ the patterns from the DATA in lines 1020–1120. Feel free to change these or add your own rhythm patterns. Each DATA statement contains one pattern for the four measures. T represents a quarter note, and R represents a rest. On the screen the patterns end with a repeat bar, so the computer actually plays the pattern twice.

After the program prints the title screen and instructions, it prompts the student to press any key to start. The ten patterns are shown in random order without repetitions. Lines 500–620 draw the basic bass staff. Lines 630–810 draw the rhythm from the pattern chosen, R$. The program examines the string R$ one character at a time in order. If the character is a T, the program draws a quarter note. If the character is an R, the program draws a rest. After four notes or rests, the program draws a bar line to separate

measures. At the end of the four measures, it draws a repeat bar.

Line 830 plays a prompting tone, then lines 840–1000 play the rhythm (twice). Again the string R$ is examined one character at a time. If the SEGment is T, a tone plays. I chose the frequency of the noise −7. You may want to choose a different noise or frequency instead. If so, change line 900.

If the SEGment is R, the program uses a frequency of 9999 with a sound level of 30 to create a rest. When the note or rest starts, line 930 prints the count. Line 940 ends the sound.

The variable J is used to print the counting and is incremented with each note or rest. Line 960 determines if J needs to be reset to count 1-2-3-4 for each measure.

Changing The Program

As listed, the program uses ten different patterns for the rhythms. If you want to change any of the patterns, simply alter the DATA statements of lines 1030–1120. Remember that T stands for a quarter note and R stands for a rest. Make sure you have 16 characters in the string. If you want more than ten patterns, you will need to DIMension P$ at the beginning of the program, then change line 360 to READ the right number of patterns, and add more DATA statements at line 1120. To play all the patterns, you will also need to change the number 10 in lines 430 and 470.

Characters 109, 110, and 111 are the graphics characters that draw the 4/4 time signature. If you wish to change the signature, for example to 2/4, you can alter those characters or define your own graphics beyond character 117. Lines 600–620 draw the time signature.

If you change the time signature, you will also need to adjust the DATA for the rhythms, the positions where the bar lines are drawn, and the counting.

Another enhancement to this program would be to start adding eighth notes to the rhythms—then sixteenth notes. You would have to define some more graphics characters for the different kinds of notes, then perhaps add E and S to the DATA strings that define the patterns. You would also have to adjust the section to draw notes (lines 630–780) and the section to play the notes (lines 830–1000).

Another idea is to use this program as a start, but instead of just playing a rhythm, have the computer choose random notes for the four measures and thus a tune. Then a student could practice reading music by playing the tune along with the computer. Each note would be drawn depending on the tone chosen—so you would need to define characters to draw the notes in all possible positions. You could use an ON-GOSUB to draw the proper note where the subroutines contain the appropriate CALL HCHAR statements. These projects should keep you busy until next month.

If you prefer not to spend the time typing this program, you can get a copy 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 the title and that you need the TI version.

A Few Answers

I appreciate your comments and ideas for columns and programs. I'll try to answer just a few questions here this month.

First, many of you have written about the future availability of TI software. Texas Instruments announced it was dropping its home computer in October 1983. If you have sent in the registration form that came with your computer, you are on a mailing list and should receive advertisements from time to time from various companies who sell TI peripherals and software. TRITON was designated as the company to sell TI products for Texas Instruments.

There are several third-party companies that are still producing peripherals and software for the TI. At this writing, there is still an abundance of software available and new titles coming out all the time. Many user groups are still going strong and are a good source of continuing support. Most of the groups publish newsletters. Personally, I will probably continue to write programs for the TI forever because I like the computer.

COMPUTE! Books has published numerous books specifically for the TI-99/4A. If you don't see them in your computer store or bookstore, remember you can order directly from COMPUTE!.

Several readers have written about using Forth on the TI. Texas Instruments made Forth available through the user groups. In other words, the program is considered public domain. It is available on disk. There is also a manual that was distributed to user groups. Several clubs have formed Forth special interest groups and are publishing software written in Forth and articles about Forth. I am not going to cover Forth in this column because Forth requires the disk drive system, memory expansion, and the *Editor/Assembler* cartridge. Most TI owners have only the basic console and a cassette recorder. I prefer to print programs that are written in Console BASIC (and maybe a few in Extended BASIC) so that any TI owner can use them.

Translating Other Programs

Some readers have asked about translating programs for other computers to work on the TI. When I first got my computer I also wondered how to translate programs, because back in 1980 very little was ever published for the TI. Now, however, there is a lot available—so you really do not need to translate. Some bookstores have a whole shelf full of TI books. I subscribe to several magazines that publish TI versions of their programs.

If you absolutely need to translate a certain program, though, here are a few hints. The main thing is that TI BASIC allows only one command per line—so where other computers use a colon or backslash to separate commands, you need to use another line number and a separate line. An exception is the PRINT statement. By the way, Extended BASIC allows much easier translation because of its enhanced capabilities.

Most of the commands are the same in all BASICs and work the same way—such as PRINT, INPUT, FOR-NEXT, IF-THEN, GOTO, GOSUB, ON-GOTO, ON-GOSUB, READ, DATA, and END. Therefore, you can usually figure out the basic logic of a program. You may need to make slight changes. For example, the TI INPUT statement uses a colon while many others use a semicolon. Also, our IF-THEN in Console BASIC includes an ELSE, and you must specify line numbers rather than additional commands. Simply go to a line number, then at the line number use the command.

The biggest problems result from machine-specific coding, largely graphics and sound. Any TI statements that start with CALL are not found on other computers. For example, CALL CLEAR is equivalent to CLS in some other BASICs. All those POKEs can be confusing, too. On other machines, POKEs are often used as substitutes for missing graphics and sound commands.

Your best bet is not to attempt to translate a program line by line, but rather design your own graphics and sounds. To translate the POKE commands on another computer, you'd really need its manual and a very good memory map to find out what the various locations do. For example, the Commodore 64 and VIC-20 require several POKE commands to make sounds, where TI BASIC lets you use CALL SOUND. For character graphics, a program for a Commodore computer may POKE a screen location with a symbol number, then POKE a color location with a color number. Our equivalent would be CALL COLOR and CALL HCHAR or CALL VCHAR. Some DATA statements in a Commodore program may be defining a character, but we would use CALL CHAR.

My recommendation is that instead of trying to translate graphics directly, you should study Chapter 5 of the *Beginning BASIC* book that came with your TI-99/4A and learn the TI graphics. The in-house programmers at COMPUTE! rarely translate a program line by line. The translations you've seen are usually programs written completely from scratch to take advantage of each computer's strong points. Only the basic concept is carried over from the original program. Often the new version even *gains* something during the translation.

Until next month—enjoy your TI.

Rhythm Player

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

```
100 REM  DRUM PRACTICE
110 CALL CLEAR
120 PRINT TAB(8);"DRUM PRACTICE"
130 PRINT :::"A RHYTHM PATTERN WILL
     BE"
140 PRINT :"SHOWN ON THE SCREEN."
150 PRINT :"PLAY YOUR DRUM ALONG WI
    TH"
160 PRINT :"THE COMPUTER."
170 PRINT ::"THERE ARE TEN RHYTHMS.
    ":::::
180 D=300
190 FOR C=97 TO 117
200 READ C$
210 CALL CHAR(C,C$)
220 NEXT C
230 REM  DATA FOR CHARACTERS
240 DATA 00000000000FF,00000000020
    2FF02,0000FF000000FF,0202FF023A
    7E7C38
250 REM
260 DATA 10080C1830300804,1C2020100
    800FF,0000000000000FF0F,00000000
    0000FFE
270 REM
280 DATA 1038FF380000FF,3110FF08090
    8FF1,0000FF000100FF,1020FF80000
    0FF
290 REM
300 DATA 00000000000FF10,2424447E0
    404001,102424447E04FF,000000000
    000FC2C
310 REM
320 DATA 2C2CFC2CAC2CFC2C,AC2CFC2C2
    C2CFC,0000000000000FF08,0808FF08
    0808FF08
330 REM
340 DATA 0808FF080808FF
350 REM
360 FOR I=0 TO 9
370 READ P$(I)
380 NEXT I
390 PRINT "PRESS ANY KEY TO START."
400 CALL KEY(0,K,S)
410 IF S<1 THEN 400
420 REM  TRY TEN PATTERNS
430 FOR C=1 TO 10
440 CALL CLEAR
450 REM  CHOOSE PATTERN
460 RANDOMIZE
470 R=INT(10*RND)
```

```
480 IF P$(R)="" THEN 470
490 R$=P$(R)
500 REM  DRAW STAFF
510 CALL HCHAR(10,3,97,26)
520 CALL HCHAR(11,3,99,26)
530 CALL HCHAR(12,3,99,26)
540 CALL HCHAR(10,4,103)
550 CALL HCHAR(10,5,104)
560 CALL HCHAR(11,4,105)
570 CALL HCHAR(11,5,106)
580 CALL HCHAR(12,4,107)
590 CALL HCHAR(12,5,108)
600 CALL HCHAR(10,7,109)
610 CALL HCHAR(11,7,110)
620 CALL HCHAR(12,7,111)
630 REM  DRAW NOTES
640 X=8
650 FOR I=1 TO 16
660 IF SEG$(R$,I,1)="R" THEN 700
670 CALL HCHAR(10,X+I,98)
680 CALL HCHAR(11,X+I,100)
690 GOTO 730
700 CALL HCHAR(11,X+I,101)
710 CALL HCHAR(12,X+I,102)
720 IF I=16 THEN 780
730 IF I/4<>INT(I/4)THEN 780
740 X=X+1
750 CALL HCHAR(10,X+I,115)
760 CALL HCHAR(11,X+I,116)
770 CALL HCHAR(12,X+I,117)
780 NEXT I
790 CALL HCHAR(10,29,112)
800 CALL HCHAR(11,29,113)
810 CALL HCHAR(12,29,114)
820 REM  PLAY RHYTHM
830 CALL SOUND(100,1497,2)
840 FOR K=1 TO 2
850 CALL HCHAR(13,8,32,20)
860 X=8
870 J=1
880 FOR I=1 TO 16
890 IF SEG$(R$,I,1)="R" THEN 920
900 CALL SOUND(D,-7,2)
910 GOTO 930
920 CALL SOUND(D,9999,30)
930 CALL HCHAR(13,X+I,J+48)
940 CALL SOUND(1,9999,30)
950 J=J+1
960 IF I/4<>INT(I/4)THEN 990
970 J=1
980 X=X+1
990 NEXT I
1000 NEXT K
1010 NEXT C
1020 REM  DATA FOR RHYTHMS
1030 DATA TTTTTTTTTTTTTTTR
1040 DATA RTTTRTTTRTTTTTTR
1050 DATA RTRTRTRTRTRTTTTR
1060 DATA TRTRTRTRTRTRTTTR
1070 DATA TTRTTTRTTTRTTTTR
1080 DATA TRTTTRTTTRTTTTTR
1090 DATA TTTTRTTTTTTTRTTR
1100 DATA RTTTRTRTRTTTRTTR
1110 DATA TRTRRTTTRTRTRTTR
1120 DATA TTRTRTRTTTRTRTTR
1130 CALL CLEAR
1140 PRINT "CHANGE LINE 180 FOR TEM
     PO.":::
1150 END
```

Threading Disassembler

Elmer N. Keil

This machine language disassembler follows a program's branches and jumps, rather than taking a linear path. Written in Microsoft BASIC for the Commodore PET, it will also work without changes on the 64 or on a VIC (with at least 16K memory expansion). With limited conversion, it should work on any 6502-based computer.

Most assemblers and disassemblers proceed through a machine language program in a linear fashion from the lowest to the highest address, which is fine as long as the program contains few jumps and branches.

However, when trying to find your way through complex routines such as the built-in ROM, a linear disassembler is almost useless. For example, the warm start entry point sets a flag in page zero; loads the accumulator and Y register; and jumps (JSR) about 1700 bytes away, only to jump immediately to another location 2400 bytes away. It settles down for ten instructions before going into several sets of compare-test-branch instructions which lead off in all directions. It can be frustrating to list long routines, only to find that the first instruction goes somewhere else. And trying to find your way back after all this jumping can be a real challenge. One solution is to use a *threading disassembler*, which follows the execution thread as it weaves through various parts of memory and keeps track of where to return after each jump.

An Efficient Structure

It is a common practice to place initialization at the end of a program so that an interpretive BASIC will not have to continually search past a block of one-time code. This program pushes that concept one step further by placing the main loop at the beginning and then jumping far back into the program and gradually working its way forward. This was an experiment, and the results are not clearly evident. The program stays ahead of my printer and can scroll listings off the CRT at a moderate rate (use the RVS key on the PET, or CTRL key on the VIC and 64, to slow the scrolling).

The program starts by initializing some variables and asking the user to select various options. Since this section is only used once, it has been placed at the end of the program so the main program loop will execute more efficiently.

The main loop gets an instruction, checks to see if it changes the program flow, decodes and formats it for printing, and then follows the flow. A dummy stack is maintained to keep track of the return points in much the same manner as the hardware stack.

Once started, the program will loop continuously until stopped. The loop contains a sequence which terminates the program when the Q (quit) key is pressed.

User's Choice

It is impossible for the program to know how to interpret the conditions associated with conditional branches. The program will display the branch destination and ask the user if the branch should be followed.

Although it is often possible to look at the preceding instructions and determine what conditions should exist, sometimes all you can do is take your best guess and see where it leads you.

The Start-Up Routines

Initialization, called by the GOSUB at line 40, clears the screen and homes the cursor for neatness. The pseudo stack pointer (SP), the stack array (SS), and the pseudo program counter (PC) are allocated. Arrays GO$, G1$, and GG$ are filled with the 6502 mnemonics (the mnemonic BAD represents invalid opcodes). Variable TP is set to the highest addressable memory location.

Since dividing by a power of two is the same as shifting a binary number to the right, variables B3 and B6 are set up to shift bit three or bit six respectively into the low order bit position. LB is used to scale the left byte before adding the number to the right byte when generating an address.

Hex Lookup Table

HX$ is a lookup table of valid hexadecimal num-

bers. Variable OP is set to the screen device number, but it may be changed to the printer device number depending on the answer to the first question, PRINTER OUTPUT? OP is used only once in the opening of file number PR, and all writes to the listing device are to file PR. (VIC users may want to change some of the PRINT statements to better fit their 22-column screens.)

The second question, TITLE?, lets you identify the listing at some future time.

Although the program was intended as a threading disassembler, it's possible to use it as a standard block disassembler, depending on your answer to question three, BLOCK DISASSEMBLY?; the program sets BD=0 for threading and BD=1 for block disassembly.

Select Decimal Mode

Normal input/output format for numbers is hexadecimal—you can select decimal mode in answer to the fourth question, DECIMAL MODE?; the program sets variable HX=1 for hexadecimal mode and HX=0 for decimal mode.

And finally the last and most important question, STARTING LOCATION?; respond with a decimal or hexadecimal number according to the mode selected. The program then prints the remaining header information and reminds you to press Q to quit at any time.

The main loop consists of lines 80–170. Line 80 looks for a keypress and will ignore anything other than a Q (including no keypress); a Q will break the loop and terminate the program at line 970. Line 90 PEEKs a byte from the location pointed to by the pseudo program counter (PC) and then calls a subroutine at 280 to convert the PC to a hexadecimal string. Line 100 combines the hex string with a decimal equivalent string and some blank spacers into PC$ for later printing.

Lines 110–130 calculate the three parts of the opcode that was PEEKed in line 90, and line 170 branches according to the type of opcode.

Converting The Opcodes

Lines 700–1470 process all of the branches, jumps, and other opcodes which change program flow. This is the heart of the program. Lines 700–710 do a table lookup for the opcode mnemonic and verify that it is a valid opcode. Line 720 tests for conditional branches and jumps to 1330 to process any it finds.

All other opcodes which change program flow are detected in line 730, which could transfer control to line 760. Line 740 branches to the appropriate routine to process and format the operand according to the addressing mode indicated by the opcode.

Line 760 further checks for opcodes which change program flow; these are processed at line 1010. JMP is detected at line 770 and processed at line 820.

Creating The Mnemonics

Once the program flow has been processed, the opcodes are processed. The mnemonics are obtained by a table lookup, the addressing mode is determined, and the operand is formatted accordingly. Lines 350 and 370 represent subroutines for fetching one-byte and two-byte operands respectively.

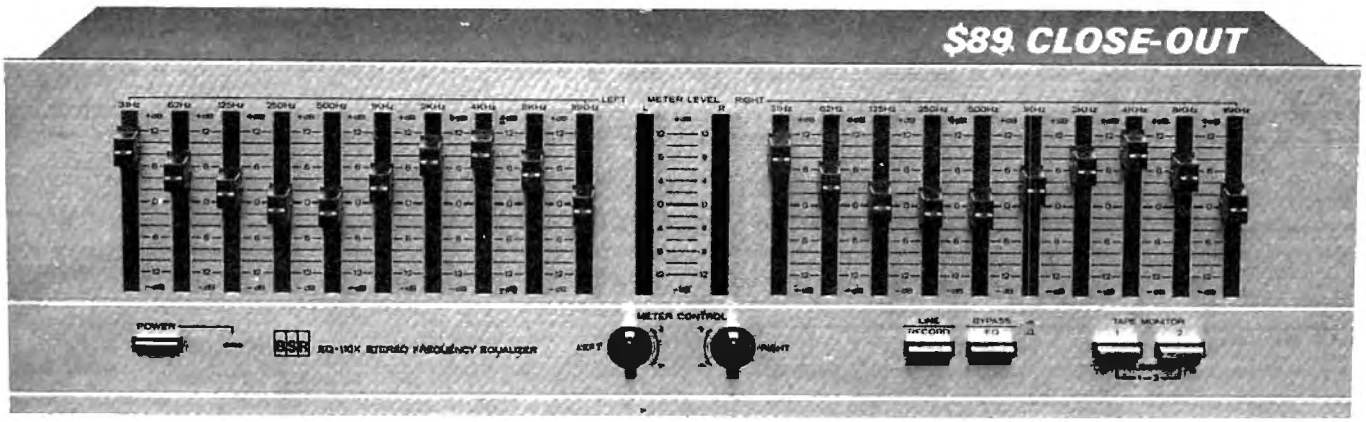
Lines 250–310 represent a subroutine for converting the operand value to a character string, and lines 430–650 may add supplemental information to the operand string as well as generating a comment string CM$ to identify addressing mode. Line 210 prints the collection of information about this particular instruction and then jumps to line 80 to start the loop for the next instruction.

If you don't have a printer, line 210 can be changed by dropping the blank spacer B2$ and the addressing mode comment CM$ from the end of the PRINT command. This will shorten the print line to under 40 characters and let you view more disassembled instructions at one time. Use the RVS or CTRL key to slow down the scrolling.

Threading Disassembler

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

```
40 GOSUB 2070                          :rem 173
60 REM{10 SPACES}MAIN LOOP STARTS HERE
                                       :rem 174
80 GET Z$:IF Z$=Q$ GOTO 970            :rem 152
90 B1=PEEK(PC):A=PC:GOSUB 280          :rem 193
100 PC$=RIGHT$(BL$+STR$(PC),5)+RIGHT$(BL$
    +A$,6)+"{3 SPACES}"                :rem 232
110 P1=INT(B1/B6):A=B1-P1*B6            :rem 33
120 P2=INT(A/B3)                       :rem 115
130 P3=A-P2*B3                         :rem 227
150 REM{3 SPACES}ANALYZE OP CODE        :rem 72
170 ON(P3+1)GOTO 700,1520,1670,1930
                                        :rem 28
190 REM{3 SPACES}PRINT A DISASSEMBLED LIN
    E                                  :rem 228
210 PRINT#PR,PC$;OP$;B2$;LEFT$(ND$+BL$,14
    );B2$;CM$:GOTO 80                   :rem 53
230 REM{3 SPACES}CONVERT OPERAND       :rem 163
250 IF HX=1 GOTO 280                     :rem 7
260 A$=STR$(A):RETURN                    :rem 3
280 ZZ$="":A$="":IF A<0 THEN A=-A:A$="-"
                                       :rem 241
290 J=INT(A/16):ZZ$=MID$(HX$,A-(J*16)+1,1
    )+ZZ$                               :rem 25
300 A=J:IF A>0 GOTO 290                :rem 167
310 A$=A$+ZZ$:RETURN                   :rem 184
330 REM{3 SPACES}GET OPERAND            :rem 99
350 A=PEEK(PC+1):PC=PC+2:GOSUB 250:RETURN
                                       :rem 224
370 A=PEEK(PC+1)+LB*PEEK(PC+2):PC=PC+3:GO
    SUB 250:RETURN                      :rem 44
400 REM{3 SPACES}ADDRESSING MODES:rem 212
```



Sound Detonator Plus

Make your stereo system's sound explode with life. Improve the sound quality by 30 to 50%. Plus, you'll add tape dubbing too with this limited BSR $89 close-out.

It's like night and day. Crashing cymbals, the depth of a string bass, more trumpets or more voice will come bursting forth from your stereo at your command.

You'll make your music so vibrant that it will virtually knock your socks off when you use this professional quality 10 band stereo Sound Detonator Plus Equalizer.

It has a frequency response from 5hz to 100,000hz ± 1 db. BSR, the ADC equalizer people, make this super equalizer and back it with a 2 year limited warranty. Our $89 close-out price is just a fraction of its true $249 retail value.

CAN YOUR STEREO SOUND BETTER?

Incredibly better. Equalizers are different from regular bass and treble controls. And, 10 band EQs are the best.

Bass controls turn up the entire low end as well as the low mid-range, making the sound muddy and heavy. With an equalizer, you simply pick the exact frequencies you want to enhance.

You can boost the low-bass at 31 hz, 62hz and/or 125hz, and the mid-bass at 250hz and 500hz to animate specific areas of the musical spectrum.

And, when you boost the part of the bass you like, you don't disturb the mid-range frequencies and make your favorite singer sound like he has a sore throat.

The high frequencies really determine the clarity and brilliance of your music.

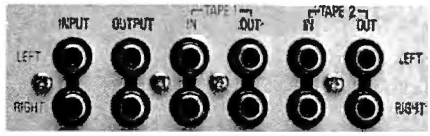
You can boost the mid-range and highs at 1,000hz, 2,000hz, 4,000hz, 8,000hz and 16,000hz. So, you can bring crashing cymbals to life at 16,000hz while at the same time you cut tape hiss or annoying record scratches at 8000hz.

You can also boost or cut specific mid-range frequency areas to add or subtract vocal, trumpets, guitars or whatever instrument ranges you prefer.

GREAT FOR 2 TAPE DECKS

You can push a button and transfer all the equalization power to the inputs of two tape decks. So, if you have a cassette deck in your car or a personal stereo that you wear, now you can pre-equalize your cassettes as you record them.

Now you can get all the dramatically enhanced sound wherever you are. This is an especially great feature for bass starved portables and high-end starved car stereos to make them come alive.



And, look at this. There are two tape inputs and outputs, so you can dub from tape deck A to B, or make two tapes at once with or without equalization.

EASY HOOK UP

Use your tape monitor circuit, but don't lose it. Now your one tape monitor circuit lets you connect two tape decks.

Just plug the equalizer into the tape 'in' and 'out' jacks on your receiver. We even supply the cables.

As you listen to your records, FM or 'aux', any time you push the tape monitor switch on your receiver you'll hear your music jump to life.

The output from your receiver is always fed directly to your tape decks for recording, and with the touch of a button, you can choose to send equalized or non-equalized signal to your recorders.

When you want to listen to a tape deck, just press a tape monitor button on the equalizer and your tape deck will work **exactly** as it did before. Except, that now you can choose to listen with or without equalization and you can dub.

You won't be listening to any distortion or hum. The Sound Detonator Plus has a 95 db signal to noise ratio and total harmonic distortion of just 0.018%

Once you've set your equalizer controls, switch it in and out of the system. You'll hear such an explosive improvement in sound, you'll think you've added thousands of dollars of new equipment.

WHY A CLOSE-OUT?

Last year DAK closed out over 18,000 of BSR's 7 band equalizers because BSR had decided to only sell equalizers under their ADC name and they still had some left with the BSR name on them.

Well, as Detroit comes out with new cars each year, ADC comes out with new equalizers. We got them to supply us with just 15,000 of last year's model before they shut down for the new one.

They had already paid for all the tooling, all the research and design, so we were able to buy these for less than half the normal price, for cold hard cash.

So, you can go to any HiFi store and buy this year's design in an ADC equalizer made by the parent company BSR, or you can get this $249 value BSR equalizer while our limited supply lasts, for $89.

THE FINAL FACTS

There are 20 slide controls, each with a bright LED to clearly show its position. Each control will add or subtract up to 12db. (That's a 24db range!)

There are separate sound detonation slide controls for each channel at 31 hz, 62hz, 125hz, 250hz, 500hz, 1,000hz, 2000hz, 4000hz, 8000hz, and 16,000hz.

LED VU meters with ± 0.5db accuracy show levels for each channel. It is 17" wide, 6½" deep and 4½" tall.

PUT LIFE INTO YOUR MUSIC RISK FREE

Prepare for a shock the first time you switch in this equalizer. Instruments you never heard in your music will emerge and bring a lifelike sound that will envelop you and revolutionize your stereo system.

If your system doesn't spring to life, simply return the equalizer within 30 days in its original box for a refund.

To order your Sound Detonator Plus Tape Dubbing BSR 110X10 Band Stereo Frequency Equalizer risk free with your credit card, call toll free or send your check not for ADC's $249 value, but for only **$89** plus **$7** for postage and handling. Order No. 9724. CA res add 6% tax.

Wake up the sound in your stereo. Your sound will explode with life as you detonate each frequency band with new musical life. And now you'll be in control of two tape decks as an added plus.

DAK INDUSTRIES INCORPORATED Dept. CP02

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8200 Remmet Ave., Canoga Park, CA 91304

The Complete Computer

Here's a 50 character per second, plain paper, dot matrix printer that you can use with virtually any home or office personal computer. It's built really tough to withstand heavy use. It's really easy to use. And, it even prints graphics. Price Slashed to $129.

By Drew Kaplan

Complete your computer. Now you can harness the full power of your computer. From writing letters to listing programs, your computer will be incredibly more useful.

It uses **plain paper** and it's super reliable. It prints both upper and lower case characters. And, if you aren't using a printer with your computer, read on.

LISTING/INDEXES/LETTERS AND MORE

Experience the thrill of actually writing your letters and reports on your computer. Now you'll be able to use all of your computer's word processing and **correcting** capabilities to really explore your creative talents.

It's easy. Some of the new word processing programs are so 'user friendly' that you can learn to use them in just about 10 minutes. Change a line, change a word, move a line. Just push a button.

Are data bases a four letter word? Not on your life. Now you can use your computer to organize all your telephone numbers, your stocks, stamps, and recipes.

If you're using your computer for business, you can have a complete, instantly accessible file for each customer by name, what they bought, when, etc.

A data base will let you find or organize and print out any information you want, however you want, whenever you want. There's no more complicated programming required. And, inexpensive data base programs are availible at any computer store.

PERMANENT RECORD

If you have a modem, you're in for a treat. You can access encyclopedias, stock market reports, and much more. When you sign on a service like Com puServe or The Source, the world is quite literally at your finger tips.

With a printer, you can get a 'hard copy' of all the incoming information. You can get everything from SAT test simulations and IQ tests to loan amortization schedules.

AFRAID OF PROGRAMMING?

You don't need to know the first thing about programming to use this or any printer. But, if you've never typed in and run a program, here's the easiest one I know. Turn on your computer.

Commodore Owners, and Atari Owners, your computer, and most others will say 'Ready'. Just push Control and Reset on an Apple. Then type the following:

```
10 PRINT "DAK IS WONDERFUL"
20 GOTO 10
RUN
```

You should type a carriage return at the end of each line. Why not try this program now? Next time, I'll tell you how to get out of the program, and maybe even discuss peeks and pokes.

If the program isn't running, type LPRINT instead of PRINT in line 10.

To you sophisticated programmers, think how easy your life will be when you can print out program lists that you can study at length.

And, you won't have to load a bunch of disks to find a program when you print out a menu for each of your disks.

LOOK AT ALL IT DOES

An ad in several August computer magazines listed a $149 thermal printer (that needs expensive thermal paper) as the lowest priced printer in the U.S.

Imagine a 50 character per second, plain paper, full 80 column dot, matrix printer with a built-in standard Centronics Parallel Interface, slashed to just $129.

This printer handles plain old cheap standard fanfold pin feed computer paper from 4.5" to 9.5" wide, with it's built-in adjustable tractor pin feed drive.

It's so powerful you can even use two-part forms for a carbon copy. Plus, there's an impact control for print darkness.

It understands and prints 116 upper and lower case characters, numerals and symbols. And that's not all.

You can even print Double Width characters. **And, look at this.** This printer has full graphic capabilities with 480 dot horizontal resolution and 63 dot per inch vertical resolution. So, you can print out your pictures, pie charts or graphs.

It prints 10 characters to the inch, six lines to the inch. In short, it's going to make typewriters into dinosaurs. When hooked to your computer, you'll never have to retype anything again. If you find an error, just make the correction and let the computer retype your work for you.

The printer is made by C.ITOH/Leading Edge in Japan. It's built to really take heavy use. But in the unlikely event that it should need service, there are approximately 400 service centers nation wide.

It takes standard long life inked ribbon cassettes that are readily available nation-wide. This is a printer that will give you many years of continuous reliable service and enjoyment.

AND NOW THE BAD NEWS

If you're the president of a large company sending important business letters, you may want a $1000 daisy wheel printer. But for most uses, dot matrix printers are incredibly faster, and there isn't any way to print out a graph or picture on a daisy wheel printer.

But, there are two things you need to know about this printer. First, it has about the dumbest name I've ever seen. It's built tough and rugged. So, they named it The Gorilla Banana Printer.

Second, like many dot matrix printers, the letters g, j, p, q, and y are level with the other letters. Each letter is completely and perfectly formed, but each sits level with the rest of the alphabet.

Upper case letters and symbols are unaffected. So, if you don't want letters that look like they were printed by a computer, this printer isn't for you.

But for most letters, term papers or reports, programming and all the data bases and information you'll get through a modem, this printer is perfect.

COMPATIBLE COMPUTERS

Any Computer with a standard Centronics parallel port, such as: **Apple, Franklin, IBM PC, TRS80, Osborn, Atari, Commodore VIC 20, Commodore 64, Kaypro, and virtually any other personal computer. Plus, most briefcase portables.**

FEAR OF INTERFACES?

Your computer is smart. But, it doesn't know how to 'talk' to other devices. That's why you need an interface.

An interface isn't just a cable. It's actually an intelligent translator that lets your computer talk to other equipment.

Usually the computer manufacturers don't include the various interfaces when you buy your computer, because they don't know if you'll ever add peripherals such as disk drives, printers or modems.

So, rather than sell you something you don't need, you don't buy an interface untill you add onto your computer.

There are two types of printer interfaces. The first allows you to do text word processing. For 99% of computer use, this is all that is needed. It translates all the possible letters and punctuation known as ASCII. This printer understands 116 characters and symbols.

A second type of interface **also** allows you to dump pictures or graphics from your screen or memory. This is more complicated because every dot must be told where to go. This interface, or 'driver program' as it is called, is available in two forms; built into an interface card, or as a program on a disk which you use in conjunction with any standard interface.

Either way, you'll have the printer operating in just a few minutes. And if you already have a printer, the same Centronics parallel interface and cable (about 85% of all printers are compatible) should work with this printer.

With this printer you can alter your graphics as you desire. You can print normal or reversed (both shown above, reduced to fit in this catalog) and you can even print double size.

WHY SO CHEAP

A new model will emerge soon with a different name. Leading Edge had just 28,000 of these remarkable printers which have been selling at discount for as little as $199, left in stock.

DAK bought them all for cold hard cash. And now we're offering them to you for less than the original price we were quoted as wholesale.

The printer is approximately 16½" wide, 9" deep and 7" tall. It's backed by Leading Edge's standard limited warranty.

ADD PRINTING POWER TO YOUR COMPUTER RISK FREE

Now you can really make use of your computer. 50 characters per second printing on plain paper for just $129. Wow!

Now you can print out your programs, your notes or your letters. If you're not 100% satisfied, simply return the printer and any accessories in their original boxes to DAK within 30 days for a refund.

To order your 50 Character Per Second Dot Matrix, Plain Paper Printer with a built-in Centronics Parallel Interface, risk free with your credit card, call toll free, or send your check for the breakthrough close-out price of just **$129** plus **$8** for postage and handling to DAK. Order No. 4101. CA res add 6% sales tax.

Special Note: If you need a serial printer for a computer, such as the TRS80 Color Computer, order the identical printer with a built-in Serial Interface for the same price. Use Order No. 4102.

The Printer comes packaged with a long life ribbon. Extra ribbons are available at computer stores. DAK has them for **$4** each ($1 P&H) Order No. 4103.

Standard Centronics Interfaces for your computer are available at any computer store. This Printer has its receiving interface built in. You simply need one, complete with its cable, to plug into your computer 'to send' information. Below are our favorites for 5 of the most popular computers.

For your Apple. We have Practical Peripherals' text interface for just **$49** ($2 P&H) Order No. 9877. We have their graphics capable interface for just **$79** ($2 P&H) Order No. 4104. If you already have a Centronics Parallel Interface, we have a graphics driver program on disk for just **$7** ($1 P&H) Order No. 4105.

For your IBM PC, you don't need an interface. It's usually already built-in. But, you do need a cable. We have a cable, ready to connect this printer to your computer, for just **$19** ($2 P&H) Order No. 9879. We have a graphics driver program on disk for just **$7** ($1 P&H) Order No. 4106.

For your Atari 800, 800XL, 400, or 600XL, we have a text interface for just **$69** ($2 P&H) Order No. 9881. We have a graphics driver program on disk for just **$7** ($1 P&H) Order No. 4107.

For your Commodore VIC 20 or 64, we have a text interface for just **$39** ($2 P&H) Order No. 9883. We have a Graphics Interface for just **$54** ($2 P&H) Order No. 4108.

Special Bonus for Commodore 64 owners. We have a powerful word processing program with editing, including changing a line, a word, or moving a line. Once you've tried computer word processing, you'll never want to look at a typewriter again.

Plus, we have a super data base program that lets you use 8 fields of information on up to 200 subjects at a time. Then you can search for any part, sort alphabetically or numerically and print out an address book, a list of your stocks or anything you can imagine. They're both yours for just **$5** ($1 P&H) with purchase of the printer. Use Order No. 4122 for Disk, or Order No. 4123 for Cassette.

For most TRS 80 Computers, you don't need an interface, just a cable. For the Black and White Computers, we have a Parallel Cable for just **$18** ($2 P&H) Order No. 9885. For the Color Computers we have a Serial Cable (you need the Serial Printer as well) for just **$18** ($2 P&H) Order No. 4109.

For **briefcase-type** portables, the Centronics Interface is usually built-in. Just stop by any computer store. All Centronics Printers use the same cable at the printer end, but you'll need a cable that fits your particular computer's plug.

Get hard copy print-outs of your programs or your graphics. Turn your computer into a powerful word processor. Forget retyping ever again. For just $129 you can make your computer complete.

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8200 Remmet Ave., Canoga Park, CA 91304

```
410 REM{8 SPACES}ZERO PAGE + INDEX
                                    :rem 121
430 GOSUB 350:ND$=A$+",X":CM$="ZERO PAGE,
    INDEX X":GOTO 210               :rem 2
450 GOSUB 350:ND$=A$+",Y":CM$="ZERO PAGE,
    INDEX Y":GOTO 210               :rem 6
470 REM{8 SPACES}ZERO PAGE         :rem 220
490 GOSUB 350:ND$=A$:CM$="ZERO PAGE":GOTO
     210                            :rem 25
510 REM{8 SPACES}ABSOLUTE + INDEX:rem 124
530 GOSUB 370:ND$=A$+",X":CM$="ABSOLUTE,I
    NDEX X":GOTO 210                :rem 7
550 GOSUB 370:ND$=A$+",Y":CM$="ABSOLUTE,I
    NDEX Y":GOTO210                 :rem 11
570 REM{8 SPACES}ABSOLUTE          :rem 223
590 GOSUB 370:ND$=A$:CM$="ABSOLUTE":GOTO
    {SPACE}210                      :rem 30
610 REM{8 SPACES}IMMEDIATE         :rem 10
630 A=PEEK(PC+1):PC=PC+2:GOSUB 280
                                    :rem 202
640 ND$="#"+A$:CM$="IMMEDIATE"     :rem 130
650 GOTO 210                       :rem 103
670 REM{7 SPACES}GROUP ZERO OP CODES
                                    :rem 91
680 REM{8 SPACES}(SOME MOSTECH GROUP 3)
                                    :rem 218
700 OP$=MID$(G0$(P1),P2*3+1,3)      :rem 25
710 IF OP$=BD$ GOTO 1970           :rem 219
720 IF P2=4 GOTO 1330:{5 SPACES}REM
    {13 SPACES}8 BRANCHES          :rem 183
730 IF P1<4 GOTO 760:{6 SPACES}REM
    {13 SPACES}SPECIAL FUNCTION    :rem 117
740 ON(P2+1)GOTO 630,490,1720,590,1930,43
    0,1720,530                      :rem 56
760 IF P2=0 GOTO 1010:{5 SPACES}REM
    {12 SPACES}BRK,JSR,RTI,RTS     :rem 110
770 IF OP$="JMP" GOTO 820: REM{12 SPACES}
    JMP                             :rem 48
780 ON(P2+1)GOTO 1930,490,1720,590,1930,4
    30,1720,530                     :rem 112
800 REM{4 SPACES}JUMPS HANDLED HERE
                                    :rem 31
820 B1=PEEK(PC+1)+LB*PEEK(PC+2):A=B1
                                    :rem 35
830 GOSUB 250:ND$=A$:CM$=BL$       :rem 33
840 IF(BD=1)AND(P1=2) THEN PC=PC+3:GOTO 1
    170                             :rem 176
850 IF P1=2 THEN PC=B1:GOTO 1170  :rem 202
860 ND$="( " + ND$ + " )"          :rem 118
870 B1=PEEK(B1) + LB*PEEK(B1+1):A=B1:GOSU
    B 250                           :rem 220
880 PRINT#PR:PRINT#PR,"*** ENCOUNTERED IN
    DIRECT JUMP"                    :rem 54
890 PRINT#PR,"{2 SPACES}THRU ";ND$;"
    {2 SPACES}TO ";A$               :rem 89
900 IF(BD=1) THEN PC=PC+3:GOTO 1170
                                    :rem 153
910 PRINT:PRINT"ENCOUNTERED INDIRECT JUMP
    ":PRINT" THRU ";ND$;" TO ";A$:rem 253
920 PRINT:PRINT"IS THIS VALID ?":INPUT A$
                                    :rem 229
930 IF LEFT$(A$,1)=YA$ THEN PC=B1:GOTO117
    0                               :rem 54
940 PRINT#PR                       :rem 239
950 PRINT:PRINT"DO YOU WANT TO CONTINUE ?
    ":INPUT A$                      :rem 118
960 IF LEFT$(A$,1)=YA$ THEN GOSUB 2320:GO
    TO 80                           :rem 220
970 CLOSE PR:END                   :rem 201
990 REM{5 SPACES}HANDLES{2 SPACES}BRK,JSR
    ,RTI, AND RTS                  :rem 146
1010 ON(P1+1)GOTO 1020,1120,1060,1210
                                    :rem 92
1020 A=PC:GOSUB 250:PRINT#PR:PRINT#PR,"**
     **{2 SPACES}BREAK AT ";A$      :rem 239
1030 PRINT:PRINT"ENCOUNTERED BREAK AT ";A
     $                              :rem 50
1040 GOTO 940                      :rem 155
1060 A=PC:GOSUB 250:PRINT#PR:PRINT#PR,"**
     **{2 SPACES}RTI AT ";A$        :rem 125
1070 PRINT:PRINT"ENCOUNTERED RTI AT ";A$
                                    :rem 192
1080 GOTO 940                      :rem 159
1100 REM{33 SPACES}STACK{2 SPACES}(JSR)
                                    :rem 92
1120 A=PEEK(PC+1) + LB*PEEK(PC+2):rem 240
1130 LC=PC:IF(BD=1) GOTO 1150       :rem 50
1140 SP=SP+1:SS(SP)=PC+2           :rem 166
1150 PC=A:GOSUB 250:ND$=A$:CM$=BL$
                                    :rem 152
1160 IF(BD=1) THEN PC=LC+3         :rem 136
1170 PRINT#PR,"-----":GOTO 210     :rem 114
1190 REM{33 SPACES}UNSTACK (RTS)    :rem 18
1210 IF(BD=1) THEN PC=PC+1:GOTO 1240
                                    :rem 192
1220 IF SP<1 GOTO 1270             :rem 103
1230 PC=SS(SP)+1:SP=SP-1           :rem 167
1240 PRINT#PR,"-----"              :rem 106
1250 ND$=BL$:CM$=BL$:GOTO 210       :rem 80
1270 A=PC:GOSUB 250:PRINT#PR:PRINT#PR,"**
     * RTS AT ";A$;" - STACK EMPTY"
                                    :rem 17
1280 PRINT:PRINT"NO STACK ENTRY FOR RTS A
     T ";A$                         :rem 29
1290 GOTO 940                      :rem 162
1310 REM{5 SPACES}BRANCHES - REL ADDR
                                    :rem 26
1330 A=PEEK(PC+1)                  :rem 170
1340 IF A>127 THEN A=A-LB           :rem 25
1350 B1= PC+2+A:ND$="*":IF A=>0 THEN ND$=
     "*+"                           :rem 224
1360 GOSUB 250:ND$=ND$+A$:CM$=BL$  :rem 49
1370 A=B1:GOSUB 250:ND$=LEFT$(ND$+BL$,7)+
     RIGHT$(BL$+A$,7)               :rem 147
1380 A=PC:GOSUB 250                 :rem 46
1390 PRINT                          :rem 90
1400 IF(BD=1) GOTO 1470            :rem 158
1410 PRINT OP$;"-- CONDITIONAL BRANCH ENC
     OUNTERED"                      :rem 13
1420 PRINT" FROM ";A$;" TO ";ND$   :rem 127
1430 PRINT:PRINT"DO YOU WANT TO FOLLOW TH
     E BRANCH ?"                    :rem 110
1440 INPUT A$                      :rem 190
1450 IF LEFT$(A$,1)=YA$ THEN PC=B1:GOTO 1
     170                            :rem 100
1460 IF LEFT$(A$,1)=Q$ GOTO 970     :rem 71
1470 PC=PC+2:GOTO 210              :rem 146
1500 REM{6 SPACES}GROUP ONE OP CODES
                                    :rem 38
1520 OP$=MID$(G1$,P1*3+1,3)        :rem 120
1530 IF (P1=4)AND(P2=2) THEN OP$=BD$:GOTO
      1970                          :rem 205
1540 ON(P2+1)GOTO 1580,490,630,590,1620,4
     30,550,530                     :rem 55
1560 REM{8 SPACES}(INDIRECT,X) ADDRESSING
                                    :rem 187
1580 GOSUB 350:ND$="( "+A$+",X )":CM$="IN
     DEXED INDIRECT":GOTO 210       :rem 243
1600 REM{8 SPACES}(INDIRECT),Y{2 SPACES}A
     DDRESSING                      :rem 183
```

```
1620 GOSUB 350:ND$="( "+A$+" ),Y":CM$="IN
     DIRECT INDEXED":GOTO 210     :rem 239
1650 REM{9 SPACES}GROUP TWO OP CODES
                                  :rem 68
1670 OP$=MID$(G2$,P1*3+1,3)       :rem 127
1680 IF P1<4 GOTO 1870{10 SPACES}REM
     {11 SPACES}SHIFTS AND ROTATES :rem 2
1690 ON(P2+1)GOTO 630,490,1710,590,1830,1
     740,1770,1810                :rem 215
1710 OP$=MID$(GG$,(P1-4)*3+1,3)   :rem 65
1720 ND$=BL$:CM$=BL$:PC=PC+1:GOTO 210
                                  :rem 75
1740 IF P1<6 GOTO 450             :rem 32
1750 IF P1>5 GOTO 430             :rem 32
1770 OP$=MID$(GG$,P1*3+1,3)       :rem 149
1780 IF OP$=BD$ GOTO 1970         :rem 19
1790 GOTO 1720                    :rem 212
1810 IF P1=5 GOTO 550             :rem 31
1820 IF P1>5 GOTO 530             :rem 31
1830 OP$=BD$:GOTO 1970            :rem 186
1850 REM{10 SPACES}SHIFTS AND ROTATES
                                  :rem 120
1870 ON(P2+1)GOTO 1830,490,1890,590,1830,
     430,1830,530                 :rem 169
1890 ND$=BL$:CM$=BL$:PC=PC+1:GOTO 210
                                  :rem 83
1910 REM{5 SPACES}VOID GROUP CODE:rem 137
1930 OP$=BD$:GOTO 1970            :rem 187
1950 REM{5 SPACES}INVALID OP CODE:rem 116
1970 ND$=BL$:CM$="BAD OP CODE"    :rem 102
1980 Z$="{2 SPACES}":FOR I=0 TO 10
                                  :rem 172
1990 A=PEEK(PC+I):GOSUB 280:Z$=Z$+A$
                                  :rem 37
2000 NEXT                          :rem 1
2010 PRINT#PR:PRINT#PR,PC$;Z$;" HEX"
                                  :rem 161
2020 PC=PC+1:GOTO1170             :rem 191
2050 REM{22 SPACES}INITIALIZATION:rem 211
2070 CL$=CHR$(147):PRINTCL$:{2 SPACES}REM
     {11 SPACES}CLEAR SCREEN AND HOME CUR
     SOR                          :rem 64
2080 SP=0:DIM SS(50):{9 SPACES}REM
     {11 SPACES}POINTER AND STACK:rem 210
2090 PC=0:{20 SPACES}REM{11 SPACES}PROGRA
     M COUNTER                    :rem 33
2110 DIM G0$(7):{14 SPACES}REM{11 SPACES}
     OP CODES                     :rem 236
2120 G0$(0)="BRKBADPHPBADBPLBADCLCBAD"
                                  :rem 245
2130 G0$(1)="JSRBITPLPBITBMIBADSECBAD"
                                  :rem 62
2140 G0$(2)="RTIBADPHAJMPBVCBADCLIBAD"
                                  :rem 29
2150 G0$(3)="RTSBADPLAJMPBVSBADSEIBAD"
                                  :rem 70
2160 G0$(4)="BADSTYDEYSTYBCCSTYTYABAD"
                                  :rem 144
2170 G0$(5)="LDYLDYTAYLDYBCSLDYCLVLDY"
                                  :rem 164
2180 G0$(6)="CPYCPYINYCPYBNEBADCLDBAD"
                                  :rem 88
2190 G0$(7)="CPXCPXINXCPXBEQBADSEDBAD"
                                  :rem 98
2200 G1$="ORAANDEORADCSTALDACMPSBC"
                                  :rem 181
2210 G2$="ASLROLLSRRORSTXLDXDECINC"
                                  :rem 33
2220 GG$="TXATAXDEXNOPTXSTSXBADBAD"
                                  :rem 45
2230 TP=65535:{16 SPACES}REM{11 SPACES}ME
     MORY ADDRESS LIMIT           :rem 44
2240 B3=4:B6=32:{14 SPACES}REM{11 SPACES}
     SHIFTS OP CODE RIGHT         :rem 41
2250 LB=256:{18 SPACES}REM{11 SPACES}LEFT
      BYTE MULTIPLIER             :rem 181
2260 BL$="{14 SPACES}":YA$="Y":BD$="BAD":
     B2$="{6 SPACES}"             :rem 78
2270 HX$="0123456789ABCDEF":Q$="Q":rem 51
2280 OP=3:{20 SPACES}REM{11 SPACES}CRT DE
     VICE RETURN WITHOUT GOSUB    :rem 38
2290 PRINT"DO YOU WANT PRINTER OUTPUT ?":
     INPUT A$                     :rem 235
2300 IF LEFT$(A$,1)=YA$ THEN OP=4:
     {5 SPACES}REM: PRINTER DEVICE RETURN
      WITHOUT GOSUB               :rem 176
2310 PR=5:OPEN PR,OP              :rem 179
2320 PRINT:PRINT"WHAT IS A GOOD TITLE FOR
      THIS ?":INPUT A$            :rem 168
2330 BD=0                         :rem 187
2340 PRINT#PR:PRINT#PR            :rem 167
2350 PRINT:PRINT"DEFAULT IS TO FOLLOW THE
      PROGRAM THREAD                :rem 8
2360 PRINT"DO YOU WANT A BLOCK DISASSEMBL
     Y                            :rem 48
2370 INPUT Z$:IF LEFT$(Z$,1)<>YA$ GOTO 24
     00                           :rem 85
2380 BD=1:PRINT#PR,"{2 SPACES}BLOCK DISAS
     SEMBLY OF":PRINT#PR,".. ";A$:rem 245
2390 GOTO 2410                    :rem 206
2400 PRINT#PR,"{2 SPACES}THREADING DISASS
     EMBLY OF":PRINT#PR,"{3 SPACES}";A$
                                  :rem 143
2410 PRINT#PR                      :rem 25
2420 PRINT"DEFAULT IS HEX MODE":PRINT"DO
     {SPACE}YOU WANT TO USE DECIMAL ?"
                                  :rem 215
2430 HX=1:INPUT A$                 :rem 6
2440 IF LEFT$(A$,1)=YA$ THEN HX=0:PRINT"D
     ECIMAL MODE SELECTED"        :rem 90
2450 PRINT"DISASSEMBLY TO START AT LOCATI
     ON ?"                        :rem 58
2460 GOSUB 2560:PC=A:IF PC>TP GOTO 2450
                                  :rem 166
2470 A=PC:GOSUB 250:PRINT#PR,"STARTING LO
     CATION =";A$                 :rem 205
2480 PRINT#PR                     :rem 32
2490 PRINT#PR,"LOC{12 SPACES}OP{5 SPACES}
     OPERAND"                     :rem 23
2500 PRINT#PR                     :rem 25
2510 PRINT:PRINT" PRESS Q TO STOP AT ANY
     {SPACE}TIME":PRINT           :rem 154
2520 RETURN                       :rem 169
2540 REM{13 SPACES}SUBROUTINE TO GET STAR
     TING LOCATION                 :rem 7
2560 IF HX=1 GOTO 2590            :rem 115
2570 INPUT A:RETURN               :rem 185
2590 A=0:INPUT A$:IF LEN(A$)>4 THEN PRINT
     "TOO BIG-TRY AGAIN":GOTO2590 :rem 16
2600 OK=1:FOR I=1 TO LEN(A$):Z$=MID$(A$,I
     ,1)                          :rem 91
2610 BAD=1:FOR J=1TO16:IF Z$<>MID$(HX$,J,
     1) GOTO 2630                 :rem 140
2620 BAD=0:A=A*16+J-1              :rem 91
2630 NEXT:IF(BAD=0)THEN NEXT:GOTO 2650
                                   :rem 6
2640 PRINT:PRINT"INVALID HEX CHAR":OK=0:N
     EXT                          :rem 40
2650 IF OK=1 THEN RETURN          :rem 115
2660 GOTO 2590                 :rem 215 ©
```

PCjr Memory Compatibility

Charles Brannon, Program Editor

IBM's memory expansion modules for the PCjr let you boost RAM up to 512K, allowing you to run many more PC programs that wouldn't fit before. However, there are still some compatibility problems that must be dealt with before you can fully take advantage of this extra memory.

IBM's snap-on 128K memory modules can expand PCjr memory to a whopping half-megabyte (512K), more than any other personal computer in its price range. Along with the new typewriter-style keyboard, this was part of IBM's response to months of slow sales and criticism that the PCjr was not as PC-compatible as it promised to be (see "IBM's New & Improved PCjr," COMPUTE!, October 1984). Now, finally, the PCjr can tackle many of the sophisticated but memory-hungry programs written for the IBM PC, such as *Lotus 1-2-3*.

Nevertheless, a few compatibility problems remain. The PCjr was not originally designed to take more than 128K RAM, and its memory layout differs somewhat from the PC's. Ironically, in many cases a 512K PCjr cannot run programs developed for a 128K Junior. To understand why, let's look at how the PCjr addresses its internal and expansion memory.

Invisible Memory

When you switch on a system with more than 128K, the IBM logo screen counts up to the total, recognizing the extra RAM. But none of this memory is visible to DOS 2.1. Since almost all programs follow DOS conventions, they'll also fail to take advantage of the extra memory.

Before any programs can "see" the added memory, you must customize your DOS 2.1 startup disk. You can reconfigure DOS in several different ways. For example, you can set up the expansion memory as additional RAM, as a RAMdisk, or as a combination of both.

A RAMdisk, or memory disk, is simply a simulated disk drive in RAM. You set aside a chunk of memory (10K to 512K) which DOS treats as a disk drive, addressed as drive C:. It acts just like an extra drive, allowing you to save and load files, call directories, and so forth, with one important exception: The files are stored in RAM instead of on a floppy disk. This means that disk access is virtually instantaneous, even faster than a hard disk. (It also means that the files will be lost if you turn off the computer without remembering to save them on a real disk.)

IBM offers the RAMdisk option so the PCjr can run some PC programs which require two disk drives (IBM doesn't make a second disk drive for the Junior, although some third-party companies do). However, some programs will not work with the RAMdisk due to memory conflicts.

Screen Memory Interference

To customize DOS for a RAMdisk or for extra memory, the memory modules come with a configuration disk containing an installation program. This program copies up to three files onto a backup of your DOS disk: CONFIG.SYS, PCJRMEM.COM, and RAMDISK.COM. By running the installation program and following its instructions, you create the customized DOS.

Why do you have to reconfigure DOS at all? On the IBM PC, DOS automatically recognizes how much memory is available. But on the PCjr, there's a complication—screen memory.

When a computer displays a picture on a screen, the image begins to fade within 1/60

second. Therefore, the video hardware must redraw the screen 60 times each second. To do this, the computer keeps a copy of the screen in memory. Different text and graphics screens require different amounts of memory—anywhere from about 2K for a 40-column text screen to as much as 32K for a 16-color graphics screen. In the PCjr, screen memory is part of regular RAM.

But in the IBM PC, screen memory doesn't consume usable RAM. Instead, it's part of the monochrome or color/graphics adapter. So a 512K IBM PC actually has 528K, including the screen RAM. In order to sell the PCjr inexpensively, some tradeoffs had to be made, so IBM decided to use part of regular RAM for screen memory.

By default, the topmost 16K of a 128K PCjr is reserved for screen memory. That's why an Enhanced Model PCjr with 128K actually has only 112K free RAM. For 32K graphics screens, such as the 320 × 200 16-color mode, extra RAM is subtracted from the top of memory. When you add memory modules to a PCjr, the extra RAM is added after the 128K boundary, but DOS still puts screen memory at the top of 128K, wedged between the internal 128K and the extra memory. This memory arrangement is shown in Figure 1.

Configuration Options

Since DOS insists that all memory be contiguous (uninterrupted), the video memory, sitting where it is, blinds DOS to the presence of extra RAM. So on a PCjr, you need a way to relocate the video memory. The configuration program can set up three new memory configurations, shown in Figures 2, 3, and 4. Figure 2 shows the default *expanded memory option*. This arrangement embeds 16K of screen memory within DOS, so all memory after the end of DOS is contiguous and usable. This is most like the IBM PC memory map.

The biggest problem is that since screen memory is embedded within DOS, there is no room to expand it to allow 32K graphics modes or multiple graphics screens. Programs requiring more than 16K of video memory just won't work with this configuration. However, it does allow maximum memory and the best compatibility with PC programs.

If you need more screen memory, you can use the *enhanced expanded memory option* (Figure 3). This puts 32K of video space within DOS. It gives you 16K less usable RAM, but allows one 32K graphics screen, two 16K screens, eight 80-column text screens, or sixteen 40-column screens. Many more PCjr programs will run un-

Figure 1: Standard PCjr Memory Configuration

The PCjr memory map with DOS 2.1. Video memory is stored just under the 128K boundary. Memory beyond 128K is ignored by DOS and applications programs running under DOS (including BASIC).

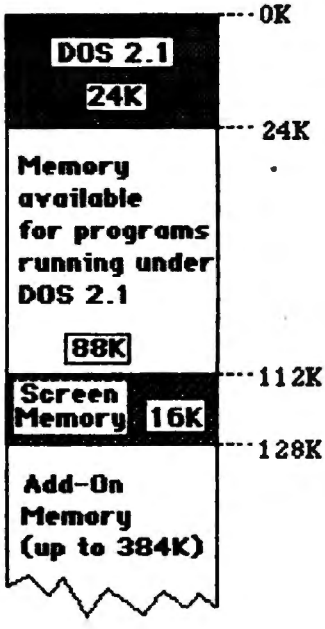


Figure 2: Expanded Memory Option

Screen memory (limited to 16K) is stored within DOS, and all memory after 52K is free for use. 32K graphics modes are not possible.

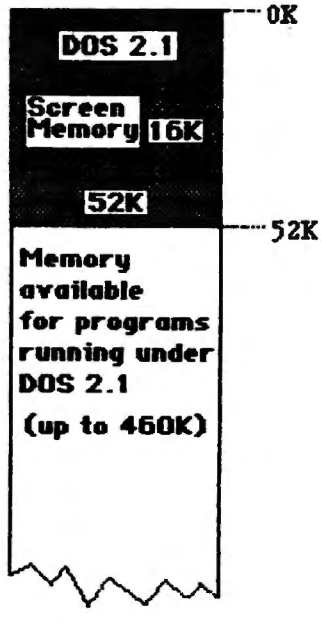


Figure 3: Enhanced Expanded Memory Option

32K of screen memory is embedded within DOS. Up to 428K of user RAM is free.

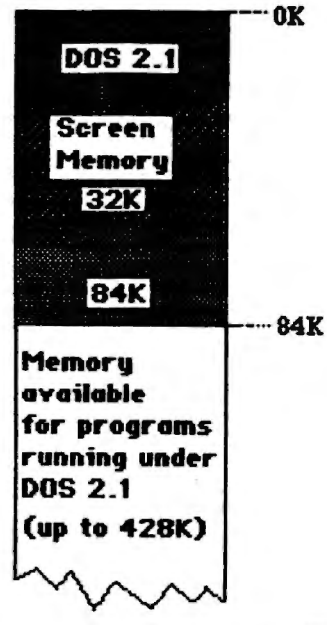
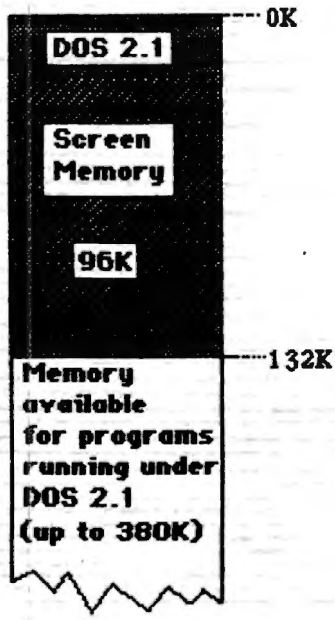


Figure 4: Compatible Expanded Memory Option

This provides the largest video area (96K), permitting screen flipping and up to three 32K screens.



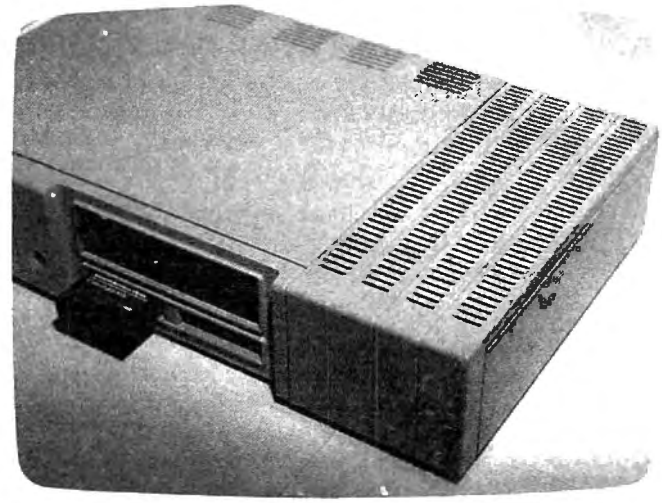
der this configuration, but not those requiring more than 32K of graphics space.

The ultimate solution is the *compatible expanded memory option* (Figure 4). This mode allows 96K of video memory, which, like the other configurations, is stored within the area reserved for DOS. The rest of memory is continuous after the end of DOS. If you don't need 96K of screen memory, this configuration is wasteful. However, it does permit up to three 32K screens, which should be enough for almost any PCjr program.

BASIC Incompatibility

Amazingly, though, none of these configurations works with PCjr Cartridge BASIC. This could be a major problem, since many applications programs are written in BASIC (including most programs published in magazines). Unfortunately, even a 512K PCjr can use no more than 64K for BASIC.

For example, "The Screen Machine" (COMPUTE!'s PC & PCjr magazine, April 1984), a graphics-drawing program written in BASIC, requires two 32K screens. Therefore, it works only with standard DOS 2.1, which ignores the extra memory. Any of the other memory configurations—even the one IBM refers to as compatible—confuses Cartridge BASIC and sometimes locks up the computer. Even the default expanded memory configuration works only with the text screen.



IBM's 128K memory expanders bolt onto the side of the PCjr system unit. More than one expander requires the power supply module in the first position. This PCjr has the maximum 512K.

Since BASIC cannot use more than 64K, it would seem that the added memory would be useless to you anyway. But think of the possibilities of over 400K of screen memory. You could instantly flip between 14 detailed 320 × 200, 16-color graphics screens. Alternately, you could store nearly 30 four-color frames. Since it takes 1/10 second for an image to fade from the human eye, this would allow three full seconds of high-quality animation. No other computer in the PCjr's price range would be capable of this feat. But with Cartridge BASIC, neither is the PCjr.

The IBM technical hotline (1-800-222-PCJR) had no answer for these problems. Probably Cartridge BASIC was never designed to use the extra memory. Indeed, IBM states that you should not try to use the expanded RAM with applications written especially for 128K. Only software written for the PC (and compatible with the PCjr) seems to anticipate additional memory. Some PCjr software doesn't even have the ability to access a second disk drive, which also precludes the ability to use the RAMdisk.

Nonetheless, 128K programs will still work with standard (unconfigured) DOS 2.1, since the extra memory is ignored. However, for full compatibility with all programs, you might end up maintaining four different DOS 2.1 disks—standard DOS and the three configurations. Plus a few more, if you want to configure the extra memory as various-sized RAMdisks.

The best solution would be to place screen memory at the very top of RAM, as high as 512K. This would leave room to expand the graphics screen downward. Again, though, unless an application knows how to find screen memory, there may be hopeless confusion. ©

Atari Disk Rx

Robert P. Dolan

"Disk Rx" is a utility which allows you to examine and repair damaged or deleted files. Here's nearly everything you need to cure sick disks. For single-density (DOS 1 and DOS 2) disks only.

When most people first purchase a personal computer, they buy a cassette recorder to save programs. This is because disk drives are often more expensive than the computers they serve. I started out with an Atari 400 and 410 program recorder, and remember thinking "Who needs a disk drive anyway?"

Well, I found out what all cassette users know. Programs can disappear for no reason at all. Since I was beginning to do a lot of programming, I wasted many hours from crashed cassettes.

I now own an Atari 810 disk drive. This mysterious peripheral enabled me to save my work frequently and reliably. Then I discovered data bases and word processors. It seemed that the fun could go on forever. Well, it's not all fun. Disks do crash for the strangest reasons. At times their directories get impossible to decipher (for example, I didn't mean to delete that file . . .).

Some of you have probably encountered these or other disasters. There is an excellent program called DISKEY, which can alleviate most of these problems. However, unless you are experienced or *very* careful, you can very easily lose files. DISKEY is good, but as far as I can tell it cannot do everything.

Reclaiming Files

Case in point: While using my data base, the program locked up and when I rebooted, the data file in which I had invested so many hours was all gone (error #170, #164, etc.). A friend who has DISKEY promised "no problem," and after several hours of trying, we gave up (maybe we didn't understand the manual—it is heavy reading). Determined not to reenter all that data, I set out to reclaim my file. After consulting COMPUTE!'s book *Inside Atari DOS*, I figured out how to get whatever was left of my file into a clean, closed, accessible file. This original routine was only 12 sectors long and now makes up the consecutive sector routine in "Disk Rx."

The more I studied, the more ideas I had about fixes for common problems. These ideas were added to Disk Rx. The program has been thoroughly tested, but I highly recommend that you transfer all important files to a backup disk (if possible) before attempting to repair the problem disk. Also, once you've repaired a disk, to be safe you should back it up immediately and reformat it to start fresh and avoid any additional problems.

Serious Modifications

Since this program performs serious modifications to the disk directory, the utmost care must be taken when typing it in. Areas requiring special attention are string assignments, disk calls, and as usual, DATA statements. If you just don't want to bother typing it in, send a disk or cassette, a self-addressed, stamped mailer, and $3 to me, and I will make a copy for you which actually initializes faster (it uses strings instead of DATA statements for the machine language setup). My address is:

Robert P. Dolan
99 Meriden St.
Rochester, NY 14612

Disk Rx In Action

The main purpose of this utility is the examination and repair of disk files. Most damaged files can be put back together for normal loading or other access. There are also provisions for file modifications which are normally not allowed by

DUP.SYS. These and other features of this program will be explained in detail in the following sections.

The main menu of the program presents these options:

[1] FILE BUILDER
[2] SPECIAL DOS
[3] ACTIVE DIRECTORY
[4] SECTOR DIRECTORY

The functions of these options are as follows:

[1] File Builder
When you select this, a second menu is displayed which allows file reconstruction in two ways. First, if a file is in a known location with consecutive sectors, a range of sectors is specified for grouping and saving in a new named file. The other and more powerful of these functions is the file trace routine. This portion allows the examination of a file's chain link on the disk. Through this, much can be learned about a damaged file, as well as one that is intact.

[2] Special DOS
Basically, this routine provides certain directory modifications that DUP.SYS would normally challenge. When called, the user is presented with another menu from which to decide the particular function desired. The subroutines are Rename, Delete, and the life-saving Undelete. If a disk has not been written to much since the target file was deleted, the deleted file can be saved. The other two functions may not sound so special, but sometimes DUP.SYS will not allow their use. These functions will be further explained in the Special DOS section.

[3] Active Directory
This is a simple directory access which will present the files that DOS considers to be on the disk. Only these files can be accessed through normal means. This program puts any files existing on the disk into this listing. Therefore, the success of an operation performed on a file can be checked by calling this directory. Of course, the ultimate proof of success is only evident when a resurrected file has been normally accessed.

[4] Sector Directory
On this directory are all of the files which exist or have existed since the disk was last formatted (except that one or more old filenames may have been written over). With this, much information can be gained about the entire disk. When called, the following data is displayed: file number, filename, starting sector, number of sectors, and the current condition of the file (locked, unlocked, deleted, or undefined).

File Builder

In most cases, the reconstruction of a lost file can be accomplished only if the file were damaged by either of two causes. First, if the file was being accessed by another program and the calling program locked up, the called file would usually be left in an open state. Subsequent attempts to access this file would be unsuccessful. If this was a data file or a text file (such as a program saved with a LIST command), almost all of the file can be reconstructed. If the damaged file was created by a SAVE command, the outlook is not so good. The second way that a file can be lost is if it is mistakenly deleted. In that case, you'll have to use the Undelete function of the Special DOS option to retrieve it.

When a file is left open, be sure not to write to this particular disk until you have a chance to try to correct the problem. Doing so decreases your chances of rebuilding the file to a usable condition, since DOS may write over some of the sectors you need. Run Disk Rx and select the File Builder option. From the second menu, select item 2, File Trace.

Provide the damaged file's name (the D: prefix is not necessary). Disk Rx will look up your file in the disk directory and determine at which sector it begins. When this is done you will be presented with a screen detailing all of the information there is on the target file. Press a key when you are ready, and the actual trace will begin.

As the file is traced, pertinent data about the file is displayed at the top of each sector display. This data is: TGT#—target file number, the number that we use as a reference; CUR#—current file number, the actual file number as derived from byte 125 of the sector just read and displayed (we want this to match our reference); NSEC#—the forward sector reference, which tells us where we are going; and BYTES—number of bytes in this sector which belong to the file we are tracing (this should equal 125 unless we are done, in which case it can be less).

While we're on the subject, a word about sectors and bytes. There are physically 720 sectors, and 128 bytes in these sectors. The reason we're interested mainly in 125 of these is that we are reading and working with data sectors which reserve the remaining three bytes for controlling where the load is going. A boot sector uses all 128 bytes since it loads consecutively and does not need control. Disk Rx is not concerned with boot sectors. This program is a file fixer and works with files and data sectors.

More Options

When a file's trace is completed or stopped, the forward sector reference should be 0. The

number of bytes claimed by our file should be less than or equal to 125. The trace routine will not continue if either of these parameters contains incorrect values, or if file number references do not match. The latter usually prevents a complete recovery of the file.

In any case, you will have the option of saving the sector data collected during this trace or aborting the effort (in which case you go back to the main menu and all strings and buffers are cleared). When you save the new file, be sure to use the D: prefix. Using a different filename is suggested, so that you don't modify the sectors you just used as your source.

The other option offered in the File Builder mode is the consecutive sector approach. This routine is used when the exact location of a file is known. This information can be learned by consulting the sector directory and tracing the file's sector linkage on the disk. The only information provided here is the sector being read and the file number to which the sector is supposed to belong.

There is no checking for file integrity. This routine will cycle until it completes the sector range previously selected by the user. At this point, you are again presented with the choice to save or abort. This routine is also good for simply taking a tour of the disk. By selecting a range of 1 to 720, you can view as much of the disk as you like. Do this by answering N to the prompt regarding data collection.

The routines and aids available in the File Builder section of Disk Rx are helpful and, in most cases, can bring a dead program back to life. However, not every damaged file can be recalled.

Special DOS: Uses And Limitations

The Special DOS functions differ from their conventional counterparts. When implemented, no checking is done on the directory bitmap or the file itself. The requested changes are made to the sector directory only. If you have a botched file and don't care about it, DOS usually won't allow you to delete it. Disk Rx will perform the deletion but will not free the sectors the target file used for other purposes. For a file which occupies many sectors, see the suggestions below. However, most small files can simply be deleted by Disk Rx and forgotten about (except for sector count discrepancies).

This checking procedure also applies to the other Special DOS functions, Rename and Delete. The filename entry will be renamed even if its sectors are written over by another file. The Rename function is useful mainly for solving the problem of having duplicate filenames on the same disk. (If it hasn't happened to you yet, you're not trying.) When a Rename command is called, it acts on the first instance of the target name in the directory. Because of this, subsequent duplications remain unchanged.

The most often needed routine in this program is probably the Undelete procedure. This function is also the simplest, but its success can only be guaranteed if the disk on which the file resides hasn't been written to since the deletion. Otherwise, recovery must be attempted through use of the File Builder option. This is another nonverify process, which means we are only changing the status of the sector directory entry so DOS will now acknowledge its presence and load it (assuming it is still intact). The final procedure recommended for this function is different from that for the Delete function. This time, load and save the newly accessible file by standard procedures to insure its success.

These Special DOS functions can only be lifesavers if any necessary follow-up procedures are performed. Once again, the only true indication of a successful operation is the loading and execution of the recovered file. It is also strongly recommended that you resave any file which has been through any of Disk Rx's routines to insure complete recovery.

Botched File Deletion

One way to delete a damaged file and clear its related sectors for other uses is to use the File Trace function of File Builder to build a deletable file. This new file *must* be saved under the same name as the old file. This will insure that the same sectors are used in the new SAVE procedure. The new file can then be deleted completely by more conventional means, thereby freeing the associated sectors. This action is usually worth the trouble for very large files.

Console Button Controls

When sectors are displayed by Disk Rx, they can be toggled or aborted at any time by using the console buttons. During the display output, simply press the START button. This will freeze output to the screen. Pressing the SELECT button will then return control to where it left off. If you wish to terminate the function in progress, press the OPTION key instead and you will be returned to the main menu.

Here are brief explanations of the subroutines included in Disk Rx. Some can be used in other applications, and to that end, have been written with portability in mind.

150-200 Initialization: String dimensions, buffer setup (clearing), machine language subroutine loading, and subroutine variable setup.

300-400 Consecutive sector loop: Note the IF-THEN statements in this routine as well as

others which provide for usage by other, more central routines.

400–500 File I/O setup: Gets filename and directs program flow to file I/O routine if there is data in the buffer to be saved.

500–600 Sector I/O routine: Probably the most used routine in the program, it is capable of reading or writing a sector as determined by the SWRITE flag (POKE 770).

600–700 Sector printout loop: Prints the contents of the sector buffer to the screen while not allowing control characters to perform their normal function. This is done by printing an escape character (CHR$(27);) before the intended character.

1000–2000 Main menu: Displays options and gets choice.

2000–3000 Console button control: Checks for START, SELECT, or OPTION pushed.

3000–4000 Special DOS routine: Prints a menu and performs Undelete, Delete, or Rename.

4000–5000 Directory search routine: This is not really suitable for portability since it jumps around so much. However, it is useful to study the method for examining and manipulating the filename string (FN$) and the directory entry string (ITEM$).

5000–6000 File trace routine: Extracts information from disk sectors for rebuilding files.

6000–7000 Sector directory printout routine: Displays sector information on the screen in the proper format.

28000–29000 File I/O routine: This is extremely portable for any application in which it is necessary to save any portion of memory to a disk file (or to any device, for that matter). It is derived from a routine provided in *De Re Atari*.

31000–32000 Proceed routine: Most routines use this to terminate their function. It clears the keyboard of previous entries and asks for another. When received, execution goes to the main menu (where the program is rerun to clear all buffers).

32000–32110 Standard disk directory routine: This is entirely portable and a very useful feature to have in any program.

Disk Rx

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

```
MM 150  ? "{CLEAR}":? "Okay...":DIM
          FN$(25),TANK$(130),DIS$(10
        ),ITEM$(25),ENT$(25),EXT$(5
        ),FLAG$(25),ID$(3),CBIN$(32
        )
NB 155  DIM CIO$(7),CURNM$(16),NWNM
        $(16)
JE 156  POKE 16,64:POKE 53774,64:SE
        TCOLOR 2,13,0
IO 157  RAM=INT(FRE(0)*0.75):DIM BU
        F$(RAM)
FA 160  CBIN=ADR(CBIN$):CIO=ADR(CIO
        $):START=ADR(TANK$)
GP 165  BUF$="{,}":BUF$(RAM)=BUF$:B
        UF$(2)=BUF$:TANK$="{,}":TAN
        K$(130)=TANK$:TANK$(2)=TANK
        $
CJ 170  NAME=4008:MENU=1000:HALT=20
        00:SREAD=500:IO=28000:CYCLE
        =220:PRNT=600:CONVERT=5160:
        DIREAD=4000
AK 175  IF PEEK(1572)=83 THEN 1010
AL 180  RESTORE :FOR A=1570 TO 1574
        :READ D:POKE A,D:NEXT A
NI 181  FOR A=1 TO 32:READ D:CBIN$(
        A,A)=CHR$(D):NEXT A
JP 182  FOR A=1 TO 7:READ D:CIO$(A,
        A)=CHR$(D):NEXT A:GOTO 1010
NI 185  DATA 104,32,83,228,96
LG 186  DATA 104,104,104,141,144,6,
        141,145,6,78,144,6,78,144,6
        ,162,5,14,145,6,202,16,250,
        162,5,78,145,6,202,16,250,9
        6
JA 187  DATA 104,104,104,170,76,86,
        228
HG 200  REM
OA 205  TRAP 1150:? "{CLEAR}{2 DOWN}
        ENTER FIRST SECTOR ";:INPUT
         FSEC:CONS=1
OB 210  ? "{DOWN}ENTER LAST SECTOR
        ";:INPUT LSEC
IK 215  POKE 764,255:TRAP 220:? "
        {DOWN}DISPLAY SECTORS ";:IN
        PUT DIS$:IF DIS$(1,1)="Y" T
        HEN DISPLAY=1
PF 217  TRAP 220:? "{DOWN}LOAD SECT
        OR DATA INTO BUFFER";:INPUT
         DIS$:IF DIS$(1,1)="Y" THEN
         FILL=1:TRAP 40000
IE 220  POKE 764,255:TRAP 225:? "
        {2 DOWN}INSERT SOURCE DISK
        AND PRESS RETURN";:INPUT A
DN 225  TRAP 40000:?
HH 300  REM
NG 305  FOR SECT=FSEC TO LSEC
OO 310  IF PEEK(53279)=6 THEN GOSUB
         HALT
AP 315  IF CONS=1 THEN ? "READING
        SECTOR ";SECT
ME 320  GOSUB SREAD:IF DISPLAY=1 TH
        EN GOSUB PRNT
LE 322  IF DIR<>1 THEN GOSUB CONVER
        T:? "FILE NO. ";FILNO:?
NH 325  IF FILL=1 THEN BUF$(BCNT,BC
        NT+TYPE)=TANK$(1,TYPE):BCNT
        =BCNT+TYPE
CJ 330  NEXT SECT:IF DIR=1 THEN RET
        URN
HI 400  REM
BH 405  ? :? "HIT START TO SAVE":?
        "HIT OPTION TO RESTART"
OB 410  IF PEEK(53279)=6 THEN 425
LG 415  IF PEEK(53279)=3 THEN GOTO
        MENU
```

```
GE 420 GOTO 410
AB 425 IF BCNT<2 THEN ? :? CHR$(25
       3);"NO DATA TO SAVE":GOTO 3
       1000
CA 427 POKE 764,255:? "{CLEAR}
       {2 DOWN}ENTER OUTPUT FILESP
       EC ";:INPUT FN$
ME 430 IF FN$(1,2)<>"D:" THEN 425
EH 435 ? "{2 DOWN}PARAMETERS FOR F
       ILE ";FN$
PP 440 BYTES=BCNT:? "{DOWN}BYTES R
       EAD=";BYTES
OC 445 ? "{DOWN}WHICH EQUALS ";INT
       (BYTES/125);" SECTORS"
OD 450 STADR=ADR(BUF$):CMD=11:GOSU
       B 10:GOTO 31000
HJ 500 REM
IM 505 REM *** SECTOR READ ROUTINE
        ***
NB 510 POKE 769,1:POKE 770,82:POKE
        779,0
AM 515 IF SWRITE=1 THEN POKE 770,8
       7
MP 520 BUFLO=START-256*INT(START/2
       56):BUFHI=INT(START/256)
LO 525 POKE 772,BUFLO:POKE 773,BUF
       HI
PO 530 POKE 778,SECT-256*INT(SECT/
       256)
NG 535 POKE 779,INT(SECT/256)
GA 540 X=USR(1570):RETURN
IC 545 REM
HK 600 REM
HP 605 REM
IC 610 FOR X=1 TO 128
PG 615 IF PEEK(53279)=6 THEN GOSUB
        HALT
GE 620 ? CHR$(27);TANK$(X,X);:NEXT
       X:? :? :RETURN
IM 996 REM
MD 997 REM *** MAIN MENU ***
LG 1000 RUN
DL 1010 SWRITE=0:DIR=0:UNDEL=0:NAM
       ER=0:CMD=7:DISPLAY=0:SECDI
       R=0:BCNT=1
PI 1020 POKE 764,255:TRAP MENU:? "
       {CLEAR}{2 DOWN}{8 SPACES}=
       =>{4 SPACES}DISK RX
       {4 SPACES}K=={9 SPACES}"
BJ 1035 FOR S=1 TO 55:POKE 53279,0
       :NEXT S
MH 1040 ? "{3 DOWN}{7 SPACES}***OP
       TIONS***"
DI 1060 ? "{DOWN} [1] BROKEN FILE
       BUILDER"
BM 1070 ? " [2] SPECIAL DOS
       {8 SPACES}"
KI 1080 ? " [3] ACTIVE DIRECTORY
       {5 SPACES}"
LO 1090 ? " [4] SECTOR DIRECTORY
       {5 SPACES}"
MF 1095 ? " [5] QUIT PROGRAM
       {4 SPACES}";
HD 1099 INPUT CHOICE:TRAP 40000
FM 1100 IF CHOICE=2 THEN 3000
HF 1110 IF CHOICE=5 THEN END
JC 1120 IF CHOICE=3 THEN 32000
GF 1130 IF CHOICE=4 THEN 6000
EI 1140 IF CHOICE<>1 THEN GOTO MEN
       U
MA 1150 TRAP 1150:? "{CLEAR}
       {2 DOWN}  {5 SPACES}FILE B
       UILDER{5 SPACES}"
MK 1160 ? "{3 DOWN}{6 SPACES}***OP
       TIONS***"
LM 1170 ? "{DOWN} [1] CONSECUTIVE
       SECTORS"
BI 1180 ? " [2] DISK SEARCH
       {8 SPACES}"
NG 1190 ? " [3] MAIN MENU
       {10 SPACES}";:INPUT OPTION:
       TRAP 40000
OE 1200 IF OPTION=1 THEN TYPE=125:
       GOTO 200
DJ 1210 IF OPTION=3 THEN GOTO MENU
MP 1220 IF OPTION<>2 THEN 1150
KI 1230 GOTO DIREAD
KG 2000 REM
OA 2020 IF PEEK(53279)=3 THEN GOTO
        MENU
FF 2030 IF PEEK(53279)=5 THEN RETU
       RN
CI 2040 GOTO HALT
KH 3000 REM
IL 3010 REM *** SPECIAL DOS ***
KJ 3020 REM
JL 3030 TRAP 3000:? "{CLEAR}
       {2 DOWN}  {5 SPACES}SPECIA
       L DOS{6 SPACES}"
MJ 3040 ? "{3 DOWN}{6 SPACES}***OP
       TIONS***"
MH 3050 ? "{DOWN} [1] UNDELETE FIL
       E"
AO 3060 ? " [2] RENAME FILE
       {8 SPACES}"
AL 3070 ? " [3] DELETE FILE
       {6 SPACES}"
MH 3080 ? " [4] MAIN MENU
       {10 SPACES}";:INPUT OPTION:
       TRAP 40000
IE 3090 ON OPTION GOTO 3110,3210,3
       110,MENU
MA 3100 GOTO 3000
KD 3110 REM *** UNDELETE ROUTINE
MM 3120 TRAP 40000:UNDEL=1:GOSUB D
       IREAD:ITEM$(1,1)="B":SECT=
       361:SWRITE=1:IF OPTION=3 T
       HEN ITEM$(1,1)="{男}"
MM 3130 BUF$(1+REC*16,16+REC*16)=I
       TEM$(1,16):START=ADR(BUF$)
ME 3140 ? :? "HIT START TO WRITE
        NEW DIRECTORY"
AP 3142 ? "HIT OPTION TO ABORT P
       ROCEDURE"
OL 3147 IF PEEK(53279)=3 THEN GOTO
        MENU
EE 3150 IF PEEK(53279)=6 THEN 3160
NG 3155 GOTO 3147
LJ 3160 GOSUB SREAD
KK 3170 FOR XX=1 TO 7
BM 3180 SECT=SECT+1:START=START+12
       8
AE 3190 GOSUB SREAD:NEXT XX:UNDEL=
       0
```

```
HH 3200 SWRITE=0:GOTO 31000
AG 3210 REM *** RENAME ROUTINE
PB 3220 NAMER=1:? "{2 DOWN}ENTER C
        URRENT FILENAME";:INPUT FN
        $:GOSUB NAME:CURNM$=FN$
BC 3230 NAMER=1:? "ENTER NEW FILEN
        AME{4 SPACES}";:INPUT FN$:
        GOSUB NAME:NWNM$=FN$:FN$=C
        URNM$
NL 3240 TRAP 40000:UNDEL=1:GOSUB 4
        010:ITEM$(6,16)=NWNM$:SECT
        =361:SWRITE=1:GOTO 3130
MC 3999 REM
AP 4000 REM *** DIRECTORY SEARCH *
        **
PA 4005 TRAP 4005:? "{DOWN}ENTER T
        ARGET FILESPEC ";:INPUT FN
        $
KH 4008 D=LEN(FN$):IF D=0 THEN 400
        5
LH 4010 FOR I=1 TO D:IF FN$(I,I)="
        ." THEN GOTO 4200
EP 4012 NEXT I
JL 4015 TRAP 4020:IF FN$(1,2)="D:"
         THEN FN$=FN$(3,LEN(FN$))
HK 4020 TRAP 40000:IF LEN(FN$)<11
        THEN FN$(LEN(FN$)+1)="
        {11 SPACES}":IF LEN(FN$)>11
         THEN FN$=FN$(1,11)
GE 4025 IF NAMER=1 THEN NAMER=0:RE
        TURN
BH 4030 FSEC=361:LSEC=368:DISPLAY=
        0:DIR=1:TYPE=128:REC=0
BM 4035 CONS=0:FILL=1:GOSUB CYCLE:
        IF REN=1 THEN REN=0:RETURN

MC 4040 ITEM$=BUF$(1+REC*16,16+REC
        *16):IF ITEM$(6,16)=FN$ TH
        EN 4055
HP 4045 IF REC>65 THEN ? CHR$(253)
        ;FN$;" NOT FOUND":GOTO 310
        00
FB 4050 REC=REC+1:GOTO 4040
FC 4055 IF UNDEL=1 THEN RETURN
BG 4060 ? "{CLEAR}{DOWN}**********
        **********************
        *{DOWN}"
BB 4065 ? :? ITEM$(6,16);" IS FILE
         NO.";REC:? :THIS=REC
FE 4070 FLAG=ASC(ITEM$(1,1)):SCNTL
        =ASC(ITEM$(2,2)):SCNTH=ASC
        (ITEM$(3,3)):SSNL=ASC(ITEM
        $(4,4)):SSNH=ASC(ITEM$(5,5
        ))
BE 4075 SCNT=SCNTH*256+SCNTL:SSN=S
        SNH*256+SSNL:IF SECDIR=1 T
        HEN RETURN
EB 4080 ? :? "*** PARAMETERS FOR F
        ILE"
BJ 4085 ? :? "DISK STARTING SECTOR
         =";SSN:?
FG 4090 ? "TOTAL SECTOR COUNT
        {3 SPACES}=";SCNT:?
FC 4095 ID$=ITEM$(1,1):IF ID$<>"b"
         AND ID$<>"B" AND ID$<>"
        {■}" THEN FLAG$="UNDEFINED
        "
AJ 4100 IF ITEM$(1,1)="b" THEN FLA
        G$="LOCKED"
JB 4105 IF ITEM$(1,1)="B" THEN FLA
        G$="UNLOCKED"
GM 4110 IF ITEM$(1,1)="{■}" THEN F
        LAG$="DELETED"
JB 4115 IF SECDIR=1 THEN RETURN
JM 4120 ? :? "CURRENT FILE STATE I
        S ";FLAG$
MH 4125 ? :? "HIT ANY KEY TO BEGIN
         TRACE":POKE 764,255
HI 4130 IF PEEK(764)<>255 THEN 500
        0
MO 4135 GOTO 4130
HC 4200 EXT$=FN$(I+1,D):FN$=FN$(1,
        I-1)
PH 4205 D=LEN(FN$):IF D<8 THEN FN$
        (D+1)="{8 SPACES}":IF LEN(
        FN$)>8 THEN FN$=FN$(1,8)
AI 4210 ? CHR$(253):FN$(LEN(FN$)+1
        )=EXT$:GOTO 4015
KJ 5000 REM
GM 5020 ? "{CLEAR}{2 DOWN}>>>>>>>FI
        LE TRACE<<<<<<<"
ON 5022 DISPLAY=0:FILL=0:POKE 764,
        255
LM 5025 TRAP 5027:? :? "{2 DOWN}DI
        SPLAY SECTORS";:INPUT DIS$
        :IF DIS$(1,1)="Y" THEN DIS
        PLAY=1
FM 5027 TRAP 5030:? "{DOWN}LOAD SE
        CTOR DATA INTO BUFFER";:IN
        PUT DIS$:IF DIS$(1,1)="Y"
        THEN FILL=1:TRAP 40000
PJ 5030 BCNT=1:SWRITE=0:UNDEL=0:DI
        R=0:TYPE=125:SEARCH=1:SECT
        =SSN:GOSUB SREAD
GK 5040 GOSUB CONVERT
EL 5050 ? :? "TGT#=";THIS;" CUR#="
        ;FILNO;" NSEC=";NSEC;" BYT
        ES=";BYTES:?
EN 5060 IF FILL=1 THEN BUF$(BCNT,B
        CNT+TYPE)=TANK$(1,TYPE):BC
        NT=BCNT+BYTES
NC 5070 IF DISPLAY=1 THEN GOSUB PR
        NT

ON 5075 IF THIS<>FILNO THEN ? :? "
        FILE NUMBER MISMATCH ";CH
        R$(253):? :? "OPTION-ABO
        RT/SELECT-CONTINUE":GOTO
         HALT
KO 5080 IF TANK$(127,127)="{,}" TH
        EN 400
IM 5090 SECT=NSEC:GOSUB SREAD
CA 5100 IF PEEK(53279)=6 THEN GOSU
        B HALT
MJ 5110 GOTO 5040
KM 5120 REM
PO 5130 REM *** BYTE CONVERT ***
KO 5140 REM
AG 5160 A=USR(CBIN,ASC(TANK$(126,1
        26)))
MP 5170 FILNO=PEEK(1680):NSECHI=PE
        EK(1681):NSECLO=ASC(TANK$(
        127,127)):BYTES=ASC(TANK$(
        128,128))
```

```
KE 5180 NSEC=NSECHI*256+NSECLO
KP 5190 RETURN
KK 6000 REM
LG 6020 REM *** SECTOR DIR. PRINTO
        UT *
KH 6030 REM
PF 6040 FSEC=361:LSEC=368:DISPLAY=
        0:DIR=1:TYPE=128:REC=1:SEC
        DIR=1:R=0:START=ADR(TANK$)
IK 6050 FILL=1:GOSUB CYCLE
GE 6055 TRAP 6060:? :? "WANT PRINT
        OUT";:INPUT ITEM$:IF ITEM$
        (1,1)="Y" THEN P=1:GOSUB 6
        200
MO 6060 ? "{CLEAR}{DOWN}
        {7 SPACES}SECTOR DIRECTORY
        {11 SPACES}"
LL 6070 ? "■REC■■FILENAME■■SSN■SCN
        T■■STATUS■■"
KA 6080 ITEM$=BUF$(1+REC*16,16+REC
        *16)
KG 6090 GOSUB 4070:GOSUB 4095
MK 6100 IF ITEM$(1,5)="{5 ,}" THEN
         SECDIR=0:GOTO 31000
IC 6105 IF P=1 THEN LPRINT REC,ITE
        M$(6,16),SSN,SCNT,FLAG$
KK 6110 POSITION 3,R+4:? REC:POSIT
        ION 6,R+4:? ITEM$(6,16):PO
        SITION 18,R+4:? SSN
NE 6120 POSITION 23,R+4:? SCNT:POS
        ITION 28,R+4:? FLAG$:R=R+1
        :REC=REC+1:IF R<>15 THEN 6
        080
BG 6130 POKE 764,255:? :? "{X}=END
        ....{C}=CONTINUE"
KP 6140 IF PEEK(764)=22 THEN GOTO
        MENU
EF 6150 IF PEEK(764)=18 THEN R=0:G
        OTO 6060
NB 6160 GOTO 6140
LC 6170 REM
LD 6200 TRAP 6220:LPRINT " ":LPRIN
        T " ":LPRINT "{7 SPACES}SE
        CTOR DIRECTORY{11 SPACES}"
KF 6210 LPRINT "REC#{6 SPACES}FILE
        NAME{12 SPACES}SSN
        {7 SPACES}SCNT{6 SPACES}ST
        ATUS":LPRINT "  ":RETURN
DH 6220 ? :? "■TURN ON PRINTER■":G
        OTO 31000

PI 27999 REM
DB 28000 REM ** SHORT FORM FILE I/
         O **
NP 28001 REM
GH 28025 CB=1:BX=16*CB:CM=834+BX:S
         TA=835+BX:AL=836+BX:AH=83
         7+BX:LL=840+BX:LH=841+BX:
         A1=4:IF CMD=11 THEN A1=8
FA 28040 CLOSE #1:OPEN #CB,A1,0,FN
         $:TEMP=STADR:GOSUB 28060:
         POKE AL,LOW:POKE AH,HI:TE
         MP=BYTES:GOSUB 28060
EH 28050 POKE LL,LOW:POKE LH,HI:PO
         KE CM,CMD:ERROR=USR(ADR(C
         IO$),BX):ERROR=PEEK(STA):
         CLOSE #1:RETURN
IG 28060 HI=INT(TEMP/256):LOW=INT(
         TEMP-HI*256):RETURN
PJ 31000 POKE 764,255:? :? :? "HIT
          ANY KEY TO CONTINUE"
EO 31010 IF PEEK(764)<>255 THEN GO
         TO MENU
CE 31020 GOTO 31010
BJ 32000 REM ■DISK DIRECTORY■
NO 32010 OPEN #5,6,0,"D:*.*":POKE
         82,1
PF 32020 ? "{CLEAR}":TRAP 32110:?
         :? "{11 SPACES}DISK DIREC
         TORY{11 SPACES}"
FG 32040 INPUT #5,ENT$:? ENT$;"  "
         ;
AJ 32050 INPUT #5,ENT$:? ENT$:GOTO
          32040
MO 32110 CLOSE #5:? :? "
         {70 SPACES}";:POKE 82,2:GO
         TO 31000
```

MACHINE LANGUAGE

Jim Butterfield, Associate Editor

Retrospective

Editor's Note: This is Jim Butterfield's last "Machine Language" column for COMPUTE!*—but that doesn't mean he is departing our pages. Butterfield will continue to contribute articles, programs, advice, and "Readers' Feedback" answers on a regular basis. And as always, he welcomes your letters, comments, and suggestions (c/o* COMPUTE!*).*

This winds up the machine language column. It's been running since issue 3 of COMPUTE! (March/April 1980) and has covered a variety of topics related to machine language. Now it's time to look back and reflect on the nature of machine language and how to cope with it.

Assembly Vs. Machine Language

Why *machine language* as opposed to *assembly language*? If I write about a command to load the A register and call it LDA, for Load A, isn't this assembly code? In a sense, yes. It seems to me that if you have your mind firmly fixed on the machine—where the program will be located, how big it is, and details on how it works—you are writing machine language.

With assembly language programming, on the other hand, you disconnect yourself from the machine to some extent. You can write code without knowing where it will eventually reside in the computer. You can call subroutines, say for input and output, without knowing exactly where they are located. You can use abstract locations in zero page and figure out later what addresses will be free for the job.

All of these characteristics of assembly language are good. They allow you to write a program in principle and worry about the details later. They let you concentrate on ideas instead of detail. They help to make code transportable from one type of computer to another.

But to the beginner, the ideas are too abstract. As you learn, you build confidence and allay fear by writing programs that work, not just on paper, but on a real machine. Most beginners want to see something happen. And that's machine language.

When you start, there are all kinds of details you must keep track of: how to use the monitor, what parts of memory are safe, how input and output works, and so on. At this stage, an assembler can be extra clutter: a whole set of extra rules you must learn. Wait.

If you're going to work in machine/assembly language a fair amount, do plan to buy an assembler . . . eventually. It will make your job easier and your programs better. But before you do, get to know machine language; you'll gain a fundamental understanding of what's going on inside the computer.

Mathematics

Most of us have learned that a computer may be mathematical in nature, but you don't need to be a math wizard to use it. In many cases we can write programs without ever visibly using mathematics.

In machine language, the mathematical nature of the computer is more tangible. We quickly discover that since each byte can contain a value of only 0 to 255, coding is needed to handle large numbers. We may be concerned with signed numbers and need to learn about the mysteries of twos-complement arithmetic. New number systems such as binary and hexadecimal become important.

Even to do simple jobs such as inputting or outputting a numeric value, we must dig into math procedures, since binary numbers must be converted to or from decimal. Addition, subtraction, multiplication, and division become new challenges. None of this is "advanced" mathematics; it's a new look at an old subject.

To some programmers, this is drudgery. To others, it's a challenge. People can be amazed to discover that numbers can be fun.

Problems And Discipline

BASIC programmers may go to the computer and type in whatever instructions pop into their

heads. That's not a good idea in BASIC, and it's a disaster in machine language.

Form a plan. Write the planned program on paper, not on your screen. Desk check: Go through each instruction and pretend you are the computer, writing down what is in each register and in memory. Then enter the program into the computer.

Try to form the program into modules so you can test it in parts. Put a halt command after each module (a BRK, break, hexadecimal 00, will do the job on 6502 systems). As each module works, remove the halt command and continue to the next module.

Your program will run correctly if you write it correctly. A computer is dumb and doesn't know how to make mistakes. It takes a programmer to do that. And it takes a careful programmer to fix the mistakes.

The Joy Of Machine Language

It's quite a thrill to get a machine language program working. Everything happens so quickly—machine language is fast. And everything happens precisely—you have more control when you write in machine language.

There's a great sense of accomplishment. And that's what programming is all about. ©

Donald B. Trivette

The Most Important Peripheral

One of my friends recently bought an IBM AT. This is the Rolls Royce of IBM Personal Computers—the machine that is three times faster than the PC and PCjr, that comes with 256K of memory, and that has an optional 20-megabyte hard disk. This is the computer that I want but can neither afford nor justify. My friend doesn't really need the speed and power of the AT either—mostly he uses it to balance his checkbook, from which he deducted a tidy $5,795 to be able to do it faster than anyone else. Until he bought the AT, he *got by* with an IBM PC-XT, an Apple III, and a PCjr. (This guy has more computer power in his spare bedroom than many Fortune 500 companies had a decade ago.)

Anyway, he was in the process of moving his files from the 10-megabyte PC-XT hard disk to the AT's 20-meg hard disk by copying them on floppy disks. Although this is time-consuming, it's not particularly difficult. At least it wouldn't have been difficult except my computer-rich friend was running his PC-XT without a monitor. His only monitor (gotta save a few bucks somewhere) was connected to the new AT. Do you know how much havoc you can cause running a computer without a video display? It's frightening!

As my friend discovered, the most important peripheral attached to a computer is the display. Some would argue that the keyboard is equally important, but the keyboard isn't a peripheral in one sense—it nearly always comes with the computer, and the display almost never does. Besides, how much damage can you do without a keyboard?

Once you've selected a PC or PCjr (or even an XT or AT), you can choose among six types of monitors. They are not completely interchangeable. An IBM Monochrome Display can be connected only to the PC; an IBM RGBjr Display can be connected only to the PCjr. For display purposes, the XT and AT are compatible with the PC. The PCjr has built-in circuitry to connect a monitor, while the more expensive PC has none. Therefore, the PC requires a separate internal display adapter before a monitor can be attached. The accompanying tables will help sort out what can be connected to what (prices don't include the cost of the video adapter boards and cables).

Display Choices

The best—and most expensive—choice for a monitor is an RGB (red-green-blue) display. An RGB monitor is capable of displaying sharp, vivid colors as well as black-and-white images. To connect this display to a PC, you'll need the color/graphics adapter board ($244). Although the PCjr has the equivalent of a color/graphics adapter built-in, IBM changed the connectors on the Junior so the IBM RGB Display is not directly compatible. It requires a four-inch long adapter cable ($20).

Because the IBM RGB Display is rather expensive ($680), IBM sells a special RGB monitor just for the PCjr—the RGBjr Display ($429). The RGBjr plugs directly into the PCjr's unusual connector. Unlike the more expensive RGB monitor, the RGBjr has an internal speaker, but it cannot be connected to the PC.

Of course, you can also use a color or black-and-white TV set with a PC-series computer. Although a TV image is less sharp and the colors less vivid than an RGB image, a TV is a good choice for running many home-type computer programs. Besides, you probably already have one. The TV connects to the PC's color/graphics adapter via an RF modulator. IBM recommends the RF modulator made by M&R Electronics

Table 1: IBM PC Display Compatibility

Display Type	Connects To	Color	Graphics	Sound	Price
IBM RGB	color/graphics adapter	Yes	Yes	No	$680
IBM RGBjr	not compatible	—	—	—	—
IBM Monochrome	monochrome adapter	No	No	No	$275
Monochrome composite video	color/graphics adapter	No	Yes	No	$100*
Color composite video	color/graphics adapter	Yes	Yes	Yes	$249†
TV set	color/graphics adapter	Yes	Yes	No	$300‡

*Approximate price of 12-inch green screen or amber monitor.
†Approximate price of 12- to 14-inch color monitor.
‡Approximate price of 12- to 19-inch color TV. Add $70 for required RF modulator.

Table 2: IBM PCjr Display Compatibility

Display Type	Connects To	Color	Graphics	Sound	Price
IBM RGB	$20 cable	Yes	Yes	No	$680
IBM RGBjr	Plug-ready	Yes	Yes	Yes	$429
IBM Monochrome	Not compatible	—	—	—	—
Monochrome composite video	Plug-ready	No	Yes	No	$100*
Color composite video	Plug-ready	Yes	Yes	Yes	$249†
TV set	RF modulator	Yes	Yes	Yes	$300‡

*Approximate price of 12-inch green screen or amber monitor.
†Approximate price of 12- to 14-inch color monitor.
‡Approximate price of 12- to 19-inch color TV. Add $30 for required RF modulator.

($70). The PCjr also requires an RF modulator, but in this case IBM sells one for $30.

A monochrome composite video monitor can also be connected to any PCjr or PC with a color/graphics adapter. This is a good choice when you don't need color but do want graphics. Such a monitor produces much sharper characters than a TV, and many people (myself included) prefer it to an RGB display for word processing. There are amber-screen and green-screen models. According to some European studies, the newer amber screens are easier on the eyes. If you want color graphics but don't want to spend the money for an RGB display, a color composite video monitor is a good alternative to a TV. Like the monochrome composite video monitor, it connects directly to the video jack on the PCjr or the color/graphics adapter on the PC.

The last choice for a display is a choice only for the PC; the IBM Monochrome Display will not work on the PCjr. While it displays superb characters, it has neither color nor graphics capabilities. It plugs into the PC's optional monochrome/printer adapter ($250).

If you have the right adapters, cables, and fittings, you can connect several displays to the PCjr at the same time. I have had a color TV, a composite video monitor, and an RGB display all connected to my PCjr—and all three displaying the same screen at the same time. Multiple monitors on the PC react differently; you must select either the monochrome or color/graphics adapter by software.

Adding Color To DOS

One of the first things you find out when you connect a color monitor to your PC or PCjr is that the Disk Operating System (DOS) screen isn't in color. DIR, CHKDSK, COPY, and all the other commands do their stuff in dull black and white. With up to $680 invested in a color monitor, who wants to look at black and white?

The solution is the BASIC program below. It sets the text, background, and border colors *and* alters DOS so that once you've left BASIC, the screen colors remain unchanged. (It requires DOS 2.0 or higher.)

Before entering the BASIC program, you've got to do some preliminary work with DOS. Format a new disk—a work disk—using the /S option. Then, from the original IBM DOS disk, copy the file named ANSI.SYS to the work disk with the COPY command:

```
COPY A:ANSI.SYS B:*.*
```

Next, make a new file on the work disk and put just one command in it. To do that, use the COPY command again—this time to copy from the keyboard into the new file. Type:

```
COPY CON: CONFIG.SYS
```

and then, the command:

```
DEVICE=ANSI.SYS
```

Finally, to save the file, press the F6 key and the Enter key. After this, there should be a file on the work disk named CONFIG.SYS as well as one named ANSI.SYS. Check to be sure.

When DOS is started, it looks to see if there's a file named CONFIG.SYS on the boot disk. If so, it uses information from that file to set certain parameters. However, even though the CONFIG.SYS file is there, DOS doesn't yet know about it. To fix that situation, clear the computer by turning it off, waiting a few seconds, and then turning it back on. (Alternately, use the Ctrl-Alt-Del sequence.) Now, as DOS boots, it will find out about CONFIG.SYS and ANSI.SYS. (Don't put anything in an AUTOEXEC.BAT file about these files.)

The next step is to type in the BASIC program following this column. Be especially careful when typing line 540—it contains semicolons in unusual places. Save the program on the boot disk with the filename COLORPGM.BAS *before running it for the first time.* If you run it without saving and there are no typing errors, the program will exit to DOS and all your typing will be lost. The irony is that if you get everything right, you lose. So save it, *then* test it.

Using The Color Changer

Now let's see how the program works. Lines 180–250 may look familiar. They are the BASIC color numbers; color 4 is red. However, DOS has a different numbering scheme; red is number 31 for the foreground and 41 for the background. Lines 60–130 are a conversion table to translate between BASIC and DOS colors. When you run the program, lines 270–290 ask whether you like the colors—initially black and white—shown on the screen. If you respond by typing anything other than Y or y, the program gives you a chance to make changes.

Lines 300–410 allow you to enter numbers for the foreground (text), background, and border colors. Background colors may be only the numbers 0 through 7, however. If you forget and enter color 12 (light red), BASIC will use color 4 (red) instead. Lines 420–500 warn if you've selected an invisible combination—black text on a black background, for example. Pressing Enter leaves the color unchanged.

Line 510 actually changes the screen colors, and line 530 loops back to display the menu again. Should this be the combination you want, answer the prompt by pressing Y. Line 540 then creates a disk file named COLOR.DOS. The filename is determined by line 40; you may want to change it to something else. Line 560 ends the program amd returns control to DOS. That's why you should save the program on disk before testing it. Should you want to stay in BASIC with the screen colors active, you'll need to delete line 560 or insert a REM as its first statement.

Once you're back in DOS, you'll find that the screen is still in black and white. The COLOR.DOS file is the one that really changes the screen colors. To get the file to perform its magic, use the DOS TYPE command. That is, at the A> prompt, enter:

```
TYPE COLOR.DOS
```

and then:

```
CLS
```

From here on, the DOS screen will appear in the colors you selected. Whether the screen colors remain when you run another program depends on whether that program sets colors.

If you get letters and numbers instead of a color change when you use the TYPE COLOR.DOS command, then CONFIG.SYS or ANSI.SYS has not been copied correctly to your disk, or you have not rebooted the system. You must boot the system using a disk containing these two files for the program to work.

Automating The Process

This *does* seem a roundabout way to change DOS colors, but it's simpler than some of the other methods. The problem is that while it's possible to set foreground and background colors for DOS, only BASIC can set the border color. When BASIC ends, it takes its colors with it—except the border color. Therefore, we use BASIC to set the border and create a file that DOS can use to set the foreground and background.

You can use DOS batch commands to automate all this. Create a DOS batch file named COLOR.BAT. In it, put the following commands:

```
BASIC COLORPGM
TYPE COLOR.DOS
CLS
```

Typing COLOR at the DOS prompt invokes the batch file, which loads BASIC, runs the COLORPGM program, and executes the TYPE and CLS (Clear Screen) commands.

You might want to change the filename in line 40 from COLOR.DOS to something else in order to create and save several files of color combinations. For example, brown on white might be named BRNWHI.DOS; blue on white might be named BLUWHI.DOS. Once these files are on the DOS disk, you can change colors just by entering TYPE *filename.* (By the way, the file extension of .DOS isn't special—use anything you like.) By including the TYPE command in an AUTOEXEC.BAT file, you can boot up DOS in color—provided the boot disk has the ANSI.SYS

and CONFIG.SYS files. And remember, TYPE *filename* can't set the border—only the BASIC program can do that.

The program requires DOS 2.0 or higher because earlier versions of DOS do not support the CONFIG.SYS features.

DOS Color Changer

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

```
LA 5 REM Program to set colors in BASI
    C & DOS
BG 10 KEY OFF
PK 20 OPTION BASE 0
FB 30 COLOR 7,0,0
LP 35 FG$="7":BG$="0":BD$="0"
OM 40 OPEN  "color.dos" FOR OUTPUT AS
    #1
DP 50 DIM FGDOS$(7), BGDOS$(7)
BA 60 FGDOS$(0)="30":   BGDOS$(0)="40"
LM 70 FGDOS$(1)="34":   BGDOS$(1)="44"
HB 80 FGDOS$(2)="32":   BGDOS$(2)="42"
GC 90 FGDOS$(3)="36":   BGDOS$(3)="46"
NB 100 FGDOS$(4)="31":   BGDOS$(4)="41
    "
NN 110 FGDOS$(5)="35":   BGDOS$(5)="45
    "
JB 120 FGDOS$(6)="33":   BGDOS$(6)="43
    "
JN 130 FGDOS$(7)="37":   BGDOS$(7)="47
    "
AF 140 CLS
OH 160 PRINT  "   SET BASIC & DOS COLO
    RS"
JO 170 PRINT
PF 180 PRINT  "  0  Black          8 Gre
    y"
AC 190 PRINT  "  1  Blue           9 Lt.
     Blue"
BE 200 PRINT  "  2  Green         10 Lt.
     Green"
MM 210 PRINT  "  3  Cyan          11 Lt.
     Cyan"
LK 220 PRINT  "  4  Red           12 Lt.
     Red"
NG 230 PRINT  "  5  Magenta       13 Lt.
     Magenta"
PM 240 PRINT  "  6  Brown         14 Yel
    low"
JK 250 PRINT  "  7  White         15 Bri
    ght White"
JN 260 PRINT
PI 270 PRINT  "  Use these colors? Y/N
    "
KO 280 A$=INKEY$:IF A$="" THEN 280
AF 290 IF A$="Y" OR A$="y" THEN 540
IC 300 PRINT
MD 310 LINE INPUT  " TEXT:  ";A$
FP 320 IF A$<>"" THEN FG$=A$
QK 330 IF VAL(FG$)>15 THEN BEEP:GOTO 1
    40
CA 340 LINE INPUT  " Background:  ";A$
ID 350 IF A$<>""  THEN BG$=A$
NA 360 IF VAL(BG$)>15 THEN BEEP:GOTO 1
    40
IO 370 LINE INPUT  " Border:  ";A$
NM 380 IF A$<>"" THEN BD$=A$
FD 390 FG=VAL(FG$)
QO 400 BG=VAL(BG$)
KA 410 IF VAL(BD$)>15 THEN BEEP:GOTO 1
    40
KD 420 IF FG>7 THEN HI$="1;":FG=FG-8:F
    G$=STR$(FG):FG=FG+8   ELSE HI$=
    "0;"
PL 430 IF BG>7 THEN BG=BG-8:BG$=STR$(B
    G)
PH 440 IF BG<>FG THEN 510
JN 450 PRINT
QL 460 BEEP
DK 470 PRINT " WARNING: Characters wil
    l be invisible."
LH 480 PRINT " Is this Okay? Y/N"
QK 490 A$=INKEY$:IF A$="" THEN 490
PD 500 IF A$="Y" OR A$="y" THEN 510 EL
    SE 140
PH 510 COLOR FG,BG,VAL(BD$)
AF 520 CLS
DC 530 GOTO 140
NI 540 PRINT #1,CHR$(27);"[";HI$;FGDOS
    $(VAL(FG$));";";BGDOS$(VAL(BG$)
    );"m"
PE 550 CLOSE
MK 560 SYSTEM
MM 570 END
```

Automatic Atari DATAline Generation

Robert E. Miller

Location 842 in Atari computers allows the computer to perform a clever trick called the dynamic keyboard. *What this means is that a line can be entered into the computer automatically from the screen. "Automatic Atari DATAline Generator" uses this technique to make data line entry less tedious.*

One of the more interesting features of the Atari is the dynamic keyboard capabilities of POKE 842,13, discussed in Bruce Frumker's "Restoring Data and Updating Data on the Atari" (COMPUTE!, August 1981). The small tutorial program discussed here illustrates a few of the possibilities.

The sample program allows storage of information in DATA lines when keyed in at "prompt" pauses. It provides a search function for printing data on the screen (or on other printers), based on the first string in the data set. Stored data can be edited—that is, corrected or changed using routines based on POKE 842,13.

Useful For Nonprogrammers

All DATA lines are written and deleted under program control, avoiding the problems inherent in typing in "line number, data, and commas." This approach is particularly useful when programs are to be run by nonprogrammers. The program incorporates "block deletion" of lines as discussed in the August 1981 article.

As explained by Frumker, the activity of writing or deleting DATA lines can be hidden from the user by setting the luminances of the background and characters on the screen to the same level if the display is objectionable. It was not suppressed here since it is instructive to observe the action and allows the checking of each entry.

String data is referred to as "first, second, and third word"; but "name", "address", etc., could be handled in the same manner. Additional explanation is included in the program description and in remarks in the listing.

The Data Storage Sample Program

Lines	
5-64	Title display call, initialization, and menu development.
66-70	Branch to appropriate subroutine.
80	Repeat menus after return from subroutine.
500-510	Closing title call, screen clearing.
600-655	Subroutine to list all entries directly.
1000-1070	Search subroutine, simply searches data using first string as the key.
2000-2100	Preparation of data for line entry subroutine. Subroutine 25010 writes prompted entries into a DATA line which has a line number incremented from previously written DATA line. Note that no further keyboard DATA inputs are required to write DATA lines because POKE 842,13 allows reading from screen. The line number is repeated as the first data item to allow incrementing after locating previous bottom DATA line. (Thanks to Frumker.)
3000-3300	Preparation of data for entry correction subroutine. This subroutine retrieves an entry ("first, second, and third word" in this example), requests revised entry, repeats new entry to insure that correction is as desired, and then branches to 25010 to automatically write a new DATA line.
4000-4999	DATA storage lines written by 25010 subroutine—could be a larger block if desired. A few entries are included as samples.
6000-6290	Preparation for entry deletion subroutine. Branches to 32000 to delete DATA line chosen

and hence entry. Sets up line number for use in 32000.

7000-7060 Program title display subroutine.

8000-8040 Closure display subroutine.

25010-25060 Enter strings and line number into a DATA line which is stored by dynamic keyboard action.

32000-32150 Block deletion subroutine. Allows automatic line deletion based on beginning and ending line numbers as in Applesoft or in a manner similar to Atari LIST line no. x, line no. y. POKE 842,13 is again the key since it, in effect, "presses the RETURN key" when a line number is onscreen. The routine is used in this program to delete a single line specified in subroutine 6000, that is, STLIN equals ENLINE. The deletion routine can be used directly with GOTO 32000 after direct entry of STLIN and ENLINE.

Automatic Atari DATAline Generator

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

```
NF 5 GOSUB 7000:REM TO DISPLAY TITLE
CP 8 DIM D$(15),E$(15),F$(15),A$(15)
    ,B$(15),C$(15),Y$(5),T$(15)
OC 10 GRAPHICS 0
HF 20 GRAPHICS 0:? "SELECT OPERATION
     BY NUMBER"
JE 30 ? :? :?
JJ 32 ? "(1) SEARCH FOR ENTRY"
KG 34 ?
GG 40 ? "(2) NEW ENTRY"
KH 44 ?
PL 50 ? "(3) CORRECT EXISTING ENTRY"
KG 52 ?
MC 56 ? "(4) LIST ALL ENTRIES"
KL 57 ?
LL 58 ? "(5) DELETE ENTRY"
KF 60 ?
LF 62 ? "(6) QUIT"
CC 64 ? :?
LM 66 INPUT SELECT
FH 70 ON SELECT GOSUB 1000,2000,3000
    ,600,6000,500
AD 80 GOTO 20
NN 500 GOSUB 8000
BH 510 GRAPHICS 0
GO 520 END
EM 600 REM TO LIST ALL ENTRIES
LM 602 RESTORE
GN 605 TRAP 650
AD 610 READ LN,A$,B$,C$
GB 620 ? A$,B$,C$
GN 625 GOTO 610
OB 650 ? "_____
    ___"
EP 651 ? :? "TO CONTINUE PRESS RETUR
    N ":INPUT T$
IA 655 RETURN
OE 1000 REM SEARCH FOR ENTRY SUBROUT
     INE
DK 1002 FLG1=0
EG 1004 GRAPHICS 0
GK 1005 ? "INPUT FIRST WORD OF ENTRY
     TO BE FOUND"
IA 1007 ? :?
ON 1008 RESTORE
NC 1009 INPUT T$
HK 1010 ? :?
MG 1011 TRAP 1065
CP 1020 READ LN,A$,B$,C$
GC 1030 IF A$=T$ THEN 1050
MB 1040 GOTO 1020
IC 1050 ? "FIRST WORD IS---";A$:FLG1
    =1
AH 1052 ? "SECOND WORD IS---";B$
EC 1054 ? "THIRD WORD IS---";C$:?
MD 1060 GOTO 1020
NI 1065 IF FLG1=0 THEN ? "NO ENTRY F
    OUND":FOR WAIT=0 TO 500:NEXT
     WAIT
EI 1066 ? :? "SEARCH FOR ANOTHER ENT
    RY?"
BL 1068 INPUT T$:IF T$="Y" THEN GOTO
     1000
KI 1070 RETURN
NC 2000 REM TO PUT ENTRY IN A COMPUT
    ER GENERATED LINE
EF 2002 GRAPHICS 0
MN 2005 ? "INPUT FIRST WORD":INPUT A
    $
AE 2007 ? "INPUT SECOND WORD":INPUT
    B$
MG 2009 ? "INPUT THIRD WORD":INPUT C
    $
OM 2015 RESTORE
GL 2020 TRAP 2050:REM CATCHES LAST E
    XISTING LINE NUMBER
CA 2030 READ LN,D$,E$,F$:REM LN=LINE
     NUMBER
ME 2040 GOTO 2030
MH 2050 LN=LN+2:IF LN>=4999 THEN STO
    P
EK 2060 GOSUB 25010:REM BRANCHES TO
    AUTOMATIC LINE WRITING SUBRO
    UTINE
CA 2070 ? :? :? "ANOTHER ENTRY?"
NH 2080 INPUT Y$
KC 2090 IF Y$="Y" THEN 2000
KD 2100 RETURN
HN 3000 REM TO CORRECT AN ENTRY
EF 3001 GRAPHICS 0
OJ 3002 RESTORE
OI 3004 ? "INPUT FIRST WORD OF CURRE
    NT ENTRY"
LN 3005 INPUT A$
AK 3010 FLG=0
ME 3015 TRAP 3100
MJ 3020 IF FLG=1 THEN GOTO 3120
DL 3021 READ LN,D$,E$,F$
ND 3030 IF D$=A$ THEN GOSUB 3200
MF 3040 GOTO 3020
EE 3100 ? "ENTRY TO BE CORRECTED NOT
     FOUND.DO YOU WANT TO TRY AG
    AIN?"
NC 3110 INPUT Y$
KC 3115 IF Y$="Y" THEN 3000
GH 3117 GOTO 20
KG 3120 RETURN
PE 3200 REM TO PRINT OLD DATA TO ASS
    URE PROPER LINE IS BEING COR
    RECTED AND TO MAKE NEW ENTRY
EH 3210 GRAPHICS 0
ED 3220 ? "#1 OLD IS---";D$
EH 3222 ? "#2 OLD IS---";E$
EL 3224 ? "#3 OLD IS---";F$
GF 3230 ? "IS THIS THE DATA TO BE CO
    RRECTED?":INPUT Y$
```

```
OC 3240 IF Y$="Y" THEN GOTO 3260
MI 3250 GOTO 3020
MN 3260 GRAPHICS 0:FLG=1
FG 3262 ? "INPUT CORRECTED FIRST WOR
        D":INPUT A$:IF A$="" THEN A$
        =D$
IN 3270 ? "INPUT CORRECTED SECOND WO
        RD":INPUT B$:IF B$="" THEN B
        $=E$
FB 3280 ? "INPUT CORRECTED THIRD WOR
        D":INPUT C$:IF C$="" THEN C$
        =F$
KF 3282 ? "IS THIS THE CORRECTED ENT
        RY YOU DESIRE?":?
DP 3284 ? "FIRST WORD---";A$
HG 3286 ? "SECOND WORD---";B$
DI 3288 ? "THIRD WORD---";C$
GL 3289 INPUT T$:IF T$<>"Y" THEN GOT
        O 3262
EG 3290 GOSUB 25010
HA 3292 ? :? "DO YOU WISH TO CORRECT
         ANOTHER ENTRY?":INPUT T$
KF 3294 IF T$="Y" THEN 3000
KG 3300 RETURN
IH 4000 DATA 4000,EPSILON,RHO,GAMMA
JA 4002 DATA 4002,MILLER,3907 MAIN,F
        ORT WORTH TX.
BL 4004 DATA 4004,COMPUTER,COMPUTE!
        MAG.,SEPT. 1981
KH 4006 DATA 4006,JONES,938-3456,A/C
         817
HE 4008 DATA 4008,SMITH W.R.,406 OAK
         ST.,DETROIT MICH.
EP 6000 REM . TO DELETE AN ENTRY
EI 6001 GRAPHICS 0
OM 6002 RESTORE
OL 6004 ? "INPUT FIRST WORD OF CURRE
        NT ENTRY"
MA 6005 INPUT A$
AN 6010 FLG=0
MK 6015 TRAP 6100
MP 6020 IF FLG=1 THEN GOTO 6120
DO 6021 READ LN,D$,E$,F$
NJ 6030 IF D$=A$ THEN GOSUB 6200
ML 6040 GOTO 6020
MN 6050 GOTO 6120
KD 6100 ? "ENTRY TO BE DELETED NOT F
        OUND.DO YOU WANT TO TRY AGAI
        N?"
OK 6110 INPUT Y$:IF Y$="Y" THEN 6000
GK 6117 GOTO 20
KJ 6120 RETURN
FO 6200 REM TO PRINT OLD DATA TO ASS
        URE PROPER LINE IS BEING DEL
        ETED AND TO MAKE NEW ENTRY
EK 6210 GRAPHICS 0
EG 6220 ? "#1 OLD IS---";D$
EK 6222 ? "#2 OLD IS---";E$
EO 6224 ? "#3 OLD IS---";F$
ME 6230 ? "IS THIS THE DATA TO BE DE
        LETED?":INPUT Y$
OI 6240 IF Y$="Y" THEN GOTO 6260
MO 6250 GOTO 6020
BF 6260 FLG=1
PM 6270 STLIN=LN:ENLINE=LN
EF 6280 GOSUB 32000
LB 6290 RETURN
EK 7000 GRAPHICS 2
NA 7010 POSITION 4,3
FN 7020 PRINT #6;"DATA STORAGE"
NH 7030 POSITION 7,5
PC 7040 PRINT #6;"SAMPLE"
DH 7050 FOR WAIT=0 TO 100:NEXT WAIT
KN 7060 RETURN
EL 8000 GRAPHICS 2
ND 8010 POSITION 5,4
FJ 8020 PRINT #6;"GOODBYE!"
DG 8030 FOR WAIT=0 TO 100:NEXT WAIT
KM 8040 RETURN
LB 25010 REM AUTOMATIC DATA LINE GEN
         ERATION
CJ 25018 ? CHR$(125)
BA 25020 ? "{DOWN}";LN;"DATA ";LN;",
         ";A$;",";B$;",";C$:REM THIS
          IS THE DUMMY LINE SET UP W
         HERE DATA IS ENTERED
KH 25024 ? :? :? :?
LF 25025 ? "CONT"
CL 25030 ? :? :?
AA 25035 POSITION 0,0
NI 25040 POKE 842,13:STOP
FI 25050 POKE 842,12
NN 25060 RETURN
AN 32000 REM TO DELETE A GROUP OF LI
         NES
KF 32021 IF STLIN>=32000 THEN 32000
NH 32022 IF ENLINE>=32000 THEN 32000
IM 32023 ? :? "STARTING LINE= ";STLI
         N
IO 32024 ? "ENDING LINE= ";ENLINE
HI 32025 FOR ERASE=STLIN TO ENLINE
LJ 32030 ? CHR$(125):REM CLEARS SCRE
         EN
GI 32040 ? "{DOWN}";ERASE:REM {DOWN}
          APPARENTLY MOVES CURSOR DO
         WN."ERASE" IS THE LINE NUMB
         ER BEING DELETED THIS PASS.
AL 32050 ? :? :? "CONT":REM MUST HAV
         E THIS TO WORK.APPEARS TO S
         TART IT AFTER STOP COMMAND
PM 32060 POSITION 0,0
PE 32070 POKE 842,13:STOP :REM APPAR
         ENTLY PUTS INTO "RETURN MOD
         E".
GF 32080 POKE 842,12:REM PUTS BACK T
         O NORMAL MODE
KN 32090 NEXT ERASE
IE 32095 GRAPHICS 0
BN 32100 ? "ANOTHER DELETION?"
AD 32105 INPUT T$
AN 32108 IF T$="Y" THEN GOTO 6000
NL 32150 RETURN
```

SpeedScript 3.0

All Machine Language Word Processor For Commodore 64

Charles Brannon, Program Editor

Since its introduction in the January 1984 issue of our companion magazine, COMPUTE!'s GAZETTE, SpeedScript *has been the most popular program ever published by COMPUTE! Publications. Written entirely in machine language,* SpeedScript *contains nearly every command and convenience you'd expect from a quality word processor. Starting this month,* COMPUTE! *presents the most recent and most powerful version of* SpeedScript *ever, version 3.0. It incorporates a year's worth of enhancements, readers' suggestions, and additional debugging. This month's* SpeedScript *is for the Commodore 64, and versions for the VIC-20, Atari, and Apple II-series computers are coming in future issues.*

SpeedScript 3.0, though compact in size (6K), has many features found on commercial word processors. *SpeedScript* is also very easy to learn and use. You can start writing with it the first time you use it. You type in everything first; preview and make corrections on the screen; insert and delete words, sentences, and paragraphs; then print out an error-free draft, letting *SpeedScript* take care of things like margins, centering, headers, and footers.

SpeedScript is a writing tool. It won't make you a better writer, but you may become a better writer once the tedium of retyping and erasing is replaced by the flexibility of a word processor. Words are no longer frozen in place by ink; they become free-floating entities. You no longer think about typewriting; you can stand back and work directly with words and ideas. The distinction between rough and final drafts becomes blurred as you perfect your writing while you write it.

Typing In *SpeedScript*

The main disadvantage of *SpeedScript* is that you can't just go into a store and buy it—you have to type it in. *SpeedScript* is one of the longest machine language programs we've ever published, but the MLX machine language entry system helps you type it right the first time. MLX also lets you type *SpeedScript* in more than one sitting. Unfortunately, if you have an earlier version of *SpeedScript*, you cannot just make certain changes to bring it up to version 3.0. You have to type it in from scratch.

Although this might seem daunting, we guarantee it will be worthwhile.

Using MLX

MLX makes it possible for you to type in a long machine language program correctly. It can detect most errors people make when entering numbers. See the MLX article elsewhere in this issue.

Before you begin typing *SpeedScript* (or begin a subsequent session of typing if you enter *SpeedScript* in more than one sitting), you must enter the following POKEs *before* you load and run the MLX program. These POKEs are essential to protect *SpeedScript* from BASIC while you are typing it in. Again, these POKEs should be performed *before* you load MLX, but are not necessary to run the finished program:

```
POKE 44,33:POKE 8448,0:NEW
```

Now load and run the 64 version of MLX. Answer the first two questions like this:

```
Starting Address? 2049
Ending Address? 8204
```

You will then see the first prompt, the number 2049 followed by a colon. Type in each three-digit number shown in the listing. You do not need to press the comma shown in the listing. MLX types the comma automatically.

The last number you enter in a line is a *checksum*. It represents the values of the other numbers in the line summed together. If you make a mistake while entering the line, the checksum calculated by MLX should not match that of the listing, and you will have to retype the line. MLX is not foolproof, though. It's possible to fool the checksum by exchanging the position of the three-digit numbers. Also, an error in one number can be offset by an error in another (just as 3 + 4 + 7 = 1 + 4 + 9). Keep this in mind. MLX will help catch your errors, but you still must be very careful.

Typing *SpeedScript* In Multiple Sittings

If you want to stop typing the listing at some point and pick up later, press SHIFT-S and follow the

screen prompts. Remember to note the line number of the last line you typed in. When you are ready to continue typing, enter the POKEs mentioned above, load MLX, answer the starting and ending address prompts, then press SHIFT-L. MLX asks for the filename you gave to the partially typed program. After the LOAD is complete, press SHIFT-N and tell MLX the line number you stopped at. Now continue typing as before. When you finish all typing, MLX automatically prompts you to save the program.

At this point MLX has saved a program file on tape or disk. If you load it and list it, you'll see that it looks like a normal one-line BASIC program, with a line number and a SYS command. The machine language program that is *SpeedScript* starts in memory just after the SYS command. The simulated BASIC line is included so that you can load *SpeedScript* like any BASIC program, and enter RUN to start it. You don't need to add the ",1" like you do with many machine language programs. Just LOAD "SPEEDSCRIPT" (or whatever filename you called it) for tape, or LOAD "SPEEDSCRIPT",8 for disk, then enter RUN. Once *SpeedScript* is in memory, you can save it from BASIC like any BASIC program. If *SpeedScript* is running, tap the RESTORE key to exit to BASIC.

Before using *SpeedScript*, you should generally unplug all cartridges and expanders such as *Simons' BASIC* or 80-column video cards. *SpeedScript* cannot take advantage of any custom hardware configurations except those that do not interfere with normal operations.

Entering Text

When you run *SpeedScript*, the screen colors change to dark gray on light gray, simulating the appearance of type on paper. The first line on the screen is black with white letters. This *command line* is used to communicate with *SpeedScript*. *SpeedScript* presents all messages here. The remaining 24 lines of the screen are used to enter, edit, and display your document. A blinking dark square, the *cursor*, shows where the next character you type will appear on the screen. *SpeedScript* lets you move the cursor anywhere within your document, making it easy to find and correct errors.

To begin using *SpeedScript*, just start typing. When the cursor reaches the right edge of the screen, it automatically jumps to the beginning of the next line, just as in BASIC. But unlike BASIC, *SpeedScript* never splits words at the right edge of the screen. If a word you're typing won't fit at the end of one line, it's instantly moved to the next line. This feature, called *word wrap* or sometimes *parsing*, makes it much easier to read your text on the screen. Even if you make numerous editing changes, *SpeedScript* reformats the screen and rewraps all words.

Scrolling And Screen Formatting

When you finish typing on the last screen line, *SpeedScript* automatically scrolls the text upward to make room for a new line at the bottom. This is similar to the way BASIC works, but with one exception: The screen can scroll both up *and* down. Imagine the screen as a 24-line window on a long continuous document. More than 43K of text space is available in memory, room enough for 20–40 printed pages of text. To check at any time how much space is left, press CTRL-= (hold down the CTRL key while pressing the = key). The number which appears in the command line indicates how much room remains for characters of text.

If you're used to a typewriter, you'll have to unlearn some habits. First, since the screen is only 40 columns wide, and most printers have 80-column carriages, it doesn't make sense to press RETURN at the end of each line as you do on a typewriter. *SpeedScript*'s word wrap takes care of this automatically. You want to press RETURN only when you want to force a carriage return to end a paragraph or limit the length of a line. To permit you to see these forced carriage returns, they appear on the screen as a left-pointing arrow. (This is called a *return-mark* in this article.)

When you print your document, *SpeedScript* automatically formats your text to fit the width of the paper. Don't manually space over for a left margin or try to center a line yourself, as you would on a typewriter. *SpeedScript*'s printing routine automatically takes care of all margins and lets you customize the margin settings. Also, don't worry about where a printed page would end. When printing, *SpeedScript* automatically fits your text onto separate pages, and can even put short phrases and page numbers at the top or bottom of each page if you want.

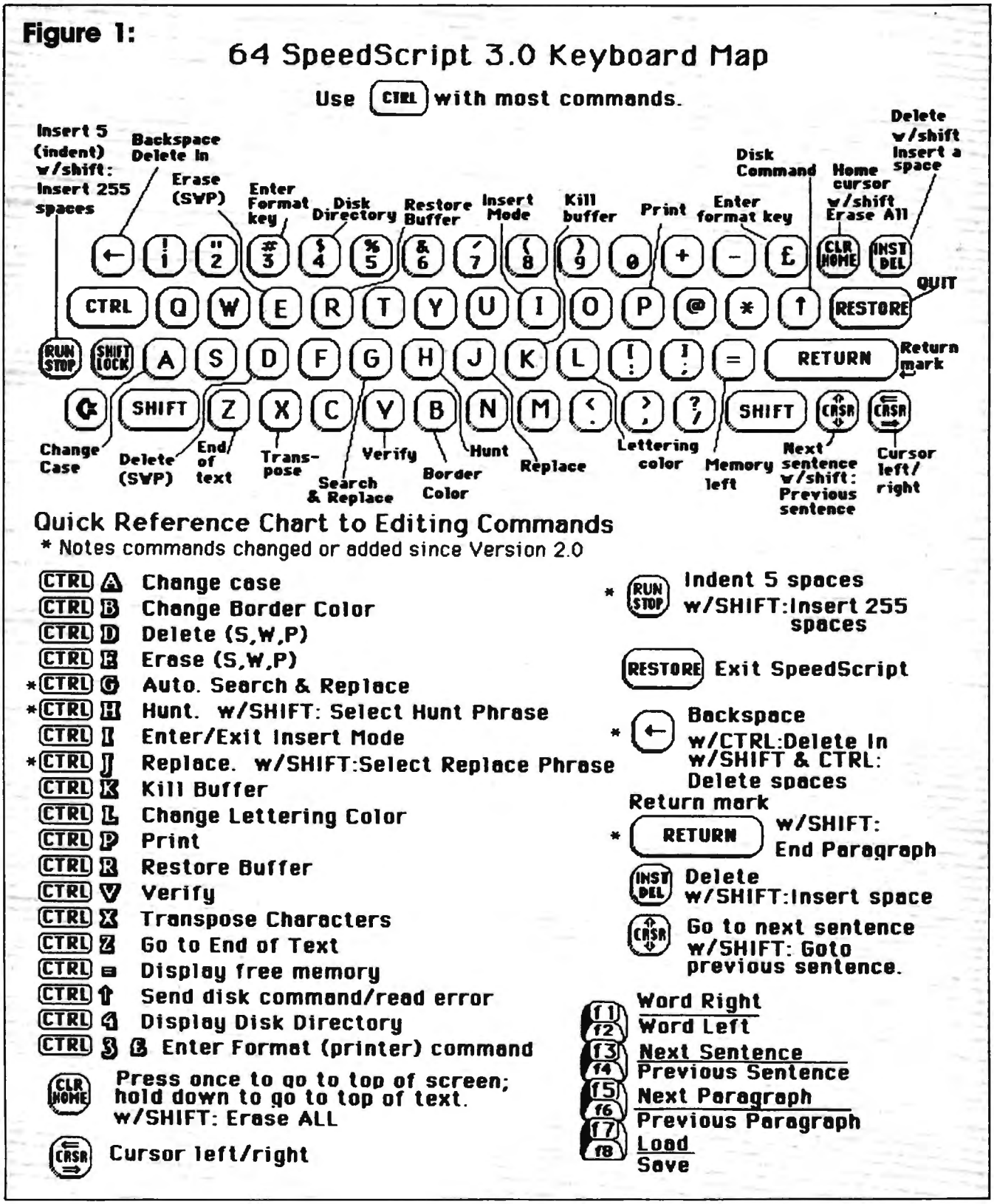
Like all good word processors, *SpeedScript* has a wide selection of editing and convenience features. You can move the cursor a single space in either direction, or skip to the next or previous word, sentence, or paragraph. You can also move the cursor to the top of the screen, the top of the document, or to the end of the document. The INST/DEL key is used to insert a single space or delete a single character. Other features let you erase a word, sentence, or paragraph, and move or copy sentences, words, and paragraphs to other places in your document. Using Search and Replace, you can find any phrase, and even automatically change one phrase to another throughout the entire document.

You can save your text on tape or disk, then load it later for additions and corrections. You can transpose (exchange) two characters, change the screen and text colors, send disk commands, read the disk error channel, and automatically tab over five spaces for paragraph indents. You don't need to learn all these commands right away, but you'll be glad they're available as you become more comfortable with word processing.

Using The Keyboard

Most of these features are accessed with control-key commands—you hold down CTRL while pressing another key. In this article, control-key commands are abbreviated CTRL-*x* (where *x* is the key you press in combination with CTRL). An example is the CTRL-= mentioned above to check on free memory. CTRL-E means hold down CTRL and press E. Sometimes you have to hold down both SHIFT and CTRL as you type the command key, as in SHIFT-CTRL-H.

Figure 1:



Other keys are referenced by name or function, such as *back-arrow* for the left-pointing arrow in the top-left corner of the keyboard, *pound sign* for the British pound sign (£), CLR/HOME for the Home Cursor key, SHIFT–CLR/HOME for the Clear Screen key, f1 for special function key 1, and *up-arrow* for the upward-pointing arrow to the left of the RESTORE key. See Figure 1 for a complete quick-reference chart of all keyboard commands.

Some keys let you move the cursor to different places in the document to make corrections or scroll text into view. *SpeedScript* uses a unique method of cursor movement that is related to writing, not programming. Programmers

work with lines of text, and need to move the cursor up and down a line or left and right across a line. *SpeedScript*, however, is oriented for writers. You aren't working with lines of text, but with a continuous document.

Therefore, *SpeedScript* moves the cursor by character, word, sentence, or paragraph. *SpeedScript* defines a word as any sequence of characters preceded or followed by a space. A sentence is any sequence of characters ending with a period, exclamation point, question mark, or return-mark. And a paragraph is defined as any sequence of characters ending in a return-mark.

Here's how to control the cursor:

- The **left-right cursor key** works as usual; pressing this key by itself moves the cursor right (forward) one space, and pressing it with SHIFT moves the cursor left (backward) one space.
- The **up/down cursor key** moves the cursor forward to the beginning of the next sentence. Pressing it with SHIFT moves the cursor backward to the beginning of the previous sentence.
- The **f1 special function key** moves the cursor forward to the beginning of the next word. The **f2 key** (hold down SHIFT and press f1) moves the cursor backward to the beginning of the previous word.
- The **f3 special function key** moves the cursor forward to the beginning of the next sentence (just like the up/down cursor key). The **f4 key** (hold down SHIFT and press f3) moves the cursor backward to the beginning of the previous sentence (just like pressing SHIFT and the up/down cursor key).
- The **f5 special function key** moves the cursor forward to the beginning of the next paragraph. The **f6 key** (hold down SHIFT and press f5) moves the cursor backward to the beginning of the previous paragraph.
- The **CLR/HOME key,** pressed once by itself, moves the cursor to the top of the screen without scrolling. Pressed twice, it moves the cursor to the beginning of the document.
- **CTRL-Z** moves the cursor to the bottom of the document.

Correcting Your Typing

One strength of a word processor is that you need never have mistakes in your printed document. Since you've typed everything before you print it, you have plenty of opportunities to proofread and correct your work. The easiest way to correct something is to just type over it, but there are other ways, too.

Sometimes you'll have to insert some characters to make a correction. Maybe you accidentally dropped a letter, typing "hngry" instead of "hungry." When you change the length of a word, you need to push over everything to the right of the word to make room for the insertion. Use **SHIFT-INST/DEL** to open up a single space, just as in BASIC. Merely position the cursor at the point where you want to insert a space, and press SHIFT-INST/DEL.

Insert Modes

It can be tedious to use the SHIFT-INST/DEL key to open up enough space for a whole sentence or paragraph. For convenience, *SpeedScript* has an insert mode that automatically inserts space for each character you type. In this mode, you can't type over characters; everything is inserted at the cursor position. To enter insert mode, press **CTRL-I.** To cancel insert mode, press CTRL-I again (a command key that turns something on and off is called a *toggle*). To let you know you're in insert mode, the normally black command line at the top of the screen turns light blue.

Insert mode is the easiest way to insert text, but it can become too slow when working with a very long document because it must move *all* the text following the cursor position. Although *SpeedScript* uses turbocharged memory-move routines, the 6502/6510 microprocessor can go only so fast. So *SpeedScript* has even more ways to insert blocks of text.

One way is to use the **RUN/STOP** key. It is programmed in *SpeedScript* to act as a five-space margin indent. To end a paragraph and start another, press RETURN twice and press RUN/STOP. Alternatively, press **SHIFT-RETURN,** which does this automatically (a function suggested by COMPUTE!'s GAZETTE reader Richard Scherer). You can use RUN/STOP to open up more space than SHIFT-INST/DEL. No matter how much space you want to insert, each insertion takes the same amount of time. So the RUN/STOP key can insert five spaces five times faster than pressing SHIFT-INST/DEL five times.

There's an even better way, though. Press **SHIFT-RUN/STOP** to insert 255 spaces. This is enough room for a sentence or two. You can press it several times to open up as much space as you need. And SHIFT-RUN/STOP is *fast*. (You don't want to be in insert mode when you use this trick; that would defeat its purpose.)

Since the INST/DEL key also is slow when working with large documents (it, too, must move all text following the cursor), you may prefer to use the back-arrow key to backspace. The back-arrow key by itself moves the cursor left one space and blanks out that position. It's more like a backspace than a delete.

After you're done inserting with these methods, there will probably be some inserted spaces left over that you didn't use. Just press **SHIFT-CTRL-back arrow.** This instantly deletes all extra spaces between the cursor and the start of following text. SHIFT-CTRL-back arrow is also generally useful whenever you want to delete a bunch of spaces.

Erasing Text

Inserting and retyping are not the only kinds of corrections you'll need to make. Part of writing is separating the wheat from the chaff. On a typewriter, you pull out the paper, ball it up, and dunk it in the trash can. *SpeedScript* lets you be more selective.

Press the **INST/DEL key** by itself to erase the character to the left of the cursor. All the following text is pulled back to fill the vacant space.

Press **CTRL-back arrow** to delete the character on which the cursor is sitting. Again, all the

following text is moved toward the cursor to fill the empty space.

These keys are fine for minor deletions, but it could take all day to delete a whole paragraph this way. So *SpeedScript* has two commands that can delete an entire word, sentence, or paragraph at a time. **CTRL-E** erases text *after* (to the right of) the cursor position, and **CTRL-D** deletes text *behind* (to the left of) the cursor.

To use the **CTRL-E erase mode,** first place the cursor at the beginning of the word, sentence, or paragraph you want to erase. Then press CTRL-E. The command line shows the message "Erase (S,W,P): RETURN to exit." Press S to erase a sentence, W for a word, or P for a paragraph. Each time you press one of these letters, the text is quickly erased. You can keep pressing S, W, or P until you've erased all the text you wish. Then press RETURN to exit the erase mode.

The **CTRL-D delete mode** works similarly, but deletes only one word, sentence, or paragraph at a time. First place the cursor after the word, sentence, or paragraph you want to delete. Then press CTRL-D. Next, press S, W, or P for sentence, word, or paragraph. The text is immediately deleted and you return to editing. You don't need to press RETURN to exit the CTRL-D delete mode unless you pressed this key by mistake. *(In general, you can escape from any command in* SpeedScript *by simply pressing RETURN.)* CTRL-D is most convenient when the cursor is already past what you've been typing.

The Text Buffer

When you erase or delete with CTRL-E and CTRL-D, the text isn't lost forever. *SpeedScript* remembers what you've removed by storing deletions in a separate area of memory called a *buffer*. The buffer is a fail-safe device. If you erase too much, or change your mind, just press **CTRL-R** to restore the deletion. However, be aware that *SpeedScript* remembers only the last erase or delete you performed.

Another, more powerful use of this buffer is to move or copy sections of text. To move some text from one location in your document to another, first erase or delete it with CTRL-E or CTRL-D. Then move the cursor to where you want the text to appear and press CTRL-R. CTRL-R instantly inserts the contents of the buffer at the cursor position. If you want to copy some text from one part of your document to another, just erase or delete it with CTRL-E or CTRL-D, restore it at the original position with CTRL-R, then move the cursor elsewhere and press CTRL-R to restore it again. You can retrieve the buffer with CTRL-R as many times as you like.

Important: The CTRL-E erase mode lets you erase up to the maximum size of the buffer (12K, or over 12,000 characters), and CTRL-E also removes the previous contents of the buffer. Keep this in mind if there's something in the buffer you'd rather keep. If you don't want the buffer to be erased, press **SHIFT-CTRL-E**. This preserves the buffer contents and adds newly erased text to the buffer.

Now you can see why CTRL-D lets you delete only a single sentence, word, or paragraph at a time. If it didn't, the deleted text would be added to the end of the buffer, and when you pressed CTRL-R to retrieve the buffer, the deleted text would be out of order (since CTRL-D deletes backward).

If you ever need to erase the contents of the buffer, press **CTRL-K** (remember *kill buffer*).

It's relatively easy to move blocks of text between documents. Using the buffer, you can load one document, erase some text into the buffer, load another document, then insert the buffer. You can also use the buffer to save an often-used word or phrase, then repeat it whenever you need it.

The Wastebasket Command

If you want to start a new document, or simply obliterate all your text, press **SHIFT-CLR/HOME**. *SpeedScript* asks, "ERASE ALL: Are you sure? (Y/N)." This is your last chance. If you *don't* want to erase the entire document, press N or any other key. Press Y to perform the irreversible deed. There is no way to recover text wiped out with Erase All.

The RUN/STOP–RESTORE reset combination has been disabled in *SpeedScript*. As mentioned above, pressing RUN/STOP by itself inserts five spaces for indenting paragraphs. Pressing RESTORE by itself brings up the message "Exit *SpeedScript*: Are you sure? (Y/N)." If you press Y for yes, you exit to BASIC. In BASIC you still have one chance to reenter *SpeedScript* without losing your text—simply enter RUN (but your chances decrease if you execute other commands in BASIC). If you press N or any other key at the prompt, you return to editing text with no harm done.

Search And Replace

Here's another feature only a computer can bring to writing. *SpeedScript* has a Hunt command that searches through your document to find a selected word or phrase. A Replace option lets you automatically change one word to another throughout the document. Since CTRL-S is synonymous with the CLR/HOME key (try it), and since *SpeedScript* already uses CTRL-R, we have to resort to command keys which are slightly less than mnemonic for these functions.

SHIFT-CTRL-H activates the Hunt feature, **SHIFT-CTRL-J** (J is used because it's next to the H) lets you selectively hunt and replace, and **CTRL-G** (also next to the H) is for automatically searching and replacing.

Searching for something is a two-step process. First you need to tell *SpeedScript* what to search for, then you trigger the actual search. Press SHIFT-CTRL-H. The command line says "Hunt for:". Type in what you'd like to search for, the *search phrase*, up to 29 characters. *SpeedScript* remembers the search phrase until you change it. (Incidentally, when you are typing on the command line, the only editing key that works is the INST/DEL key for backing up. *SpeedScript* does not let you enter control codes or cursor controls when you type in the command line, and you can type no more than one screen line.) Press RETURN when you've finished typing. If you press RETURN alone without typing anything, the Hunt command is canceled.

When you are ready to search, press **CTRL-H**. *SpeedScript* looks for the next occurrence of the search phrase *starting from the cur-*

rent cursor position. If you want to hunt through the entire document, press CLR/HOME twice to move the cursor to the very top before beginning the search. Each time you press CTRL-H, *SpeedScript* looks for the next occurrence of the search phrase and places the cursor at the start of the phrase. If the search fails, you'll see the message "Not Found."

CTRL-J (Replace) works together with CTRL-H. After you've specified the search phrase with SHIFT-CTRL-H, press **SHIFT-CTRL-J** to select the replace phrase. *SpeedScript* also remembers this replace phrase until you change it. (You can press RETURN alone at the "Replace with:" prompt to select a *null* replace phrase. When you hunt and replace, this deletes the located phrase.) To manually search and replace, start by pressing CTRL-H. After *SpeedScript* finds the search phrase, press CTRL-J if you want to replace the phrase. If you don't want to replace the phrase, don't press CTRL-J. You are not in a special search and replace mode. You're free to continue writing at any time.

CTRL-G links CTRL-H and CTRL-J together. It first asks "Hunt for:", then "Replace with:", then automatically searches and replaces throughout the document starting at the cursor position.

A few hints and cautions: First, realize that if you use "the" as the search phrase, *SpeedScript* dutifully finds the embedded "the" in words like "therefore" and "heathen." If you changed all occurrences of "the" to "cow," these words would become "cowrefore" and "heacown." If you want to find or replace a single word, include a space as the first character of the word, since almost all words are preceded by a space. Naturally, if you are replacing, you need to include the space in the replace phrase, too. Also, *SpeedScript* distinguishes between uppercase and lowercase. The word "Meldids" does not match with "meldids." *SpeedScript* will not find a capitalized word unless you capitalize it in the search phrase. To cover all bases, you will sometimes need to make two passes when replacing a word. Keep these things in mind when using CTRL-G, since you don't have a chance to stop an out-of-control search and replace.

Storing Your Document

Another advantage of word processing is that you can store your writing on tape or disk. A Commodore disk, with 170K of storage space, can store 80–150 pages of text in one or more documents. Tapes also have great storage capacity, but they're slower, and it's harder to locate one of several documents on a cassette. However, *SpeedScript* can be used with tape, making it possible to set up an extremely economical word processing system. (Note: Although you can load *SpeedScript* much more quickly from cassette using the "TurboTape" utility published in the January 1985 issue of COMPUTE!, you can't use TurboTape to save and load *SpeedScript* documents at high speed. The two programs are not compatible.)

SpeedScript can also be used as a simple data base manager. Type in the information you need, then store it as a *SpeedScript* document. The search feature lets you quickly find information, especially if you use graphics characters to flag key lines. You can search for the graphics characters and quickly skip from field to field.

It's easy to store a document. First, make sure the cassette or disk drive is plugged in and functioning. Insert the tape and rewind it, or insert a formatted (NEWed) disk into the drive. Press **f8** (SHIFT-f7). You'll see the prompt "Save:". Type in a filename for your document. A filename can be up to 16 characters long and can include almost any characters, but do not use question marks or asterisks. You cannot use the same name for two different documents on a single disk. To replace a document already on disk using the same filename, precede your filename with the characters **@0:** or **@:**. You can also precede the filename with either **0:** or **1:** if you use a dual disk drive. *SpeedScript* cannot access a second disk drive with a device number of 9.

After entering the filename, answer the prompt "Tape or Disk" by pressing either the **T** or **D** key. (Unless you see the green cursor on the command line, *SpeedScript* is asking only for a single keystroke, and RETURN is not necessary.) You can cancel the SAVE command by pressing RETURN without typing anything else at either the "Save:" or "Tape or Disk?" prompt.

After you press T for tape, press RECORD and PLAY simultaneously on the cassette drive. *SpeedScript* begins saving. If you press D for disk, and the disk is formatted and has room, your file is stored relatively quickly. After the SAVE, *SpeedScript* reports "No errors" if all is well, or reads and reports the disk error message if not.

It is not possible to detect errors during a tape SAVE, so if you want peace of mind, use the Verify command. Rewind the tape, press **CTRL-V**, then type the filename. Press T for tape, then press PLAY on the recorder. *SpeedScript* compares the file on tape with that in memory, and reports "No errors" if the verify succeeds, or "Verify Error" if not. You can also verify disk files.

Loading A Document

To recall a previously saved document, press **f7**. Answer the "Load:" prompt with the filename. Insert the tape or disk, rewind the tape, then answer T or D. Press PLAY on tape. *SpeedScript* loads the file and should display "No errors." Otherwise, *SpeedScript* reads the error channel of the disk drive or simply reports "Load error" for tape.

The position of the cursor is important before loading a file. *SpeedScript* starts loading at the cursor position, so be sure to press CLR/HOME twice or SHIFT–CLR/HOME (Erase All) to move the cursor to the start of text space, unless you want to merge two documents. When you press f7 to load, the command line turns green to warn you if the cursor is not at the top of the text space.

To merge two or more files, simply load the first file, press CTRL-Z to move the cursor to the end of the document, and then load the file you want to merge. Do not place the cursor somewhere in the middle of your document before loading. A LOAD does not insert the text from tape or disk,

but overwrites all text after the cursor position. The last character loaded becomes the new end-of-text pointer, and you cannot access any text that appears ahead of this pointer.

File Compatibility

SpeedScript documents are stored as program files (a PRG type on disk). Naturally, you can't load and run a *SpeedScript* file from BASIC. Program files on tape are more reliable than data files. The characters are stored in their screen code (POKE) equivalents. Several commercial word processors store text similarly, including *WordPro 3+*, *PaperClip*, and *EasyScript*. As a matter of fact, two commercial spelling checkers designed for *WordPro* also work with *SpeedScript*: *SpellRight Plus* (from Professional Software) and *SpellPro 64* (from Pro-Line).

Program 2 after this article is a *SpeedScript* file conversion utility. It translates *SpeedScript* screen-code program files into either Commodore ASCII or true ASCII. These translated files are stored in SEQuential format, the file type used in most file-processing applications. The file converter program can also translate a Commodore ASCII sequential file into a screen-code *SpeedScript* program file. You can use the file converter to translate a data base into a *SpeedScript* file (or vice versa), and you can convert *SpeedScript* files to true ASCII and use a modem program to upload them to another computer.

Disk Commands

Sometimes you forget the name of a file, or need to scratch or rename a file. *SpeedScript* gives you full control over the disk drive. Just press **CTRL-up arrow**, then type in a 1541 disk command. You don't need to type PRINT#15 as you do in BASIC, just the actual command. If you press RETURN without typing a disk command, *SpeedScript* displays the disk status. It also displays the status after completing a disk command. Here is a quick summary of disk commands:

n:*disk name*,**ID** This formats (NEWs) a disk. You must format a new disk before using it for the first time. The disk name can be up to 16 characters. The ID (identifier) is any two characters. You must use a unique ID for each disk you have. Don't forget that this command erases any existing data on a disk.

s:*filename* Scratches (deletes) a file from the disk.

r:*newname*=*oldname* Changes the name of file *oldname* to *newname*.

c:*backup filename*=*original name* Creates a new file (the backup copy) of an existing file (original copy) on the same disk.

i: Initialize disk. This resets several disk variables and should be used after you swap disks or when you have trouble reading a disk.

v: Validate disk. This recomputes the number of available blocks and can sometimes free up disk space. Always use Validate if you notice a filename on the directory flagged with an asterisk. Validate can take awhile to finish.

uj: Resets the disk drive to power-up state.

Additional Features

SpeedScript has a few commands that don't do much, but are nice to have. **CTRL-X** exchanges the character under the cursor with the character to the right of the cursor. Thus you can fix transposition errors with a single keystroke. **CTRL-A** changes the character under the cursor from uppercase to lowercase or vice versa. You can hold down CTRL-A to continue changing the following characters.

Press **CTRL-B** to change the background and border colors. Each time you press CTRL-B, one of 16 different background colors appears. Press **CTRL-L** to cycle between one of 16 character (lettering) colors. The colors are preserved until you change them. In fact, if you resave *SpeedScript*, the program will load and run with your color choice in the future.

PRINT!

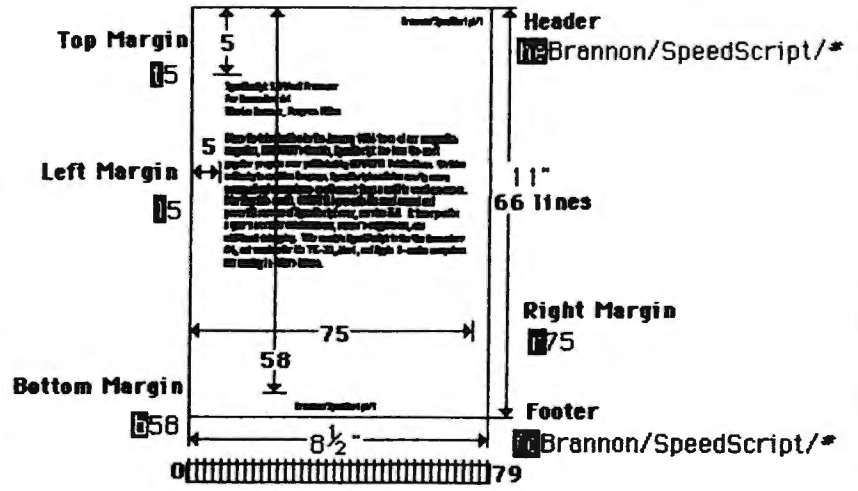
If you already think *SpeedScript* has plenty of commands, wait until you see what the printing package offers. *SpeedScript* supports an array of powerful formatting features. It automatically fits your text between left and right margins you can specify. You can center a line or block it against the right margin. *SpeedScript* skips over the perforation on continuous-form paper, or can wait for you to insert single-sheet paper. A line of text can be printed at the top of each page (a *header*) and/or at the bottom of each page (a *footer*), and can include automatic page numbering, starting with whatever number you like.

SpeedScript can print on different lengths and widths of paper, and single-, double-, triple-, or any-

Figure 2:

Graphic Representation of Margin Settings

Values shown are default settings.



spacing is easy. You can print a document as big as can fit on a tape or disk by linking several files together during printing. You can print to the screen or to a sequential disk file instead of to a printer. Other features let you print to most printers using most printer interfaces, and send special codes to the printer to control features like underlining, boldfacing, and double-width type (depending on the printer).

But with all this power comes the need to learn additional commands. Fortunately, *SpeedScript* sets most of these variables to a default state. If you don't change these settings, *SpeedScript* assumes a left margin of five, a right margin position of 75, no header or footer, single-spacing, and continuous-paper page feeding. To begin printing, simply press **CTRL-P.** If your printer is attached, powered on, and selected (on-line), *SpeedScript* begins printing immediately. To cancel printing, hold down the **RUN/STOP** key until printing stops, then release it when the border color changes to white.

Before printing, be sure the paper in your printer is adjusted to top-of-form (move the paper perforation just above the printing element). CTRL-P assumes a Commodore printer, so it's helpful if your interface simulates the modes and codes of the Commodore 1525, MPS-801, or 1526 printers. CTRL-P prints with a device number of 4 and a secondary address of 7 (uppercase/lowercase mode).

If CTRL-P doesn't work for you, try another variation, **SHIFT-CTRL-P.** Answer the prompt "Print to: Screen, Disk, Printer?" with the single letter **S**, **D**, or **P**. Press any other key to cancel the command.

If you press P for printer, *SpeedScript* requests two more keystrokes. First answer "Device number" with a number from 4 to 7. This lets you print to one of several printers addressed with different device numbers. Next answer "Secondary Address?" with a number from 0 to 9.

Non-Commodore Printers

The secondary address is used on most non-Commodore printer interfaces to control special features.

Figure 3: Quick Reference Chart
Format (Printer) Commands
Enter with CTRL-3 or CTRL-£

Command	Description	Default
a	True ASCII	off
b	Bottom Margin	58
c	Centering	
e	Edge Right	
f	Footer	
g	Goto Linked File*	
h	Header	
i	Information*	
j	Select linefeeds*	
l	Left Margin	5
m	Margin Release*	
n	Next Page	
p	Page Length*	66
r	Right Margin	75
s	Spacing	1
t	Top Margin	5
u	Underline toggle	
w	Page Wait	
x	Columns across*	80
@	Initial page #*	1
?	Skip pages*	
#	Print page number	

hc SpeedScript/#←	Centered Header with page number
l10 r70 s2←	Left margin 10, right margin 70, double spacing.
gD:SpeedScript.2←	Goto and continue printing with filename "SpeedScript.2"

* Notes command changed or added since Version 2.0

For example, you can bypass the emulation features and use graphic mode to communicate directly with your printer (see the true ASCII command below). Consult the list of secondary addresses in your printer interface manual. *SpeedScript* does not work properly with RS-232 serial printers or interfaces.

One additional note: Some printers and interfaces incorporate an automatic skip-over-perforation feature. The printer skips to the next page when it reaches the bottom of a page. Since *SpeedScript* already controls paper feeding, you need to turn off this automatic skip-over-perf feature before running *SpeedScript*, or paging won't work properly.

We've successfully tested *SpeedScript* with the following printers: Commodore 1525/MPS-801, Commodore 1526 (second revision), Prowriter/C. Itoh 8510, Epson MX-80, Gemini 10-X, Okimate-10, Okidata 82, Okidata 92, and Hush-80 CD.

We've also successfully tested *SpeedScript* with these printer interfaces: Cardco A/B/G+, Tymac Connection, Xetec, TurboPrint, and MW-350.

SpeedScript should work even if your printer or interface is not on this list. These are just the ones we've tested.

Be sure your printer or interface supplies its own linefeeds. Again, consult your manuals and insure that either your printer or interface (but not both) supplies an automatic linefeed after carriage return. To test this, print a small sample of text with CTRL-P. Since the default is single-spacing, you should not see double-spacing, nor should all printing appear on the same line. If you still aren't getting linefeeds, use the linefeed command discussed below.

Printing To Screen And Disk

SHIFT-CTRL-P prints to the screen when you press S. The screen colors change to white letters on a black background, and what appears on the screen is exactly what would print on the printer. It takes two screen lines to hold one 80-column printed line, of course. If you use double-spacing (see below), it's much easier to see how each line is printed. With this screen preview, you can see where lines and pages break. To freeze printing, hold down either SHIFT key or engage SHIFT lock. The border color changes to white while SHIFT is held down. When printing is finished, press any key to return to editing.

SHIFT-CTRL-P prints to a disk file when you press D. Enter the filename when requested. *SpeedScript* sends out all printer information to a sequential file. You can use other programs to process this formatted file. Try this simple example:

```
10 OPEN 1,4
20 OPEN 2,8,8,"filename"
30 GET#2,A$:SS=ST:
   PRINT#1,A$;:IF SS=0
   THEN 30
40 PRINT#1:CLOSE1
50 CLOSE2
```

This program dumps the disk file specified by the filename in line 20 to any printer. You can use it to print *SpeedScript* files (produced with SHIFT-CTRL-P) on another Commodore computer and printer without running *SpeedScript*. Change line 10 to **OPEN 1,2,0,CHR$(6)** to dump the file to a modem or RS-232 printer, or **OPEN 1,3** to display it on the screen.

Formatting Commands

The print formatting commands must be distinguished from normal text, so they appear onscreen in reverse field with the text and background colors switched. You enter these reverse-video letters by pressing **CTRL-pound sign.** You can also use **CTRL-3**, which is easier to type with one hand. Answer the prompt "Enter format key:" by pressing a single key. This key is inserted into text in reverse video. All lettered printer commands should be entered in lowercase (unSHIFTed). During printing, *SpeedScript* treats these characters as printing commands.

There are two kinds of printing commands, which we'll call Stage 1 and Stage 2. Stage 1 commands usually control variables such as left margin and right margin. Most are followed by a number, with no space between the command and the number. Stage 1 commands are executed before a line is printed.

Stage 2 commands, like centering and underlining, are executed while the line is being printed. Usually Stage 1 commands must be on a line of their own, although you can group several Stage 1 commands together on a line. Stage 2 commands are by nature embedded within a line of text. A sample Stage 1 line could look like this:

```
l10r50s2
```

Embedded Stage 2 commands look like this:

```
cThis line is centered.←
This is uunderlininguu.←
```

Stage 1 Commands

l Left margin. Follow with a number from 0 to 255. Use 0 for no margin. Defaults to 5. See Figure 2 for a graphic illustration of margin settings.

r Right margin position, a number from 1 to 255. Defaults to 75. Be sure the right margin value is greater than the left margin value, or *SpeedScript* will go bonkers.

t Top margin. The position at which the first line of text is printed, relative to the top of the page. Defaults to 5. The header (if any) is always printed on the first line of the page, before the first line of text.

b Bottom margin. The line at which printing stops before continuing to the next page. Standard 8½ × 11-inch paper has 66 lines. Bottom margin defaults to the fifty-eighth line. The footer (if any) is always printed on the last line of the page, after the last line of text.

p Page length. Defaults to 66. If your printer does not print six lines per inch, multiply lines-per-inch by 11 to get the page length. European paper is usually longer than American paper—11⅝ or 12 inches. Try a page length of 69 or 72.

s Spacing. Defaults to single-spacing. Follow with a number from 1 to 255. Use 1 for single-spacing, 2 for double-spacing, 3 for triple-spacing.

@ Start numbering *at* page number given. Page numbering normally starts with 1.

? Disables printing until selected page number is reached. For example, a value of 3 would start printing the third page of your document. Normally, *SpeedScript* prints starting with the first page.

x Sets the page width, in columns (think *a cross*). Defaults to 80. You need to change this for the sake of the centering command if you are printing in double-width or condensed type, or are using a 40-column or wide-carriage printer.

n Forced paging. Normally, *SpeedScript* prints the footer and moves on to the next page only when it has finished a page, but you can force it to continue to the next page by issuing this command. It requires no numbers.

m Margin release. Disables the left margin for the next printed line. Remember that this executes before the line is printed. It's used for outdenting.

a True ASCII. Every character is assigned a number in the ASCII (American Standard Code for Information Interchange) character set. Most printers use this true ASCII standard, but Commodore printers exchange the values for uppercase and lowercase to match Commodore's own variation of ASCII. Some printer interfaces do not translate Commodore ASCII into true ASCII, so you need to use this command to tell *SpeedScript* to translate. Also, you will sometimes want to intentionally disable your interface's emulation mode in order to control special printer features that would otherwise be rejected by emulation. Place this command as the first character in your document, even before the header and footer definitions. Don't follow it with a number.

Since, in effect, the true ASCII command changes the case of all letters, you can type something in

lowercase and use true ASCII to make it come out in uppercase.

w Page wait. Like the true ASCII command, this one should be placed at the beginning of your document before any text. With page wait turned on, *SpeedScript* prompts you to "Insert next sheet, press RETURN" when each page is finished printing. Insert the next sheet, line it up with the printhead, then press RETURN to continue. Page wait is ignored during disk or screen output.

j Select automatic linefeeds after carriage return. Like **a** and **w**, this command must be placed before any text. Don't use this command to achieve double-spacing, but only if all text prints on the same line.

i Information. This works like REM in BASIC. You follow the command with a line of text, up to 255 characters, ending in a return-mark. This line will be ignored during printing, and is handy for making notes to yourself such as the filename of the document.

h Header define and enable. The header must be a single line of text (up to 255 characters) ending in a return-mark. The header prints on the first line of each page. You can include Stage 2 commands such as centering and page numbering in a header. You can use a header by itself without a footer. The header and footer should be defined at the top of your document, before any text. If you want to prevent the header from printing on the first page, put a return-mark by itself at the top of your document before the header definition.

f Footer define and enable. The footer must be a single line of text (up to 255 characters) ending in a return-mark. The footer prints on the last line of each page. As with the header, you can include Stage 2 printing commands, and you don't need to set the header to use a footer.

g GOTO (link) next file. Put this command as the last line in your document. Follow the command with the letter D for disk or T for tape, then a colon (:), then the name of the file to print next. After the text in memory is printed, the link command loads the next file into memory. You can continue linking in successive files, but don't include a link in the last file. Before you start printing a linked file, make sure the first of the linked files is in memory. When printing is finished, the last file linked to will be in memory.

Stage 2 Commands

These commands either precede a line of text, or are embedded within one.

c Centering. Put this at the beginning of a line you want to center. This will center only one line ending in a return-mark. Repeat this command at the beginning of every line you want centered. Centering uses the page-width setting (see above) to properly center the line. To center a double-width line, either set the page width to 40 or pad out the rest of the line with an equal number of spaces. If you use double width, remember that the spaces preceding the centered text will be double-wide spaces.

When *SpeedScript* encounters this command, it prints the current page number. You usually embed this within a header or footer.

u A simple form of underlining. It does not work on Commodore printers, but only on printers that recognize CHR$(8) as a backspace and CHR$(95) as an underline character. Underlining works on spaces, too. Use the first **u** to start underlining, and another one to turn off underlining.

Fonts And Styles

Most dot-matrix printers are capable of more than just printing text at ten characters per inch. The Commodore MPS-801 can print in double width and reverse field. Some printers have several character sets, with italics and foreign language characters. Most can print in double width (40 characters per line), condensed (132 characters per line), and in either pica or elite. Other features include programmable characters, programmable tab stops, and graphics modes. Many word processors customize themselves to a particular printer, but *SpeedScript* was purposely designed not to be printer-specific. Instead, *SpeedScript* lets you define your own Stage 2 printing commands.

You define a programmable *printkey* by choosing any character that is not already used for other printer commands. The entire uppercase alphabet is available for printkeys, and you can choose letters that are related to their function (like D for double width). You enter these commands like printer commands, by first pressing **CTRL-3**.

To define a printkey, just press CTRL-3, then the key you want to assign as the printkey, then an equals sign (=), and finally the ASCII value to be substituted for the printkey during printing. For example, to define the + key as the letter Z, you first look up the ASCII value of the letter Z (in either your printer manual or in Appendix J in *The Commodore 64 User's Manual*). The ASCII value of the letter Z is 91, so the definition is: [CTRL-3]+=91[RETURN].

Now, anywhere you want to print the letter Z, substitute the printkey:

Gad+ooks! The +oo is +any![RETURN]

This would appear on paper as:

Gadzooks! The zoo is zany!

More practically, look up the value of reverse-on and reverse-off. Reverse-on, a value of 18, prints all text in reverse video until canceled by reverse-off (a value of 146) or a carriage return. So define SHIFT-R as 18 and SHIFT-O as 146. Anywhere you want to print a word in reverse, bracket the word with printkey R and printkey O.

You can similarly define whatever codes your printer uses for features like double width or emphasized mode. For your convenience, four of the printkeys are predefined, though you can change them. Printkey 1 is defined as a 27, the value of the ESCape code used to precede many two-character printer commands. For example, the Epson command for double strike is ESC-G. You can select it in *SpeedScript* with [CTRL-3]G

Printkey 2, a value of 14, goes into double-width mode on most printers, and printkey 3, a value of 15, turns off double width on some printers and selects condensed mode on others. Printkey 4 is de-

fined as 18, which selects reverse field with Commodore printers (and on some graphics interfaces in emulation mode), or condensed mode on some other printers.

With so many codes available, you can even design custom logos and symbols using your printer's graphics mode. For example, on the 1525/MPS-801, you can draw a box (perhaps for a checklist) by first setting the appropriate codes:

1=82=253=2554=193←

Then display the box with text by typing:

13444432 Toothpaste←

This appears on paper as:

☐ Toothpaste

Keep one thing in mind about printkeys. *SpeedScript* always assumes it is printing to a rather dumb, featureless printer, the least common denominator. *SpeedScript* doesn't understand the intent of a printkey; it justs sends its value out. So if you make one word within a line double-width, it may make the line overflow the specified right margin. There's no way for *SpeedScript* to include built-in font and type-style codes without being customized for a particular printer, since no set of codes is universal to all printers.

Hints And Tips

It may take you awhile to fully master *SpeedScript*, but as you do you'll discover many ways to use the editing and formatting commands. For example, there is a simple way to simulate tab stops, say for a columnar table. Just type a period at every tab stop position. Erase the line, then restore it multiple times. When you are filling in the table, just use word left/word right or sentence left/sentence right keys to jump quickly between the periods. Or you can use programmable printkeys to embed your printer's own commands for setting and jumping to tab stops.

You don't have to change or define printer commands every time you write. Just save these definitions as a small text file, and load this file in each time you write. You can create many custom definition files and have them ready to use on disk. You can create customized "fill-in-the-blank" letters. Just type the letter, and everywhere you'll need to insert something, substitute a graphic symbol. When you're ready to customize the letter, just hunt for each graphic symbol and insert the specific information.

SpeedScript does not work with any 80-column video boards or software. *SpeedScript* also wipes out most kinds of resident (RAM-loaded) software, including most software-simulated printer drivers.

The Commodore 64 version of *SpeedScript 3.0* may be ordered on disk directly from COMPUTE! Publications. Call **TOLL FREE 800-334-0868** (in NC 919-275-9809) to charge your order 8:30 a.m.–7:00 p.m. EST, Monday through Friday. Or send check or money order ($12.95 plus $2.00 shipping and handling) to:

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Greensboro, NC 27403 USA

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Program 1: *SpeedScript 3.0* For Commodore 64

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

```
2049 :011,008,010,000,158,050,238
2055 :048,054,049,000,000,000,158
2061 :032,136,009,169,203,205,255
2067 :110,035,141,110,035,240,178
2073 :003,032,055,009,032,197,097
2079 :009,076,105,010,165,038,178
2085 :141,067,008,165,039,141,086
2091 :068,008,165,158,141,070,141
2097 :008,165,159,141,071,008,089
2103 :166,181,240,032,169,000,075
2109 :141,021,032,160,000,185,088
2115 :000,000,153,000,000,200,164
2121 :204,021,032,208,244,238,252
2127 :068,008,238,071,008,224,184
2133 :000,240,007,202,208,224,198
2139 :165,180,208,222,096,165,103
2145 :181,170,005,180,208,001,074
2151 :096,024,138,101,039,141,130
2157 :139,008,165,038,141,138,226
2163 :008,024,138,101,159,141,174
2169 :142,008,165,158,141,141,108
2175 :008,232,164,180,208,004,155
2181 :240,013,160,255,185,082,044
2187 :036,153,087,036,136,192,011
2193 :255,208,245,206,139,008,182
2199 :206,142,008,202,208,234,127
2205 :096,169,040,133,195,133,155
2211 :020,169,004,133,196,169,086
2217 :216,133,021,173,017,032,249
2223 :133,251,173,018,032,133,147
2229 :252,162,001,173,020,032,053
2235 :133,012,173,029,013,141,176
2241 :032,208,160,000,173,044,042
2247 :013,145,020,177,251,153,190
2253 :029,032,200,041,127,201,067
2259 :031,240,019,192,040,208,173
2265 :235,136,177,251,041,127,160
2271 :201,032,240,005,136,208,021
2277 :245,160,039,200,132,059,040
2283 :136,185,029,032,145,195,189
2289 :136,016,248,164,059,024,120
2295 :152,101,251,133,251,165,020
2301 :252,105,000,133,252,224,195
2307 :001,208,003,140,016,032,147
2313 :192,040,240,008,169,032,178
2319 :145,195,200,076,009,009,137
2325 :024,165,195,105,040,133,171
2331 :195,133,020,144,004,230,241
2337 :196,230,021,232,224,025,193
2343 :240,003,076,195,008,165,214
2349 :251,141,027,032,165,252,145
2355 :141,028,032,096,173,008,017
2361 :032,133,251,141,017,032,151
2367 :141,023,032,133,057,173,110
2373 :009,032,133,252,141,018,142
2379 :032,141,024,032,133,058,239
2385 :056,173,011,032,237,009,087
2391 :032,170,169,032,160,255,137
2397 :198,252,145,251,200,230,089
2403 :252,145,251,200,208,251,126
2409 :230,252,202,208,246,145,108
2415 :251,096,133,059,132,060,074
2421 :160,000,177,059,240,006,247
2427 :032,210,255,200,208,246,250
2433 :096,032,228,255,240,251,207
2439 :096,169,147,032,210,255,020
2445 :169,054,133,001,169,000,155
2451 :141,020,032,141,008,032,009
2457 :141,010,032,141,012,032,009
2463 :141,014,032,141,176,032,183
2469 :141,207,032,169,036,024,006
2475 :105,001,141,009,032,169,116
2481 :207,141,011,032,169,208,177
2487 :141,013,032,169,255,141,166
2493 :015,032,141,174,032,076,147
2499 :132,255,032,226,013,169,254
2505 :128,141,138,002,133,157,132
2511 :032,093,017,169,006,141,153
2517 :024,003,169,010,141,025,073
2523 :003,173,008,032,133,057,113
2529 :173,009,032,133,058,032,150
2535 :246,009,169,038,160,030,115
2541 :032,113,009,238,019,032,168
2547 :076,177,011,032,078,010,115
2553 :169,018,160,030,032,113,003
2559 :009,169,000,141,019,032,113
2565 :096,072,138,072,152,072,095
2571 :169,127,141,013,221,172,086
2577 :013,221,016,003,076,114,204
2583 :254,173,113,036,240,006,077
2589 :165,002,160,000,145,057,046
2595 :169,002,133,012,032,204,075
2601 :255,032,078,010,169,247,064
2607 :160,031,032,113,009,032,168
2613 :167,016,208,009,032,069,042
2619 :020,120,169,127,076,102,161
2625 :254,032,069,020,162,250,084
2631 :154,032,197,009,076,105,132
2637 :010,162,039,169,032,157,134
2643 :000,004,202,016,250,169,212
2649 :019,076,210,255,072,041,250
2655 :128,074,133,059,104,041,122
2661 :063,005,059,096,160,000,228
2667 :140,113,036,177,057,133,251
2673 :002,160,000,177,057,073,070
2679 :128,145,057,173,113,036,003
2685 :073,001,141,113,036,032,009
2691 :158,008,032,228,255,208,252
2697 :013,165,162,041,016,240,006
2703 :245,169,000,133,162,076,160
2709 :114,010,170,160,000,165,000
2715 :002,145,057,140,113,036,136
2721 :224,095,208,012,032,112,076
2727 :012,169,032,160,000,145,173
2733 :057,076,105,010,173,019,101
2739 :032,240,007,138,072,032,188
2745 :246,009,104,170,138,201,029
2751 :013,208,002,162,095,138,041
2757 :041,127,201,032,144,078,052
2763 :224,160,208,002,162,032,223
2769 :138,072,160,000,177,057,045
2775 :201,031,240,005,173,020,117
2781 :032,240,003,032,056,016,088
```

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2787 :104,032,093,010,160,000,114
2793 :145,057,032,158,008,056,177
2799 :165,057,237,023,032,133,118
2805 :059,165,058,237,024,032,052
2811 :005,059,144,014,165,057,183
2817 :105,000,141,023,032,165,211
2823 :058,105,000,141,024,032,111
2829 :230,057,208,002,230,058,030
2835 :032,177,011,076,105,010,174
2841 :138,174,059,011,221,059,175
2847 :011,240,006,202,208,248,178
2853 :076,105,010,202,138,010,066
2859 :170,169,010,072,169,104,225
2865 :072,189,100,011,072,189,170
2871 :099,011,072,096,039,029,145
2877 :157,137,133,002,012,138,128
2883 :134,020,148,004,019,009,145
2889 :147,135,139,005,136,140,007
2895 :022,145,017,159,018,024,208
2901 :026,016,028,030,006,001,192
2907 :011,008,031,003,131,010,029
2913 :141,007,102,012,111,012,226
2919 :122,012,176,012,016,013,198
2925 :029,013,044,013,146,013,111
2931 :217,014,055,016,013,015,189
2937 :080,015,157,016,190,016,083
2943 :224,016,001,017,163,017,053
2949 :202,019,181,018,025,020,086
2955 :044,013,146,013,097,020,216
2961 :123,021,033,022,244,012,088
2967 :179,022,168,019,079,027,133
2973 :244,014,049,022,225,013,212
2979 :232,027,239,029,244,015,181
2985 :236,015,139,028,028,016,119
2991 :199,027,032,015,012,056,004
2997 :165,057,237,017,032,165,086
3003 :058,237,018,032,176,032,228
3009 :056,173,017,032,237,008,204
3015 :032,133,059,173,018,032,134
3021 :237,009,032,005,059,240,019
3027 :013,165,057,141,017,032,124
3033 :165,058,141,018,032,032,151
3039 :158,008,056,173,027,032,165
3045 :229,057,133,251,173,028,076
3051 :032,229,058,133,252,005,176
3057 :251,240,002,176,024,024,190
3063 :173,017,032,109,016,032,114
3069 :141,017,032,173,018,032,154
3075 :105,000,141,018,032,032,075
3081 :158,008,076,225,011,096,071
3087 :056,173,023,032,237,010,034
3093 :032,133,059,173,024,032,218
3099 :237,011,032,005,059,144,003
3105 :012,173,010,032,141,023,168
3111 :032,173,011,032,141,024,196
3117 :032,056,165,057,237,008,088
3123 :032,133,059,165,058,237,223
3129 :009,032,005,059,176,011,093
3135 :173,008,032,133,057,173,127
3141 :009,032,133,058,096,056,197
3147 :165,057,237,023,032,133,210
3153 :059,165,058,237,024,032,144
3159 :005,059,176,001,096,173,085
3165 :023,032,133,057,173,024,023
3171 :032,133,058,096,230,057,193
3177 :208,002,230,058,076,177,088
3183 :011,165,057,208,002,198,240
3189 :058,198,057,076,177,011,182
3195 :165,057,133,251,165,058,184
3201 :133,252,198,252,160,255,099
3207 :177,251,201,032,240,004,016
3213 :201,031,208,003,136,208,160
3219 :243,177,251,201,032,240,011
3225 :008,201,031,240,004,136,005
3231 :208,243,096,056,152,101,247
3237 :251,133,057,165,252,105,104
3243 :000,133,058,076,177,011,114
3249 :160,000,177,057,201,032,036
3255 :240,008,201,031,240,004,139
3261 :200,208,243,096,200,208,064
3267 :011,230,058,165,058,205,154
3273 :024,032,144,002,208,025,124
3279 :177,057,201,032,240,236,126
3285 :201,031,240,232,024,152,069
3291 :101,057,133,057,165,058,022
3297 :105,000,133,058,076,177,006
3303 :011,173,023,032,133,057,148
3309 :173,024,032,133,058,076,221
3315 :177,011,169,000,141,017,246
3321 :032,173,024,032,056,233,031
3327 :004,205,009,032,176,003,172
3333 :173,009,032,141,018,032,154
3339 :032,158,008,076,232,012,017
3345 :238,029,013,173,029,013,000
3351 :041,015,141,029,013,096,102
3357 :012,238,044,013,173,044,041
3363 :013,041,015,141,044,013,046
3369 :076,158,008,011,165,057,004
3375 :133,251,165,058,133,252,015
3381 :198,252,160,255,177,251,066
3387 :201,046,240,012,201,033,024
3393 :240,008,201,063,240,004,053
3399 :201,031,208,004,136,208,091
3405 :235,096,177,251,201,046,059
3411 :240,027,201,033,240,023,079
3417 :201,063,240,019,201,031,076
3423 :240,015,136,208,235,198,103
3429 :252,165,252,205,008,032,247
3435 :176,226,076,134,013,132,096
3441 :059,198,059,200,240,010,111
3447 :177,251,201,032,240,247,243
3453 :136,076,162,012,164,059,222
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6171 :208,003,032,009,025,173,221
6177 :164,032,240,003,032,049,041
6183 :025,056,046,164,032,173,023
6189 :022,032,141,021,032,169,206
6195 :110,133,253,169,033,133,114
6201 :254,032,051,029,032,066,009
6207 :025,173,166,032,205,156,052
6213 :032,144,003,032,151,024,199
6219 :056,165,251,237,023,032,071
6225 :133,059,165,252,237,024,183
6231 :032,005,059,240,056,144,111
6237 :054,173,151,032,240,011,242
6243 :169,000,141,150,032,141,220
6249 :155,032,032,151,024,173,160
6255 :170,032,201,003,208,003,216
6261 :032,130,009,032,225,255,032
6267 :240,251,169,001,032,195,243
6273 :255,032,231,255,173,111,162
6279 :036,141,029,013,162,250,254
6285 :154,032,246,009,076,105,251
6291 :010,076,190,023,056,173,163
6297 :154,032,237,166,032,168,174
6303 :136,136,240,008,048,006,221
6309 :032,084,025,136,208,250,132
6315 :173,151,032,240,017,141,157
6321 :021,032,169,111,133,253,128
6327 :169,035,133,254,032,049,087
6333 :025,032,051,029,032,084,186
6339 :025,032,084,025,032,084,221
6345 :025,238,159,032,208,003,098
6351 :238,160,032,173,158,032,232
6357 :208,050,173,170,032,201,023
6363 :003,240,043,201,008,240,186
6369 :039,056,173,159,032,237,153
6375 :161,032,173,160,032,237,002
6381 :162,032,144,024,032,204,067
6387 :255,032,078,010,169,179,198
6393 :160,031,032,113,009,032,114
6399 :130,009,032,167,022,162,009
6405 :001,032,201,255,173,150,049
6411 :032,240,017,141,021,032,238
6417 :169,110,133,253,169,034,117
6423 :133,254,032,049,025,032,036
6429 :051,029,172,155,032,140,096
6435 :166,032,136,240,008,048,153
6441 :006,032,084,025,136,208,020
6447 :250,096,169,032,172,152,150
6453 :032,140,165,032,240,006,156
6459 :032,106,022,136,208,250,045
6465 :096,172,157,032,024,152,186
6471 :109,166,032,141,166,032,205
6477 :032,084,025,136,208,250,044
6483 :096,169,013,032,106,022,009
6489 :173,112,036,240,003,032,173
6495 :106,022,096,141,168,032,148
6501 :041,127,032,071,022,174,056
6507 :173,025,221,173,025,240,196
6513 :009,202,208,248,206,165,127
6519 :032,076,190,026,202,138,015
6525 :010,170,140,167,032,169,045
6531 :025,072,169,144,072,189,034
6537 :193,025,072,189,192,025,065
6543 :072,096,056,173,167,032,227
6549 :101,251,133,251,165,252,022
6555 :105,000,133,252,076,190,143
6561 :023,177,251,201,031,240,060
6567 :001,136,140,167,032,096,227
6573 :018,087,065,076,082,084,073
6579 :066,083,078,072,070,064,100
6585 :080,063,088,077,073,071,125
6591 :074,032,026,050,026,059,202
6597 :026,069,026,079,026,089,000
6603 :026,099,026,109,026,124,101
6609 :026,158,026,006,026,022,217
6615 :026,246,025,236,025,227,232
6621 :025,183,026,224,026,041,234
6627 :026,200,169,000,141,164,159
6633 :032,076,162,025,200,032,248
6639 :019,021,141,163,032,076,179
6645 :162,025,200,032,019,021,192
6651 :141,161,032,173,139,032,161
6657 :141,162,032,076,162,025,087
6663 :200,032,019,021,141,159,067
6669 :032,173,139,032,141,160,178
6675 :032,076,162,025,200,032,034
6681 :019,021,141,154,032,076,212
6687 :162,025,169,000,141,158,174
6693 :032,200,076,162,025,169,189
6699 :010,141,112,036,200,076,106
6705 :162,025,200,169,001,141,235
6711 :171,032,076,162,025,200,209
6717 :032,019,021,141,152,032,202
6723 :076,162,025,200,032,019,069
6729 :021,141,153,032,076,162,146
6735 :025,200,032,019,021,141,005
6741 :155,032,076,162,025,200,223
6747 :032,019,021,141,156,032,236
6753 :076,162,025,200,032,019,099
6759 :021,141,157,032,076,162,180
6765 :025,172,167,032,200,152,089
6771 :072,032,151,024,104,168,154
6777 :140,167,032,096,032,151,227
6783 :026,136,140,150,032,160,003
6789 :001,177,251,153,109,034,090
6795 :200,204,150,032,144,245,090
6801 :240,243,200,076,162,025,067
6807 :200,177,251,201,031,208,195
6813 :249,096,032,151,026,136,079
6819 :140,151,032,160,001,177,056
6825 :251,153,110,035,200,204,098
6831 :151,032,144,245,240,243,206
6837 :076,162,025,032,151,026,141
6843 :076,162,025,200,177,251,054
6849 :201,061,240,007,136,173,243
6855 :168,032,076,217,023,200,147
6861 :032,019,021,072,173,168,178
6867 :032,041,127,170,104,157,074
6873 :238,032,032,162,025,076,014
6879 :145,025,200,162,008,177,172
6885 :251,041,063,201,004,240,005
6891 :009,162,001,201,020,240,100
6897 :003,076,177,022,142,027,176
6903 :019,200,177,251,201,058,139
6909 :240,003,076,177,022,200,203
6915 :177,251,201,031,240,009,144
6921 :032,071,022,153,106,032,169
6927 :076,002,027,152,056,233,049
6933 :003,162,109,160,032,032,007
6939 :189,255,032,204,255,169,107
6945 :002,032,195,255,169,002,176
6951 :174,027,019,160,000,032,195
6957 :186,255,032,055,009,169,239
6963 :000,166,057,164,058,032,016
6969 :213,255,144,003,076,177,157
6975 :022,142,023,032,140,024,190
6981 :032,104,104,162,001,032,248
6987 :201,255,076,180,023,032,074
6993 :231,255,169,000,032,189,189
6999 :255,169,015,162,008,160,088
7005 :015,032,186,255,032,192,037
7011 :255,144,011,169,015,032,213
7017 :195,255,032,231,255,076,125
7023 :246,009,032,078,010,169,143
7029 :029,160,031,032,113,009,235
7035 :032,056,018,240,022,162,141
7041 :015,032,201,255,176,223,007
7047 :169,069,160,032,032,113,198
7053 :009,169,013,032,210,255,061
7059 :032,204,255,032,231,255,132
7065 :169,000,032,189,255,169,199
7071 :015,162,008,160,015,032,039
7077 :186,255,032,192,255,176,237
7083 :186,032,078,010,162,015,142
7089 :032,198,255,032,056,018,000
7095 :032,204,255,169,015,032,122
7101 :195,255,032,231,255,169,046
7107 :001,141,019,032,096,032,004
7113 :240,027,173,176,032,240,065
7119 :022,032,147,028,032,022,234
7125 :028,173,174,032,201,255,052
7131 :240,009,032,182,028,032,230
7137 :158,008,076,211,027,076,013
7143 :246,009,173,141,002,201,235
7149 :005,208,038,032,078,010,096
7155 :169,213,160,031,032,113,193
7161 :009,032,056,018,141,176,169
7167 :032,208,003,076,246,009,061
7173 :160,000,185,069,032,153,092
7179 :177,032,200,204,026,032,170
7185 :208,244,076,246,009,165,197
7191 :057,133,251,165,058,133,052
7197 :252,169,255,141,174,032,028
7203 :160,001,162,000,173,176,195
7209 :032,240,080,189,177,032,023
7215 :032,093,010,209,251,240,114
7221 :002,162,255,200,208,011,123
7227 :230,252,165,252,205,024,163
7233 :032,240,002,176,054,232,033
7239 :236,176,032,208,224,024,203
7245 :152,101,251,133,059,165,170
7251 :252,105,000,133,060,173,038
7257 :023,032,197,059,173,024,085
7263 :032,229,060,144,024,056,128
7269 :165,059,237,176,032,133,135
7275 :057,141,173,032,165,060,223
7281 :233,000,133,058,141,174,084
7287 :032,032,177,011,096,032,243
7293 :078,010,169,223,160,031,028
7299 :032,113,009,169,001,141,084
7305 :019,032,096,173,141,002,088
7311 :201,005,208,035,032,078,190
7317 :010,169,233,160,031,032,016
7323 :113,009,032,056,018,141,012
7329 :207,032,240,014,160,000,046
7335 :185,069,032,153,208,032,078
7341 :200,204,026,032,208,244,063
7347 :076,246,009,056,165,057,020
7353 :133,158,237,173,032,133,027
7359 :059,165,058,133,159,237,234
7365 :174,032,005,059,208,101,008
7371 :169,255,141,174,032,024,230
7377 :173,176,032,101,057,133,113
7383 :038,169,000,101,058,133,202
7389 :039,056,173,023,032,229,005
7395 :158,133,180,173,024,032,159
7401 :229,159,133,181,032,035,234
7407 :008,056,173,023,032,237,000
7413 :176,032,141,023,032,173,054
7419 :024,032,233,000,141,024,193
7425 :032,173,207,032,240,041,214
7431 :141,169,032,169,000,141,147
7437 :170,032,032,078,016,160,245
7443 :000,185,208,032,032,093,057
7449 :010,145,057,200,204,207,080
7455 :032,208,242,024,165,057,247
7461 :109,207,032,133,057,165,228
7467 :058,105,000,133,058,076,217
7473 :177,011,160,000,204,021,110
7479 :032,240,032,177,253,048,069
7485 :029,032,071,022,032,208,199
7491 :029,032,106,022,173,172,089
7497 :032,240,010,169,008,032,052
7503 :106,022,169,095,032,106,097
7509 :022,200,076,053,029,096,049
7515 :140,167,032,041,127,141,227
7521 :168,032,032,071,022,201,111
7527 :067,208,027,056,173,163,029
7533 :032,237,021,032,074,056,049
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7539 :237,152,032,168,169,032,137
7545 :032,106,022,136,208,250,107
7551 :172,167,032,076,086,029,177
7557 :201,069,208,017,056,173,089
7563 :153,032,237,021,032,056,158
7569 :237,152,032,168,169,032,167
7575 :076,121,029,201,085,208,103
7581 :008,173,172,032,073,001,104
7587 :141,172,032,201,035,208,184
7593 :026,140,167,032,174,159,099
7599 :032,173,160,032,160,055,019
7605 :132,001,032,205,189,160,132
7611 :054,132,001,172,167,032,233
7617 :076,086,029,174,168,032,246
7623 :189,238,032,032,106,022,050
7629 :076,086,029,174,171,032,005
7635 :240,026,133,059,041,127,069
7641 :201,065,144,018,201,091,169
7647 :176,014,170,165,059,041,080
7653 :128,073,128,074,074,133,071
7659 :059,138,005,059,096,032,112
7665 :078,010,056,173,010,032,088
7671 :237,023,032,170,173,011,125
7677 :032,237,024,032,160,055,025
7683 :132,001,032,205,189,160,210
7689 :054,132,001,169,001,141,251
7695 :019,032,096,008,014,155,083
7701 :146,211,080,069,069,068,152
7707 :211,067,082,073,080,084,112
7713 :032,051,046,048,000,032,242
7719 :066,089,032,195,072,065,046
7725 :082,076,069,083,032,194,069
7731 :082,065,078,078,079,078,255
7737 :000,194,085,070,070,069,033
7743 :082,032,195,076,069,065,070
7749 :082,069,068,000,194,085,055
7755 :070,070,069,082,032,198,084
7761 :085,076,076,000,196,069,071
7767 :076,069,084,069,032,040,201
7773 :211,044,215,044,208,041,088
7779 :000,058,032,193,082,069,021
7785 :032,089,079,085,032,083,249
7791 :085,082,069,063,032,040,226
7797 :217,047,206,041,058,000,174
7803 :197,210,193,211,197,032,139
7809 :193,204,204,032,212,197,147
7815 :216,212,000,197,082,065,139
7821 :083,069,032,040,211,044,108
7827 :215,044,208,041,058,032,233
7833 :018,210,197,212,213,210,189
7839 :206,146,032,084,079,032,226
7845 :069,088,073,084,000,208,175
7851 :082,069,083,083,032,070,078
7857 :079,082,077,065,084,032,084
7863 :075,069,089,058,000,211,173
7869 :065,086,069,058,000,212,167
7875 :065,080,069,032,197,210,080
7881 :210,207,210,000,211,084,099
7887 :079,080,080,069,068,000,071
7893 :214,069,082,073,070,089,042
7899 :032,197,082,082,079,082,005
7905 :000,206,079,032,069,082,181
7911 :082,079,082,083,000,147,192
7917 :032,018,212,146,065,080,022
7923 :069,032,079,082,032,018,043
7929 :196,146,073,083,075,063,117
7935 :000,204,079,065,068,058,217
7941 :000,214,069,082,073,070,001
7947 :089,058,000,208,082,069,005
7953 :083,083,032,018,210,197,128
7959 :212,213,210,206,146,000,242
7965 :196,073,083,075,032,067,043
7971 :079,077,077,065,078,068,223
7977 :058,000,036,206,079,032,196
7983 :210,079,079,077,000,206,186
7989 :079,032,084,069,088,084,233
7995 :032,073,078,032,066,085,169
8001 :070,070,069,082,046,000,146
8007 :147,208,082,073,078,084,231
8013 :032,084,079,058,032,018,124
8019 :211,146,067,082,069,069,215
8025 :078,044,018,196,146,073,132
8031 :083,075,044,018,208,146,157
8037 :082,073,078,084,069,082,057
8043 :063,000,196,069,086,073,082
8049 :067,069,032,078,085,077,009
8055 :066,069,082,063,000,211,098
8061 :069,067,079,078,068,065,039
8067 :082,089,032,193,068,068,151
8073 :082,069,083,083,032,035,009
8079 :063,000,208,082,073,078,135
8085 :084,032,084,079,032,070,018
8091 :073,076,069,078,065,077,081
8097 :069,058,000,147,208,082,213
8103 :073,078,084,073,078,071,112
8109 :046,046,046,013,013,000,081
8115 :201,078,083,069,082,084,008
8121 :032,078,069,088,084,032,056
8127 :083,072,069,069,084,044,100
8133 :032,080,082,069,083,083,114
8139 :032,018,210,197,212,213,061
8145 :210,206,146,000,200,085,032
8151 :078,084,032,070,079,082,128
8157 :058,000,206,079,084,032,168
8163 :198,079,085,078,068,000,223
8169 :210,069,080,076,065,067,032
8175 :069,032,087,073,084,072,144
8181 :058,000,197,216,201,212,105
8187 :032,211,080,069,069,068,012
8193 :211,067,082,073,080,084,086
8199 :000,013,013,013,013,013,072
```

Program 2: *SpeedScript 3.0* File Converter

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

```
100 PRINT"{CLR}{RVS}{N}{2 SPACES}SPEEDSCRIPT
    {SPACE}FILE CONVERSION PROGRAM{3 SPACES}"
                                        :rem 25
110 GOSUB410                            :rem 167
120 INPUT"{DOWN}INPUT FILE NAME";I$     :rem 113
130 IFI$=""THEN120                      :rem 211
140 INPUT"{DOWN}OUTPUT FILE NAME";O$    :rem 218
150 PRINT"{DOWN}{RVS}D{OFF}ISK, {RVS}S{OFF}CR
    EEN, {RVS}P{OFF}RINTER, {RVS}M{OFF}ODEM,
    {SPACE}{RVS}O{OFF}THER"             :rem 223
160 GETA$:IFA$=""THEN160                :rem 81
170 DV=-(A$="T")-2*(A$="M")-3*(A$="S")-4*(A$=
    "P")-8*(A$="D"):SA=7                :rem 166
180 IFDV=0THENINPUT"DEVICE NUMBER";DV:INPUT"S
    ECONDARY ADDRESS";SA                :rem 11
190 PRINT"{2 DOWN}WHICH CONVERSION:"    :rem 192
200 PRINT"{DOWN}1) SPEEDSCRIPT TO COMMODORE A
    SCII"                               :rem 197
210 PRINT"{DOWN}2) SPEEDSCRIPT TO TRUE ASCII"
                                        :rem 98
220 PRINT"{DOWN}3) COMMODORE ASCII TO SPEEDSC
    RIPT"                               :rem 201
230 GETP$:IFP$<"1"ORP$>"3"THEN230       :rem 101
240 ADR=828+VAL(P$)*3-3                 :rem 220
250 OPEN15,8,15,"I0":REM REMOVE ,"I0" IF YOU'
    VE CHANGED THE DRIVE'S SPEED        :rem 97
260 OPEN1,8,3,I$:INPUT#15,EN,EM$:F$=I$:IFEN=0
    THEN290                             :rem 44
270 PRINT"{DOWN}DISK ERROR FOR ";F$:PRINTEM$
                                        :rem 185
280 PRINT"{3 DOWN}RUN{3 UP}":CLOSE1:CLOSE2:CL
    OSE15:END                           :rem 48
290 IFDV=2THENOPEN2,2,3,CHR$(6+32)+(6+64):GOT
    O 380                               :rem 28
295 IFDV<>8THENOPEN2,DV,SA,O$:GOTO380   :rem 65
300 EX$=",S,W":IFP$="3"THENEX$=",P,W"   :rem 56
310 OPEN2,DV,SA,"0:"+O$+EX$:INPUT#15,EN,EM$:F
    $=O$                                :rem 42
320 IFEN=0THEN380                       :rem 238
330 IFEN<>63THEN270                     :rem 99
340 IFEN=63THENPRINT"{DOWN}";O$;" EXISTS... R
    EPLACE? {RVS}Y{OFF}/{RVS}N{OFF}:"   :rem 26
350 GETA$:IFA$<>"Y"ANDA$<>"N"THEN350    :rem 45
360 IFA$="N"THEN270                     :rem 36
370 PRINT#15,"S0:"+O$:CLOSE2:GOTO310    :rem 100
380 SYS(ADR):IF(PEEK(144)AND191)=0THENPRINT"
    {DOWN}DONE.":GOTO280                :rem 184
390 PRINT"I/O ERROR DURING CONVERSION.":INPUT
    #15,EN,EM$:IFEN<>0THEN270           :rem 253
400 GOTO280                             :rem 103
410 FORI=828TO1001:READA:POKEI,A:CK=CK+A:NEXT
    :IFCK=21584THENRETURN               :rem 222
420 PRINT"{RVS}ERROR IN DATA STATEMENTS.":END
                                        :rem 251
430 DATA 076,069,003,076,122,003        :rem 33
440 DATA 076,174,003,032,225,255        :rem 36
450 DATA 240,018,032,216,003,032        :rem 20
460 DATA 095,003,032,183,255,072        :rem 39
470 DATA 032,224,003,104,041,064        :rem 21
480 DATA 240,233,076,204,255,133        :rem 38
490 DATA 251,041,064,010,005,251        :rem 24
500 DATA 041,191,133,251,041,032        :rem 20
510 DATA 073,032,010,005,251,201        :rem 12
520 DATA 095,208,002,169,013,133        :rem 34
530 DATA 251,096,032,225,255,240        :rem 37
540 DATA 221,032,216,003,032,095        :rem 24
550 DATA 003,041,127,201,065,144        :rem 25
560 DATA 018,201,091,176,014,170        :rem 34
570 DATA 165,251,041,128,073,128        :rem 43
580 DATA 074,074,133,251,138,005        :rem 41
590 DATA 251,133,251,032,183,255        :rem 40
600 DATA 072,032,224,003,104,041        :rem 15
610 DATA 064,240,207,076,204,255        :rem 37
620 DATA 032,225,255,240,169,032        :rem 35
630 DATA 216,003,201,013,208,002        :rem 14
640 DATA 169,031,072,041,128,074        :rem 40
650 DATA 133,251,104,041,063,005        :rem 24
660 DATA 251,133,251,032,183,255        :rem 38
670 DATA 072,032,224,003,104,041        :rem 22
680 DATA 064,240,217,076,204,255        :rem 45
690 DATA 162,001,032,198,255,076        :rem 47
700 DATA 207,255,162,002,032,201        :rem 21
710 DATA 255,165,251,076,210,255        :rem 42
```

Auto-Applesoft

Karl R Beach

This program automates educational programming. But it's also useful for adding text to an adventure game or simply writing a letter to a friend.

This program is a conversion of "VIC Automatic BASIC" (COMPUTE!, April 1983). "Auto-Applesoft" will allow educators to write their own educational software.

Auto-Applesoft is designed to let you see how each page of text will appear on the screen before it is converted into BASIC. It is designed to allow the use of all of the Apple II's screen-editing features. Most important, it is designed to allow pages of instructional text to be quickly created in BASIC program lines rather than through the use of sequential text files.

Just as VIC Automatic BASIC was useful for a variety of noninstructional uses, Auto-Applesoft is a handy utility to keep on a disk in case you want to add some text to an animated adventure game (either directly or by appending it) or write an Apple-letter to a friend. The program here is deliberately specialized for educational applications, but you can experiment with the program, and mold it to fit your needs.

Specialized Feature

When several students are going to use the program at one time, programs made with Auto-Applesoft will allow the instructor to monitor their work. When prompted for "Name," the instructor may enter TEACHER and review up to 50 students' work. To avoid problems with rapid scrolling, the instructor must press a key (any key will do) to call up each student's results. It would be easy to customize the program to direct the results to either a printer or a sequential disk file by rewriting the program between lines 600 and 800.

To write a page of text: First, load Auto-Applesoft. Then, insert an initialized disk into the disk drive and type RUN. You will be greeted by a flashing announcement of the program's name. You can shorten the time delay in line 8 to save time when you run the program. After the title screen, you will be asked to input a beginning line number. Jot this line number on a scrap of paper since you might wish to refer to it later.

The first line number you should enter is 1000. When you've entered it, the screen will go blank and the cursor will appear at the upper left-hand corner. Simply type your first line of text. When you come to the right-hand margin, press the SHIFT key and the asterisk (*). The cursor will drop down two lines and back to the left-hand margin. This is the position where the second line of text will be when you run your program. Many children have a very difficult time reading Apple II screens when the text is single-spaced.

Type additional lines the same way. To reposition the cursor after each line, just press SHIFT and the asterisk. It is possible to enter up to nine lines of text on one page. However, fewer lines make a nicer display and are safer when you are ready to trick the Apple into letting you trap the text as BASIC program lines.

If you make a typing error, press the SHIFT key and the at symbol (@). The cursor will drop one line and back to the left-hand margin. You can then retype the line.

Trapping Text

When you are ready to trap the text as BASIC lines, press the SHIFT key and the ampersand symbol (&) key. You will be asked if this is the end of a page of text. If it is, enter 1, but if you

expect the student to input a response, enter 2. If you enter a 1, the screen will immediately be filled with what appears to be a well-spaced set of BASIC program lines beginning one line number higher than the beginning line number that you initially entered. If you enter a 2, you will be asked to input the answer that the students should give. After you have entered this answer, the screen will fill with program lines as described above. The spacing of these lines is critical if text trapping is to work on the Apple II.

Creating BASIC Lines

On the Apple you have to move the cursor all the way to the end of a line to enter the entire program line. If you hit RETURN before the end of the line, only the portion preceding the RETURN will be entered into the computer. Follow these steps to enter the lines displayed on the screen as BASIC program lines:

Press the ESCAPE key and drive the cursor to the top of the screen by holding down the REPEAT key and the I key. Then drive the cursor all the way across the program line using the → cursor control key and the REPEAT key. Make sure you move past the last quotation mark of the line, then press RETURN. The cursor should drop down beside the next line number. Repeat these steps until the entire screen has been entered as part of your BASIC program.

Type RUN again and begin with a line number higher than the last one that you saw on the screen. While this process isn't painless, you will quickly develop a rhythm for it and you'll be amazed at how quickly you can build up a fairly complex educational program.

Adding Highlight And Flash

There are many times when it is important to highlight a word or phrase in an educational program. Auto-Applesoft has provisions for two methods of highlighting: inverse video and flashing.

Immediately before you type the word you want to highlight in inverse video, press CTRL and the I key. The cursor will blink, but it will not move. Now type the word you want highlighted. Immediately after typing the word, press CTRL N. The cursor will again blink without moving. Now simply type the rest of your line of text as you normally would. When you are ready to trap the text, you'll see that the proper commands for inverse video have automatically been included around the word in the line.

If you want to highlight a word or phrase in flashing video, follow the same procedure you used for highlighting in inverse, except type CTRL and the letter F instead of CTRL-I. This will add some flash to your finished program.

When you've completed your program, enter a program line with the instruction GOTO 890 before your END statement. Delete the core of Auto-Applesoft by typing DEL 1,200 and pressing RETURN. Put a title, a FOR–NEXT time delay, and a HOME command in between line 306 and 309. Finally, save the program on an initialized disk.

Auto-Applesoft

```
4  HOME : VTAB 10: HTAB 10: FLASH : PRINT
     "                    "
5  HTAB 10: PRINT "  AUTO-APPLESOFT
     "
6  HTAB 10: PRINT "
     ": NORMAL
8  FOR I = 1 TO 2000: NEXT I: HOME
10  PRINT : INPUT "BEGIN LINE # ";LN

12  HOME
15  FOR L = 1 TO 9
20  GET E$: IF E$ = "" THEN 20
25  IF E$ = "@" THEN A$(L) = "":E$ =
     "": PRINT : PRINT ;: GOTO 20
27  IF E$ =  CHR$ (6) THEN E$ = "":A
     $(L) = A$(L) +  CHR$ (34) + ";:
     FLASH:PRINT" +  CHR$ (34): GOTO
     20
28  IF E$ =  CHR$ (14) THEN E$ = "":
     A$(L) = A$(L) +  CHR$ (34) + ";
     :NORMAL:PRINT" +  CHR$ (34): GOTO
     20
29  IF E$ =  CHR$ (9) THEN E$ = "":A
     $(L) = A$(L) +  CHR$ (34) + ";:
     INVERSE:PRINT" +  CHR$ (34): GOTO
     20
30  IF E$ = "&" THEN 60
35  IF E$ = "*" THEN 50
40  PRINT E$;
45 A$(L) = A$(L) + E$:E$ = "": GOTO
     20
50  PRINT : PRINT : PRINT ;
52 K = K + 1
55  NEXT L
60  INPUT "1=PAGE 2=ANSWER ";B
65  IF B = 1 THEN 75
70  INPUT "ANSWER=";B$
75  HOME
80  FOR L = 1 TO K
85 LN = LN + L
90  PRINT : PRINT "  ";LN;"PRINT:PRI
     NT"; CHR$ (34);A$(L); CHR$ (34)

95  NEXT L
100  IF B = 1 THEN  PRINT : PRINT "
      ";LN + 1;"GOSUB900"
105  IF B = 2 THEN  PRINT : PRINT "
      ";LN + 1;"A$=";  CHR$ (34);B$; CHR$
     (34);":GOSUB800"
110  END
250  DIM ST$(50),SC$(50)
300 S =  - 16336
305  HOME
306  REM  TITLE
310  FOR I = 1 TO 100:Z =  PEEK (S):
      NEXT I
```

```
330  FOR I = 1 TO 100:Z =  PEEK (S):
      NEXT I
340  FOR I = 1 TO 2000: NEXT I: HOME

400  VTAB 10: HTAB 5: INPUT "WHAT'S
     YOUR NAME? ";N$
402  IF N$ = "TEACHER" THEN 600
405  PRINT : HTAB 15: PRINT "HELLO,
     ";N$;"!"
410  FOR I = 1 TO 100:Z =  PEEK (S):
      NEXT I
415  PRINT : HTAB 15: PRINT "I'M YOU
     R COMPUTER!"
420  FOR I = 1 TO 2000: NEXT I
500  HOME : GOTO 1000
600  HOME
605  FOR L = 1 TO CT
610  PRINT : PRINT ST$(L);"=";SC$(L)

615  GET P$: IF P$ = "" THEN 615
620 P$ = ""
625  NEXT L
630  HOME : GOTO 400
800  PRINT : PRINT : INVERSE : PRINT
     "  PLEASE TYPE YOUR ANSWER & RE
     TURN  ": NORMAL
805  PRINT : INPUT "ANSWER= ";B$
810  IF A$ = B$ THEN R = R + 1: GOSUB
     850: PRINT "CORRECT, ";N$;"!"
820  IF A$ <  > B$ THEN W = W + 1: GOSUB
     870: PRINT "THE ANSWER IS ";A$;
     "."
830  FOR I = 1 TO 2000: NEXT I: HOME
     : RETURN
850  FOR I = 1 TO 50:Z =  PEEK (S): NEXT
     I
855  FOR I = 1 TO 50: NEXT I
860  FOR I = 1 TO 50:Z =  PEEK (S): NEXT
     I
865  RETURN
870  FOR I = 1 TO 200:Z =  PEEK (S):
      NEXT I
875  RETURN
890  HOME : VTAB 10: PRINT "  GOOD J
     OB, ";N$;"!"
891 CT = CT + 1:ST$(CT) = N$:SC$(CT)
      =  STR$ (R) + "&" +  STR$ (W)
892  FOR I = 1 TO 100:Z =  PEEK (S):
      NEXT I
893  PRINT : PRINT "  YOUR SCORE= ";
     R;" AND ";W
894  PRINT : PRINT : PRINT : FLASH :
      PRINT "PLEASE GET THE NEXT STU
     DENT!": NORMAL
895  PRINT : INVERSE : PRINT "    TY
     PE ANY KEY TO BEGIN PROGRAM
     ": NORMAL : PRINT : PRINT
896  GET P$: IF P$ = "" THEN 896
897 P$ = "":W = 0:R = 0: HOME : GOTO
     300
900  PRINT : PRINT : INVERSE : PRINT
     "   PRESS ANY KEY FOR NEXT PAGE
          ": NORMAL
905  GET P$: IF P$ = "" THEN 905
910 P$ = "": HOME : RETURN
1000  REM  PROGRAM AREA
9999  END
```

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COMPUTE!'s Guide To Typing In Programs

Before typing in any program, you should familiarize yourself with your computer. Learn how to use the keyboard to type in and correct BASIC programs. Read your manuals to understand how to save and load BASIC programs to and from your disk drive or cassette unit. Computers are precise—take special care to type the program *exactly* as listed, including any necessary punctuation and symbols. To help you with this task, we have implemented a special listing convention as well as a program to help check your typing—the "Automatic Proofreader." Please read the following notes before typing in any programs from COMPUTE!. They can save you a lot of time and trouble.

Since programs can contain some hard-to-read (and hard-to-type) special characters, we have developed a listing system that spells out in abbreviated form the function of these control characters. You will find these special characters within curly braces. For example, {CLEAR} or {CLR} instructs you to insert the symbol which clears the screen on the Atari or Commodore machines. A symbol by itself within curly braces is usually a control key or graphics key. If you see {A}, hold down the CONTROL key and press A. Commodore machines have a special control key labeled with the Commodore logo. Graphics characters entered with the Commodore logo key are enclosed in a new kind of special bracket. A graphics character can be listed as [<A>]. In this case, hold down the Commodore logo key as you type A. Our Commodore listings are in uppercase, so shifted symbols are underlined. A graphics heart symbol (SHIFT-S) would be listed as S. One exception is {SHIFT-SPACE}. Hold down SHIFT and press the space bar.

If a number precedes a symbol, such as {5 RIGHT}, {6 S}, or [<8 Q>], you would enter five cursor rights, six shifted S's, or eight Commodore-Q's. On the Atari, inverse characters (printed in white on black) should be entered with the Atari logo key. Since spacing is sometimes important, any more than two spaces will be listed, for example, as: {6 SPACES}. A space is never left at the end of a line, but will be moved to the next printed line as {SPACE}. There are no special control characters found in our IBM PC/PCjr, TI-99/4A, and Apple program listings. For your convenience, we have prepared this quick-reference key for the Commodore and Atari special characters:

Atari 400/800/XL

When you see	Type	See	
{CLEAR}	ESC SHIFT <		Clear Screen
{UP}	ESC CTRL -		Cursor Up
{DOWN}	ESC CTRL =		Cursor Down
{LEFT}	ESC CTRL +		Cursor Left
{RIGHT}	ESC CTRL *		Cursor Right
{BACK S}	ESC DELETE		Backspace
{DELETE}	ESC CTRL DELETE		Delete character
{INSERT}	ESC CTRL INSERT		Insert character
{DEL LINE}	ESC SHIFT DELETE		Delete line
{INS LINE}	ESC SHIFT INSERT		Insert line
{TAB}	ESC TAB		TAB key
{CLR TAB}	ESC CTRL TAB		Clear tab
{SET TAB}	ESC SHIFT TAB		Set tab stop
{BELL}	ESC CTRL 2		Ring buzzer
{ESC}	ESC ESC		ESCape key

Commodore PET/CBM/VIC/64

When You Read:	Press:	See:	When You Read:	Press:	See:
{CLR}	SHIFT CLR/HOME		{GRN}	CTRL 6	
{HOME}	CLR/HOME		{BLU}	CTRL 7	
{UP}	SHIFT CRSR ↑		{YEL}	CTRL 8	
{DOWN}	CRSR ↓		{F1}	f1	
{LEFT}	SHIFT CRSR ←		{F2}	f2	
{RIGHT}	CRSR →		{F3}	f3	
{RVS}	CTRL 9		{F4}	f4	
{OFF}	CTRL 0		{F5}	f5	
{BLK}	CTRL 1		{F6}	f6	
{WHT}	CTRL 2		{F7}	f7	
{RED}	CTRL 3		{F8}	f8	
{CYN}	CTRL 4		←	←	
{PUR}	CTRL 5		↑	SHIFT ↑	

The Automatic Proofreader

Also, we have developed a simple, yet effective program that can help check your typing. Type in the appropriate Proofreader program for your machine, then save it for future use. On the VIC, 64, or Atari, run the Proofreader to activate it, then enter NEW to erase the BASIC loader (the Proofreader will still be active, hidden in memory, as a machine language program). Pressing RUN/STOP–RESTORE or SYSTEM RESET deactivates the Proofreader. You can use SYS 886 to reactivate the VIC/64 Proofreader, or PRINT USR(1536) to reenable the Atari Proofreader. The IBM Proofreader is a BASIC program that lets you enter, edit, list, save, and load programs that you type. It simulates the IBM's BASIC line editor.

Using The Automatic Proofreader

Once the Proofreader is active, try typing in a line. As soon as you press RETURN, either a number (on the Commodore) or a pair of letters

(Atari or IBM) appears. The number or pair of letters is called a *checksum*. Try making a change in the line, and notice how the checksum changes.

All you need to do is compare the value provided by the Proofreader with the checksum printed in the program listing in the magazine. In Commodore listings, the checksum is a number from 0 to 255. It is set off from the rest of the line with *rem*. This prevents a syntax error if the checksum is typed in, but the REM statements and checksums need *not* be typed in. It is just there for your information.

In Atari and IBM listings, the checksum is given to the left of each line number. Just type in the program, a line at a time (without the printed checksum) and compare the checksum generated by the Proofreader to the checksum in the listing. If they match, go on to the next line. If not, check your typing: You've made a mistake. On the Commodore and Atari Proofreader, spaces are not counted as part of the checksum, and no check is made to see that you've typed in the characters in the right order. If characters are transposed, the checksum will still match the listing. Because of the checksum method used, do not use abbreviations, such as ? for PRINT. However, the Proofreader does catch the majority of typing errors most people make. The IBM Proofreader is even pickier; it *will* detect errors in spacing and transposition. Also, be sure you leave Caps Lock on, except when you need to enter lowercase characters.

Special Proofreader Notes For Commodore Cassette Users

The Proofreader resides in the cassette buffer, which is used during tape LOADs and SAVEs. Be sure to press RUN/STOP–RESTORE before you save or load a program, to get the Proofreader out of the way. If you want to use the Proofreader with tape, run the Proofreader, then enter these two lines *exactly* as shown, pressing RETURN after each one:

```
A$="PROOFREADER.T":B$="{10 SPACES}"
    :FORX=1TO4:A$=A$+B$:NEXT
FORX=886TO1018:A$=A$+CHR$(PEEK(X))
    :NEXT:OPEN 1,1,1,A$:CLOSE1
```

Then press RECORD and PLAY on a blank tape, and a special version of the Proofreader will be saved to tape. Anytime you need to reload the Proofreader after it has been erased, just rewind the tape, type OPEN1:CLOSE1, then press PLAY. When READY comes back, enter SYS 886.

IBM Proofreader Commands

Since the IBM Proofreader replaces the computer's normal BASIC line editor, it has to include many of the direct-mode IBM BASIC commands. The syntax is identical to IBM BASIC. Commands simulated are LIST, LLIST, NEW, FILES, SAVE, and LOAD. When listing your program, press any key (except Ctrl-Break) to stop the listing. If you enter NEW, the Proofreader will prompt you to press Y to be especially sure you mean yes.

Two new commands are BASIC and CHECK. BASIC exits the Proofreader back to IBM BASIC, leaving the Proofreader in memory. CHECK works just like LIST, but shows the checksums along with the listing. After you have typed in a program, save it to disk. Then exit the Proofreader with the BASIC command, and load the program into the normal BASIC environment (this will replace the Proofreader in memory). You can now run the program, but you may want to resave it to disk. This will shorten it on disk and make it load faster, but it can no longer be edited with the Proofreader. If you want to convert a program to Proofreader format, save it to disk with SAVE "filename",A.

VIC/64 Proofreader

```
100 PRINT"{CLR}PLEASE WAIT...":FORI=886TO1018:READA:CK=CK+A:POKEI,A:NEXT
110 IF CK<>17539 THEN PRINT"{DOWN}YOU MADE {SPACE}AN ERROR":PRINT"IN DATA STATEMENTS.":END
120 SYS886:PRINT"{CLR}{2 DOWN}PROOFREADER ACTIVATED.":NEW
886 DATA 173,036,003,201,150,208
892 DATA 001,096,141,151,003,173
898 DATA 037,003,141,152,003,169
904 DATA 150,141,036,003,169,003
910 DATA 141,037,003,169,000,133
916 DATA 254,096,032,087,241,133
922 DATA 251,134,252,132,253,008
928 DATA 201,013,240,017,201,032
934 DATA 240,005,024,101,254,133
940 DATA 254,165,251,166,252,164
946 DATA 253,040,096,169,013,032
952 DATA 210,255,165,214,141,251
958 DATA 003,206,251,003,169,000
964 DATA 133,216,169,019,032,210
970 DATA 255,169,018,032,210,255
976 DATA 169,058,032,210,255,166
982 DATA 254,169,000,133,254,172
988 DATA 151,003,192,087,208,006
994 DATA 032,205,189,076,235,003
1000 DATA 032,205,221,169,032,032
1006 DATA 210,255,032,210,255,173
1012 DATA 251,003,133,214,076,173
1018 DATA 003
```

Atari Proofreader

```
100 GRAPHICS 0
110 FOR I=1536 TO 1700:READ A:POKE I,A:CK=CK+A:NEXT I
120 IF CK<>19072 THEN ? "Error in DATA Statements.  Check Typing.":END
130 A=USR(1536)
140 ? :? "Automatic Proofreader Now Activated."
```

```
150 END
1536 DATA 104,160,0,185,26,3
1542 DATA 201,69,240,7,200,200
1548 DATA 192,34,208,243,96,200
1554 DATA 169,74,153,26,3,200
1560 DATA 169,6,153,26,3,162
1566 DATA 0,189,0,228,157,74
1572 DATA 6,232,224,16,208,245
1578 DATA 169,93,141,78,6,169'
1584 DATA 6,141,79,6,24,173
1590 DATA 4,228,105,1,141,95
1596 DATA 6,173,5,228,105,0
1602 DATA 141,96,6,169,0,133
1608 DATA 203,96,247,238,125,241
1614 DATA 93,6,244,241,115,241
1620 DATA 124,241,76,205,238,0
1626 DATA 0,0,0,0,32,62
1632 DATA 246,8,201,155,240,13
1638 DATA 201,32,240,7,72,24
1644 DATA 101,203,133,203,104,40
1650 DATA 96,72,152,72,138,72
1656 DATA 160,0,169,128,145,88
1662 DATA 200,192,40,208,249,165
1668 DATA 203,74,74,74,74,24
1674 DATA 105,161,160,3,145,88
1680 DATA 165,203,41,15,24,105
1686 DATA 161,200,145,88,169,0
1692 DATA 133,203,104,170,104,168
1698 DATA 104,40,96
```

IBM Proofreader

```
10 'Automatic Proofreader Version 2.00 (L
   ines 270,510,515,517,620,630 changed f
   rom V1.0)
100 DIM L$(500),LNUM(500):COLOR 0,7,7:KEY
    OFF:CLS:MAX=0:LNUM(0)=65536!
110 ON ERROR GOTO 120:KEY 15,CHR$(4)+CHR$
   (7):ON KEY(15) GOSUB 640:KEY (15) ON
   :GOTO 130
120 RESUME 130
130 DEF SEG=&H40:W=PEEK(&H4A)
140 ON ERROR GOTO 650:PRINT:PRINT"Proofre
   ader Ready."
150 LINE INPUT L$:Y=CSRLIN-INT(LEN(L$)/W)
   -1:LOCATE Y,1
160 DEF SEG=0:POKE 1050,30:POKE 1052,34:P
   OKE 1054,0:POKE 1055,79:POKE 1056,13:
   POKE 1057,28:LINE INPUT L$:DEF SEG:IF
    L$="" THEN 150
170 IF LEFT$(L$,1)=" " THEN L$=MID$(L$,2)
   :GOTO 170
180 IF VAL(LEFT$(L$,2))=0 AND MID$(L$,3,1
   )=" " THEN L$=MID$(L$,4)
190 LNUM=VAL(L$):TEXT$=MID$(L$,LEN(STR$(L
   NUM))+1)
200 IF ASC(L$)>57 THEN 260 'no line numbe
   r, therefore command
210 IF TEXT$="" THEN GOSUB 540:IF LNUM=LN
   UM(P) THEN GOSUB 560:GOTO 150 ELSE 15
   0
220 CKSUM=0:FOR I=1 TO LEN(L$):CKSUM=(CKS
   UM+ASC(MID$(L$,I))*I) AND 255:NEXT:LO
   CATE Y,1:PRINT CHR$(65+CKSUM/16)+CHR$
   (65+(CKSUM AND 15))+" "+L$
230 GOSUB 540:IF LNUM(P)=LNUM THEN L$(P)=
   TEXT$:GOTO 150 'replace line
240 GOSUB 580:GOTO 150 'insert the line
260 TEXT$="":FOR I=1 TO LEN(L$):A=ASC(MID
   $(L$,I)):TEXT$=TEXT$+CHR$(A+32*(A>96
   AND A<123)):NEXT
270 DELIMITER=INSTR(TEXT$," "):COMMAND$=T
   EXT$:ARG$="":IF DELIMITER THEN COMMAN
   D$=LEFT$(TEXT$,DELIMITER-1):ARG$=MID$
   (TEXT$,DELIMITER+1) ELSE DELIMITER=IN
   STR(TEXT$,CHR$(34)):IF DELIMITER THEN
    COMMAND$=LEFT$(TEXT$,DELIMITER-1):AR
   G$=MID$(TEXT$,DELIMITER)
280 IF COMMAND$<>"LIST" THEN 410
290 OPEN "scrn:" FOR OUTPUT AS #1
300 IF ARG$="" THEN FIRST=0:P=MAX-1:GOTO
   340
310 DELIMITER=INSTR(ARG$,"-"):IF DELIMITE
   R=0 THEN LNUM=VAL(ARG$):GOSUB 540:FIR
   ST=P:GOTO 340
320 FIRST=VAL(LEFT$(ARG$,DELIMITER)):LAST
   =VAL(MID$(ARG$,DELIMITER+1))
330 LNUM=FIRST:GOSUB 540:FIRST=P:LNUM=LAS
   T:GOSUB 540:IF P=0 THEN P=MAX-1
340 FOR X=FIRST TO P:N$=MID$(STR$(LNUM(X)
   ),2)+" "
350 IF CKFLAG=0 THEN A$="":GOTO 370
360 CKSUM=0:A$=N$+L$(X):FOR I=1 TO LEN(A$
   ):CKSUM=(CKSUM+ASC(MID$(A$,I))*I) AND
    255:NEXT:A$=CHR$(65+CKSUM/16)+CHR$(6
   5+(CKSUM AND 15))+" "
370 PRINT #1,A$+N$+L$(X)
380 IF INKEY$<>"" THEN X=P
390 NEXT :CLOSE #1:CKFLAG=0
400 GOTO 130
410 IF COMMAND$="LLIST" THEN OPEN "lpt1:"
    FOR OUTPUT AS #1:GOTO 300
420 IF COMMAND$="CHECK" THEN CKFLAG=1:GOT
   O 290
430 IF COMMAND$<>"SAVE" THEN 450
440 GOSUB 600:OPEN ARG$ FOR OUTPUT AS #1:
   ARG$="":GOTO 300
450 IF COMMAND$<>"LOAD" THEN 490
460 GOSUB 600:OPEN ARG$ FOR INPUT AS #1:M
   AX=0:P=0
470 WHILE NOT EOF(1):LINE INPUT #1,L$:LNU
   M(P)=VAL(L$):L$(P)=MID$(L$,LEN(STR$(V
   AL(L$)))+1):P=P+1:WEND
480 MAX=P:CLOSE #1:GOTO 130
490 IF COMMAND$="NEW" THEN INPUT "Erase p
   rogram - Are you sure";L$:IF LEFT$(L$
   ,1)="y" OR LEFT$(L$,1)="Y" THEN MAX=0
   :GOTO 130:ELSE 130
500 IF COMMAND$="BASIC" THEN COLOR 7,0,0:
   ON ERROR GOTO 0:CLS:END
510 IF COMMAND$<>"FILES" THEN 520
515 IF ARG$="" THEN ARG$="A:" ELSE SEL=1:
   GOSUB 600
517 FILES ARG$:GOTO 130
520 PRINT"Syntax error":GOTO 130
540 P=0:WHILE LNUM>LNUM(P) AND P<MAX:P=P+
   1:WEND:RETURN
560 MAX=MAX-1:FOR X=P TO MAX:LNUM(X)=LNUM
   (X+1):L$(X)=L$(X+1):NEXT:RETURN
580 MAX=MAX+1:FOR X=MAX TO P+1 STEP -1:LN
   UM(X)=LNUM(X-1):L$(X)=L$(X-1):NEXT:L$
   (P)=TEXT$:LNUM(P)=LNUM:RETURN
600 IF LEFT$(ARG$,1)<>CHR$(34) THEN 520 E
   LSE ARG$=MID$(ARG$,2)
610 IF RIGHT$(ARG$,1)=CHR$(34) THEN ARG$=
   LEFT$(ARG$,LEN(ARG$)-1)
620 IF SEL=0 AND INSTR(ARG$,".")=0 THEN A
   RG$=ARG$+".BAS"
630 SEL=0:RETURN
640 CLOSE #1:CKFLAG=0:PRINT"Stopped.":RET
   URN 150
650 PRINT "Error #";ERR:RESUME 150
```

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.

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, 64 MLX redefines part of the keyboard as a numeric keypad (lines 581–584):

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

64 MLX Commands

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

You don't have to enter the whole ML program in one sitting. MLX lets you enter as much as you want, save it, and then reload the file from tape or disk later. 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 VERSION 2.0
   0 ARE 750,765,770 AND 860          :rem 50
20 REM LINE CHANGED FROM MLX VERSION 2.01
    IS 300                            :rem 147
100 PRINT"{CLR}{6$}";CHR$(142);CHR$(8);:PO
    KE53281,1:POKE53280,1             :rem 67
```

```
101 POKE 788,52:REM DISABLE RUN/STOP
                                    :rem 119
110 PRINT"{RVS}{39 SPACES}";        :rem 176
120 PRINT"{RVS}{14 SPACES}{RIGHT}{OFF}[*]
    £{RVS}{RIGHT} {RIGHT}{2 SPACES}[*]
    {OFF}[*]£{RVS}£{RVS}{14 SPACES}";
                                    :rem 250
130 PRINT"{RVS}{14 SPACES}{RIGHT} [G]
    {RIGHT} {2 RIGHT} {OFF}£{RVS}£[*]
    {OFF}[*]{RVS}{14 SPACES}";      :rem 35
140 PRINT"{RVS}{41 SPACES}"         :rem 120
200 PRINT"{2 DOWN}{PUR}{BLK} MACHINE LANG
    UAGE EDITOR VERSION 2.02{5 DOWN}"
                                    :rem 238
210 PRINT"[5]{2 UP}STARTING ADDRESS?
    {8 SPACES}{9 LEFT}";            :rem 143
215 INPUTS:F=1-F:C$=CHR$(31+119*F)
                                    :rem 166
220 IFS<256OR(S>40960ANDS<49152)ORS>53247
    THENGOSUB3000:GOTO210           :rem 235
225 PRINT:PRINT:PRINT               :rem 180
230 PRINT"[5]{2 UP}ENDING ADDRESS?
    {8 SPACES}{9 LEFT}";:INPUTE:F=1-F:C$=
    CHR$(31+119*F)                  :rem 20
240 IFE<256OR(E>40960ANDE<49152)ORE>53247
    THENGOSUB3000:GOTO230           :rem 183
250 IFE<STHENPRINTC$;"{RVS}ENDING < START
    {2 SPACES}":GOSUB1000:GOTO 230
                                    :rem 176
260 PRINT:PRINT:PRINT               :rem 179
300 PRINT"{CLR}";CHR$(14):AD=S      :rem 56
310 A=1:PRINTRIGHT$("0000"+MID$(STR$(AD),
    2),5);":";                      :rem 33
315 FORJ=ATO6                       :rem 33
320 GOSUB570:IFN=-1THENJ=J+N:GOTO320
                                    :rem 228
390 IFN=-211THEN 710                :rem 62
400 IFN=-204THEN 790                :rem 64
410 IFN=-206THENPRINT:INPUT"{DOWN}ENTER N
    EW ADDRESS";ZZ                  :rem 44
415 IFN=-206THENIFZZ<SORZZ>ETHENPRINT"
    {RVS}OUT OF RANGE":GOSUB1000:GOTO410
                                    :rem 225
417 IFN=-206THENAD=ZZ:PRINT:GOTO310
                                    :rem 238
420 IF N<>-196 THEN 480             :rem 133
430 PRINT:INPUT"DISPLAY:FROM";F:PRINT,"TO
    ";:INPUTT                       :rem 234
440 IFF<SORF>EORT<SORT>ETHENPRINT"AT LEAS
    T";S;"{LEFT}, NOT MORE THAN";E:GOTO43
    0                               :rem 159
450 FORI=FTOTSTEP6:PRINT:PRINTRIGHT$("000
    0"+MID$(STR$(I),2),5);":";      :rem 30
451 FORK=0TO5:N=PEEK(I+K):PRINTRIGHT$("00
    "+MID$(STR$(N),2),3);",";       :rem 66
460 GETA$:IFA$>""THENPRINT:PRINT:GOTO310
                                    :rem 25
470 NEXTK:PRINTCHR$(20);:NEXTI:PRINT:PRIN
    T:GOTO310                       :rem 50
480 IFN<0 THEN PRINT:GOTO310        :rem 168
490 A(J)=N:NEXTJ                    :rem 199
500 CKSUM=AD-INT(AD/256)*256:FORI=1TO6:CK
    SUM=(CKSUM+A(I))AND255:NEXT     :rem 200
510 PRINTCHR$(18);:GOSUB570:PRINTCHR$(146
    );                              :rem 94
511 IFN=-1THENA=6:GOTO315           :rem 254
515 PRINTCHR$(20):IFN=CKSUMTHEN530
                                    :rem 122
520 PRINT:PRINT"LINE ENTERED WRONG : RE-E
    NTER":PRINT:GOSUB1000:GOTO310:rem 176
530 GOSUB2000                       :rem 218
540 FORI=1TO6:POKEAD+I-1,A(I):NEXT:POKE54
    272,0:POKE54273,0               :rem 227
550 AD=AD+6:IF AD<E THEN 310        :rem 212
560 GOTO 710                        :rem 108
570 N=0:Z=0                         :rem 88
580 PRINT"[£]";                     :rem 81
581 GETA$:IFA$=""THEN581            :rem 95
582 AV=-(A$="M")-2*(A$=",")-3*(A$=".")-4*
    (A$="J")-5*(A$="K")-6*(A$="L"):rem 41
583 AV=AV-7*(A$="U")-8*(A$="I")-9*(A$="O"
    ):IFA$="H"THENA$="0"            :rem 134
584 IFAV>0THENA$=CHR$(48+AV)        :rem 134
585 PRINTCHR$(20);:A=ASC(A$):IFA=13ORA=44
    ORA=32THEN670                   :rem 229
590 IFA>128THENN=-A:RETURN          :rem 137
600 IFA<>20 THEN 630                :rem 10
610 GOSUB690:IFI=1ANDT=44THENN=-1:PRINT"
    {OFF}{LEFT} {LEFT}";:GOTO690    :rem 62
620 GOTO570                         :rem 109
630 IFA<48ORA>57THEN580             :rem 105
640 PRINTA$;:N=N*10+A-48            :rem 106
650 IFN>255 THEN A=20:GOSUB1000:GOTO600
                                    :rem 229
660 Z=Z+1:IFZ<3THEN580              :rem 71
670 IFZ=0THENGOSUB1000:GOTO570      :rem 114
680 PRINT",";:RETURN                :rem 240
690 S%=PEEK(209)+256*PEEK(210)+PEEK(211)
                                    :rem 149
691 FORI=1TO3:T=PEEK(S%-I)          :rem 67
695 IFT<>44ANDT<>58THENPOKES%-I,32:NEXT
                                    :rem 205
700 PRINTLEFT$("{3 LEFT}",I-1);:RETURN
                                    :rem 7
710 PRINT"{CLR}{RVS}*** SAVE ***{3 DOWN}"
                                    :rem 236
715 PRINT"{2 DOWN}(PRESS {RVS}RETURN{OFF}
    ALONE TO CANCEL SAVE){DOWN}":rem 106
720 F$="":INPUT"{DOWN} FILENAME";F$:IFF$=
    ""THENPRINT:PRINT:GOTO310       :rem 71
730 PRINT:PRINT"{2 DOWN}{RVS}T{OFF}APE OR
    {RVS}D{OFF}ISK: (T/D)"          :rem 228
740 GETA$:IFA$<>"T"ANDA$<>"D"THEN740
                                    :rem 36
750 DV=1-7*(A$="D"):IFDV=8THENF$="0:"+F$:
    OPEN15,8,15,"S"+F$:CLOSE15      :rem 212
760 T$=F$:ZK=PEEK(53)+256*PEEK(54)-LEN(T$
    ):POKE782,ZK/256                :rem 3
762 POKE781,ZK-PEEK(782)*256:POKE780,LEN(
    T$):SYS65469                    :rem 109
763 POKE780,1:POKE781,DV:POKE782,1:SYS654
    66                              :rem 69
765 K=S:POKE254,K/256:POKE253,K-PEEK(254)
    *256:POKE780,253                :rem 17
766 K=E+1:POKE782,K/256:POKE781,K-PEEK(78
    2)*256:SYS65496                 :rem 235
770 IF(PEEK(783)AND1)OR(191ANDST)THEN780
                                    :rem 111
775 PRINT"{DOWN}DONE.{DOWN}":GOTO310
                                    :rem 113
780 PRINT"{DOWN}ERROR ON SAVE.{2 SPACES}T
    RY AGAIN.":IFDV=1THEN720        :rem 171
781 OPEN15,8,15:INPUT#15,E1$,E2$:PRINTE1$
    ;E2$:CLOSE15:GOTO720            :rem 103
790 PRINT"{CLR}{RVS}*** LOAD ***{2 DOWN}"
                                    :rem 212
795 PRINT"{2 DOWN}(PRESS {RVS}RETURN{OFF}
    ALONE TO CANCEL LOAD)"          :rem 82
800 F$="":INPUT"{2 DOWN} FILENAME";F$:IFF
    $=""THENPRINT:GOTO310           :rem 144
810 PRINT:PRINT"{2 DOWN}{RVS}T{OFF}APE OR
    {RVS}D{OFF}ISK: (T/D)"          :rem 227
820 GETA$:IFA$<>"T"ANDA$<>"D"THEN820
                                    :rem 34
```

```
830 DV=1-7*(A$="D"):IFDV=8THENF$="0:"+F$
                                    :rem 157
840 T$=F$:ZK=PEEK(53)+256*PEEK(54)-LEN(T$
    ):POKE782,ZK/256                :rem 2
841 POKE781,ZK-PEEK(782)*256:POKE780,LEN(
    T$):SYS65469                    :rem 107
845 POKE780,1:POKE781,DV:POKE782,1:SYS654
    66                              :rem 70
850 POKE780,0:SYS65493              :rem 11
860 IF(PEEK(783)AND1)OR(191ANDST)THEN870
                                    :rem 111
865 PRINT"{DOWN}DONE.":GOTO310      :rem 96
870 PRINT"{DOWN}ERROR ON LOAD.{2 SPACES}T
    RY AGAIN.{DOWN}":IFDV=1THEN800
                                    :rem 172
880 OPEN15,8,15:INPUT#15,E1$,E2$:PRINTE1$
    ;E2$:CLOSE15:GOTO800            :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:POKE54276,32:POKE54
     273,0:POKE54272,0:RETURN       :rem 202
2000 REM BELL SOUND                 :rem 78
2001 POKE54296,15:POKE54277,0:POKE54278,2
     47                             :rem 152
2002 POKE 54276,17:POKE54273,40:POKE54272
     ,0                             :rem 86
2003 FORT=1TO100:NEXT:POKE54276,16:RETURN
                                    :rem 57
3000 PRINTC$;"{RVS}NOT ZERO PAGE OR ROM":
     GOTO1000                       :rem 89
```

CAPUTE!

Modifications Or Corrections To Previous Articles

VIC TurboTape

In both the VIC and 64 versions of this high-speed tape utility from the January 1985 issue (p. 124), location $8B (139) is used for temporary storage. On both computers this is the first of five bytes ($8B–$8F) that hold a *seed value* for the random number generator. TurboTape's use of this location does not appear to cause problems for the 64, but it introduces a bug in the VIC version with some programs. When a program containing the function RND(1) is Turboloaded and run, an ?OVERFLOW ERROR results because the Turboload routine leaves a value in $8B that produces a random number that is too large.

There are several simple ways to prevent this. First, you could change all occurrences of RND(1) to RND (−TI) so that the random number generator will take its seed value from the software timer. This should not significantly alter the operation of any program using random numbers. Alternatively, reader Brian Mason notes that you could add the statement POKE 139,128 before the first RND(1) to return location $8B to its proper value. If you'd like to change VIC TurboTape itself so that this problem is avoided, Joseph Kovalik suggests changing all references to location $8B to the otherwise unused location $FB. To accomplish this, change the following lines in the generator program (Program 2) and create a new version of TurboTape to replace the existing one:

```
50 IF CK<>123822 THEN PRINT "{RVS}ERROR D
   ETECTED IN DATA STATEMENTS":STOP
                                    :rem 69
4859 DATA 173,28,145,133,251,9      :rem 215
4907 DATA 28,145,133,251,9,12       :rem 153
4997 DATA 207,252,165,251,141,28    :rem 57
5201 DATA 252,165,251,141,28,145    :rem 37
```

JTERM For Atari

Several readers have complained that lines 490, 510, and 590 of this telecommunications program from the January 1985 issue (p. 145) are too long to type in. The simple solution is to omit all spaces between the BASIC statements in those lines. For example, Atari BASIC sees no difference between POKE 702,64:INPUT SPOOL$ and POKE702,64:INPUTSPOOL$. Leaving out the spaces doesn't affect the Automatic Proofreader checksum values either, since the Proofreader ignores all spaces except those within quotes. When you list the lines, the screen editor will add spaces between the BASIC keywords so the lines will be easier to read.

The JTERM program cannot be used with the new Atari 1030 modems, since these are handled by the computer as the T: device. JTERM is designed for communications via the R: device, the designation of the older Atari 850 Interface Module to which the Atari 830 and other standard RS232 modems are connected.

Atari Paratrooper

Line 11 of this game from the January 1985 issue (p. 70) has the same line-length problem as JTERM, and the same solution applies. Simply omit all spaces between the statements.

TI Guitar Tuner

Line 280 of this music utility from the January 1985 issue (p. 100) is acceptable in Extended BASIC, but is too long to be typed in with regular console BASIC. To remedy this, break the line into two parts as shown:

```
280 A=-(A$="e")-2*(A$="a")-3*(A$="d
    ")-4*(A$="g")-5*(A$="b")-6*(A$=
    CHR$(133))-7*(A$="E")-8*(A$="A"
    )-9*(A$="D")
285 A=A-10*(A$="G")-11*(A$="B")
```

NEWS&PRODUCTS

The Okimate 20 printer for IBM PCs and compatibles offers letter-quality, color printing for $268. From Okidata.

New IBM, Apple Printers

Okidata has introduced the Okimate 20, a letter-quality, color printer for the IBM PC and PC compatibles, and the Microline 182, a dot-matrix printer for IBM and Apple computers, both of which retail for under $300.

The Okimate 20 ($268) uses a thermal transfer printing process to create full color screen dumps on virtually any kind of paper. Two software programs, *Learn to Print* and *Color Screen Print*, are included. It prints 80 characters per second in draft mode, and 40 cps in letter-quality mode. The Microline 182 ($299) prints 120 cps in utility-quality printing, and 60 cps for enhanced printing.

Okidata, 532 Fellowship Rd., Mt. Laurel, NJ 08054

Circle Reader Service Number 200.

Commodore Software, Books

Thirteen new titles for the Commodore 64, encompassing books, language and development software, and productivity packages, have been announced by Abacus Software.

New programs are: *Ada Training Course; BASIC-64 Compiler; C Language Compiler; Fortran Compiler; Video Basic Development; Cadpak-64* (design package); *Chartpak-64* (charting package); *Datamat-64* (data management program); and *Power Plan-64*, a spreadsheet with graphics. New book titles include: *Cassette Book for C-64; More Tricks & Tips for C-64; Peeks & Pokes for C-64;* and *Turbo Pascal Training Guide.*

Abacus Software, 2201 Kalamazoo S.E., P.O. Box 7211, Grand Rapids, MI 49510

Circle Reader Service Number 201.

Typing Program Update

An update of the popular typing instruction program *MasterType* has been announced by Scarborough Systems. The new version, *New Improved MasterType*, teaches basic and advanced typing and keyboard skills with a space-age game.

The program has 18 difficulty levels and is suitable for ages six through adult. Versions are available on disk for the Apple II family of computers, IBM PC-XT and PCjr, and Commodore 64 ($39.95 each). A version for the Apple Macintosh is available for $49.95. Cartridge formats for the Commodore 64 and Atari computers also are available.

Scarborough Systems, Inc., 25 N. Broadway, Tarrytown, NY 10591

Circle Reader Service Number 202.

Apple, Atari Educational Programs

Three educational programs that teach geography, history, and social studies have been announced by Rand McNally & Company for Apple II and Atari computers.

Unlocking the Map Code teaches geography and map reading skills. It is targeted for students in grades four through six. In *Time and Seasons*, students in grades seven through nine learn the various seasonal and time differences around the world. *Choice or Chance?* helps students understand and comprehend the reasons behind historical happenings in light of geography. Also targeted for grades seven through nine, it covers three eras in history: exploration, westward movement, and industrialization.

Each program retails for $111.

Rand McNally & Co., P.O. Box 7600, Chicago, IL 60680

Circle Reader Service Number 203.

Games, Graphics Software

Brøderbund Software has announced a new graphics package, *Dazzle Draw*, for the Apple IIc and Apple IIe with 128K of memory, as well as an update of its *Print Shop* graphics package for the Apple II family and the Commodore 64. The firm also has released three new games, *Karateka, The Ancient Art of War,* and *The Serpent's Star.*

The Print Shop Graphics Library Disk 1 ($24.95) adds 120 designs, pictures, and symbols to the *Print Shop* program. *Dazzle Draw* ($59.95) uses mouse control, icons, and pull-down menus to select various program functions. It requires an 80-column card, a Revision "B" board, and one disk drive.

The Serpent's Star ($39.95, for Atari computers and the Commodore 64), an adventure game with animated graphics, is a sequel to *Mask of the Sun. Karateka* ($34.95; for Apple II computers and the Commodore 64) is a karate game. *The Ancient Art of War* ($44.95) is a strategy game for the IBM PC, PCjr, PC-XT, and compatibles.

Brøderbund Software, 17 Paul Dr., San Rafael, CA 94903

Circle Reader Service Number 204.

Brøderbund Software's new program, Dazzle Draw, *lets you create colorful graphics with an Apple II computer.*

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:

Home and Educational COMPUTING! (Summer 1981 and Fall 1981—count as one back issue): Exploring The Rainbow Machine, VIC As Super Calculator, Custom Characters On The VIC, Alternative Screens, Automatic VIC Line Numbers, Using The Joystick (Spacewar Game), Fast VIC Tape Locater, Window, VIC Memory Map.

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,

COMPUTE! Back Issues

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, 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.

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Games, Educational Packages

Action games and educational software for a variety of home computers have been announced by Datasoft. New titles include four action games, *Conan, Mr. Do!, Mancopter,* and *Lost Tomb*; and a series of educational games featuring the cartoon cat Heathcliff. *Mr. Do!* and *Conan* retail for $39.95 each, while the other packages have a suggested price of $34.95 each.

Datasoft, 19808 Nordhoff Place, Chatsworth, CA 91311

Circle Reader Service Number 205.

Apple II, IBM Driving Program

CBS Software has announced *Keys to Responsible Driving* ($79.95), a program to help youngsters ages 15 and older become responsible, defensive drivers. The program, available for the Apple II+, IIc, IIe, and IBM PC/PCjr, includes a pretest, nine topics, and a posttest. The user can assess his or her knowledge of safe driving principles with the pretest, and then work through the topics.

CBS Software, One Fawcett Place, Greenwich, CT 06836

Circle Reader Service Number 206.

64, Apple Educational Programs

History Flash and *Jigsaw Joggle*, two educational programs for the Commodore 64 and Apple II+ and IIe computers, have been announced by Orbyte Software at a suggested retail price of $29.95 each.

History Flash leads students through 400 years of facts about the United States, from the discovery of the New World through today. *Jigsaw Joggle* is designed to develop creative problem-solving abilities and to challenge spatial relations skills.

Orbyte Software, P.O. Box 948, Waterbury, CT 06720

Circle Reader Service Number 207.

IBM Election Simulation

President's Choice, an educational game where the player assumes the role of a newly elected U.S. president, has been released by Spinnaker Software for IBM PCs with 128K of memory.

The objective of the game, which has a suggested retail price of $39.95, is to manage the national economy to win reelection. The game is based on 20 years of actual government statistics. Versions for the Apple II family of computers and the Commodore 64 also are scheduled.

Spinnaker Software, One Kendall Square, Cambridge, MA 02139

Circle Reader Service Number 208.

PC, Apple II Word Game

Monty Plays Scrabble, a computer version of the Scrabble crossword board game, has been released for the IBM PC and compatibles by Ritam Corporation. Versions for the Apple II family of computers also are available.

The game has a vocabulary of 44,000 words. It can be played by one, two, or three people at eight different skill levels. Suggested retail price is $39.95.

Ritam Corporation, P.O. Box 921, Fairfield, IA 52556

Circle Reader Service Number 209.

Crosswords, Trivia For Computers

Uptown Software has announced *Compuzzler* and *Double Crostics*, two crossword computer games, and *Trivia*, a game with more than 3000 questions, for Commodore 64, Apple II-series, and IBM PC/PCjr computers.

Compuzzler and *Double Crostic* feature 70 puzzles each. Suggested retail price of each game is $39.95.

Uptown Software, 310 Franklin St., Suite 339, Boston, MA 02110

Circle Reader Service Number 210.

Productivity, Running, Educational Packages

A program for runners at every level, *The Running Program*, and a tutorial to help learn programming skills, *BASIC Building Blocks*, have been announced by Micro Education Corporation of America (MECA).

In addition, the firm has released an IBM PCjr version of its program *Managing Your Money* (suggested retail price $199) in cartridge format. Also, registered owners of the program are being sent a free upgrade of the package. *BASIC Building Blocks* and *The Running Program* are available on disk for Apple, Atari, and IBM computers. Suggested retail price of each program is $79.95.

Micro Education Corporation of America, 285 Riverside Ave., Westport, CT 06880

Circle Reader Service Number 211.

Strategy Games

Imperium Galactum, a space strategy game for Apple and Atari computers, and *Field of Fire*, a tactical game of World War II combat for Atari and Commodore 64 computers, have been introduced by Strategic Simulations. The games have a suggested retail price of $39.95 each.

Imperium Galactum features four difficulty levels. Up to four players, human or computer, try to conquer the universe and amass power through negotiations or war. In *Field of Fire*, the player leads Easy Company through many famous battles of World War II.

Strategic Simulations Inc., 883 Stierlin Rd., Bldg. A-200, Mountain View, CA 94043-1983

Circle Reader Service Number 212.

Spelling Program

Cross Educational Software has announced *Spell-A-Vision*, a series of programs to aid poor spellers, for Apple, Commodore 64, and IBM PC computers.

Recommended for ages ten to adult, each program contains 8000 words, with each word used in a sentence that communicates the word's meaning. Volumes 1 and 2 are one-syllable words. Volumes 3 and 4 are two-syllable words. Volume 5 asks students to choose between two words that sound alike. Volumes 6 and 7 are polysyllabic words, and volume 8 has "spelling demons." Each disk retails for $19.95. The entire series may be purchased for $150.

Cross Educational Software, P.O. Box 1536, Ruston, LA 71270

Circle Reader Service Number 213.

Apple II Educational, Graphics Programs

Scholastic's software division has announced three new educational and graphics programs for the Apple II family of computers: *Survey Taker, Kids at Work*, and *Mystery Sentences*.

In *Mystery Sentences* ($39.95), childrens' verbal and analytical skills are challenged as they try to uncover missing parts of sentences. *Survey Taker* ($24.95) lets children take their own surveys and print out the results. With *Kids at Work* ($24.95), children team up with a pair of animated workers to produce their own city and country scenes.

Scholastic, Inc., 730 Broadway, New York, NY 10003

Circle Reader Service Number 214.

Apple Music Learning System

EduSoft has announced the *Magic Piano Learning System*, a package of three programs for Apple II-series computers. The package retails for $49.95.

The programs included are *Magic Piano*, a music creativity tool; and the *Rhythm Game* and the *Melody Game*, two music skill-building programs. As users play songs on the keyboard, the program scores and displays the song on the screen. Compositions can be played back, edited, stored, or printed.

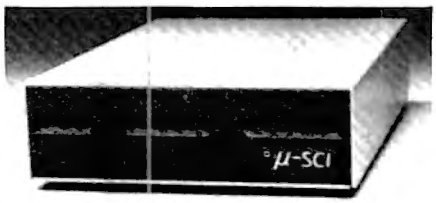
EduSoft, P.O. Box 2560, Berkeley, CA 94702

Circle Reader Service Number 215.

Apple Half-Height Disk Drives

Microsci Corporation has introduced two half-height disk drives, the A.5 and A.5c, for the Apple II family of computers. Suggested list prices are $269 and $299 respectively.

The drives are less than two inches in height. Both have 143K of memory. The A.5 is 100 percent compatible with



Microsci Corporation has introduced two half-height disk drives for Apple II computers.

the Apple IIe. It can be attached directly to any Apple disk controller or to Microsci's C2 controller. The A.5c is designed as a second disk drive for the Apple IIc. It plugs directly into the machine, and also is 100 percent compatible.

Microsci Corp., 2158 S. Hathaway St., Santa Ana, CA 92705

Circle Reader Service Number 216.

Casino Gaming Series

A series of programs designed to improve casino game skills, Caesar's Guide to Gaming, has been announced by Screenplay for IBM PC and compatibles, Apple II series, and Commodore computers.

Players will be able to use the appropriate casino house rules for such games as 21, roulette, craps, and baccarat. The rules can be modified to suit individual tastes. The first program in the series, *Blackjack*, has a suggested retail price of $69.95.

Screenplay, Inc., 1095 Airport Rd., Minden, NV 89423

Circle Reader Service Number 217.

IBM, Apple Tax Packages

Design Trends has released two state tax packages for the 1984 tax year which can be used with the company's *SofTax* program for filing federal taxes. The New York tax package retails for $300, and the package for New Jersey has a suggested price of $250.

All *SofTax* packages run on the IBM PC or XT and the Apple II+, IIe, and III computers. The federal program is available in three versions. The individual version contains 20 of the 1040 forms and schedules, and costs $199. Annual updates are $70. A professional preparer's version retails for $499, with annual updates costing $150. A professional version which also contains corporate, partnership, and trust returns costs $850, with annual updates available for $225 each.

Design Trends, Ltd., 525 S. Washington St., Naperville, IL 60540

Circle Reader Service Number 218.

Tax Planning Program

Tax Command Planner, a program designed to compare the effects of financial decisions on taxes, has been released for Commodore, Apple, and IBM computers by Practical Programs.

Designed for end-of-year tax planning, the program allows the user to try different strategies to see which are best for his or her situation. Up to six strategies for periods of up to five years can be explored simultaneously. The program can be used in conjunction with *Tax Command*, a tax preparation program. Available on disk, the program retails for $49.95 on the Commodore 64, $99.95 for the IBM PC version, and $79.95 for the Apple version.

Practical Programs, Inc., 625 N. Milwaukee St., P.O. Box 93104, Milwaukee, WI 53203

Circle Reader Service Number 219.

Atari, Apple Robot Game

Run For It, a game which features a friendly robot, has been announced for Atari and Apple computers by Weekly Reader Family Software.

In the game, the player must help Orbit, the robot, escape from his adversaries through a series of 72 maze-like rooms, each of which contains ledges that become increasingly difficult to climb. Orbit can be reduced or expanded in size as he springs from ledge to ledge, depending upon the obstacles he faces. Suggested retail price is $39.95. Available on disk.

Weekly Reader Family Software, Xerox Education Publications, 245 Long Hill Rd., Middletown, CT 06457

Circle Reader Service Number 220.

Educational Typing Program

Mindscape has released *Keyboard Cadet*, a touch-typing/keyboarding skills program that features 3-D graphics for Apple, Commodore 64, and IBM computers.

Keyboard Cadet teaches proper hand positioning techniques, and uses animated hands to illustrate proper finger reaches. The program is designed for beginning to advanced typists. Suggested retail price is $39.95.

Mindscape Inc., 3444 Dundee Rd., Northbrook, IL 60062

Circle Reader Service Number 221.

Apple Speech Synthesizer

The Voice Master, a speech synthesizer originally introduced for the Commodore 64, has been released for the Apple IIe as an expansion board by Covox, Inc.

The Voice Master digitally records and plays back up to ten seconds of natural speech in any order. Up to 64 numbered words, phrases, or other sounds can be stored in memory for recall, using BASIC commands.

Complete vocabularies also can be put on disk or tape, and prerecorded vocabularies can be played back on some computers without any additional hardware.

The hardware includes a microphone and software on disk or tape, for $89.95.

Covox, Inc., 675 Conger Street, Eugene, OR 97402

Circle Reader Service Number 222.

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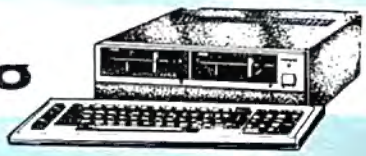

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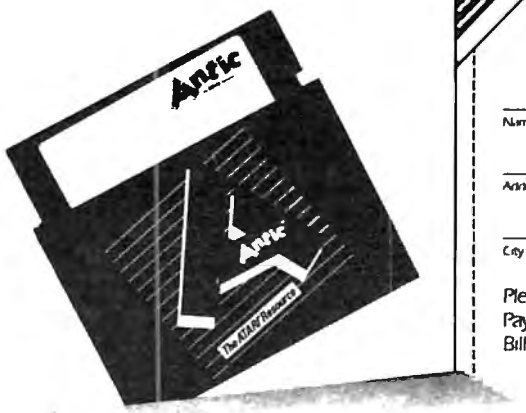

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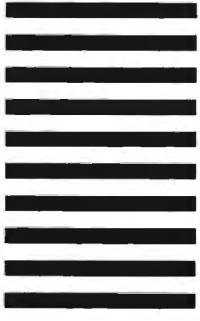

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FRENZY/ FLIP FLOP

(Ages 6 to 14) (Milliken Edulun) FRENZY (subtraction and division) The hungry gator arrives save the fish play the BONUS game. FLIP FLOP (transformed geometry) look at the two figures do they need to flip, turn or slide? (Diskette)

7:30

SOLAR FOX

It's erase or be erased as you navigate spaceship over a grid of colorful pulsating entities, armed with laser. Unlimited levels. A BALLY MIDWAY original. (Cartridge)

8:00

EASY SCRIPT

Our best wordprocessor. Displays 764 lines by 40 characters. Prints over 130 columns. Global/local search/replace/hunt/find. Super/subscripts. Insert/delete characters, lines, sentences, paragraphs. (Diskette)

8:30

THE MANAGER

A powerful database management system. For business, educational or personal files. Not for Rockford's files. With four built-in applications. Or design your own. (Diskette)

9:00

MAGIC DESK I

The scene opens on an office desk, complete with digital clock, typewriter, wastebasket and file cabinet. Select functions (typing, filing, editing) by pointing animated finger. (Cartridge)

9:30

INTER-NATIONAL SOCCER

(Gold Medallion Game) Sports highlight. With passing, kicking, diving goalies, even trophies! Great color, 3-D realism. No locker room interviews. (Cartridge)

10:00

SIMONS' BASIC

Rated PG. Expands Commodore BASIC by an additional 114 commands. Convenient programming commands such as RENUMBER and TRACE plus graphics plotting command. (Cartridge)

Announcing the most exciting variety show on television.

Featuring many of the stars of arcade games, education and the business world.

Produced by (and for) Commodore, the people who bring you the Commodore 64,™ a 64K computer that would be a value at three times its price. In fact, many of its competitors are three times its price.

Produced in living high resolution graphics with 16 available colors and with eight 3-dimensional sprites.

With a real high fidelity sound that covers a 9-octave range.

And a supporting cast of low-price, high capacity disk drives, printers, monitors (a better way to watch Commodore 64) and modems.

So, if you're not pleased with what's on your tv set tonight, simply turn on your Commodore 64.

COMMODORE 64

IT'S NOT HOW LITTLE IT COSTS, IT'S HOW MUCH YOU GET.