## IBM Compatibles: The Universe Expands

# COMPU <br> \$3.00 July 1987 Issue 86 Vol. 9, No. 7 ${ }_{02193}^{54} 25$ Conada LSSN 0194-357X 

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 programs.[^1]This month's guest editorial is written by Selby Bateman, COMPUTE!'s associate publisher and a long-time Commodore watcher.

## The Commodore Shake Up

T. S. Eliot wrote that April is the cruelest month, and for the senior management of Commodore International's U.S. group-including Chief Executive Officor Thomas Rattigan-this past April seems to have lived up to its billing.

Rattigan and a group of high-level Commodore executives were unexpectedly relieved of their duties in April by Commodore International Chairman Irving Gould and the company's board of directors. Coming on the heels of three consecutive profitable quarters (after more than a year in the red), the ouster seemed to shock just about everyone.

Among those purged were several top Rattigan people, including Nigel Shepherd, general manager of Commodore's North American operations, and Alan Gauthier, vice president of fyinance. Rattigan promptly filed a $\$ 9$ million lawsuit against Commodore for allegedly breaching his contract, a charge the company denied.

What caused the rift and abrupt firings? Rumors seem to vary depending on whether they come from Rattigan loyalists or Gould supporters. Members of the former group say that it was Rattigan's policies that turned the company around during the past year and a half through stringent cost controls that saved Commodore from bankruptcy. Some in the Gould camp maintain that Commodore's bankers largely charted the austerity budgeting that helped return Commodore to profitability, and that Rattigan and his team had done little to boost lagging U.S. sales which have been outstripped by European sales.

Both sides seem to agree that there were personality conflicts aplenty between Rattigan and Gould. And some saw the infighting as reminiscent of the John Sculley-Steve Jobs clash that resuited in Apple cofounder Jobs leaving the company when Sculley reportedly convinced the board of directors that he represented the future of the company. In the Commodore case, Gould-who
has been in charge at Commodore for a quarter of a century -proved once again that when push comes to shove, he's the boss. Remember, it was Gould who stayed at Commodore and Jack Tramiel who left the company after the two were said to have fought several years ago.

Gould and the Commodore board have named Alfred Duncan as the new general manager of U.S. operations and Richard McIntyre as general sales manager in the U.S. Both have considerable experience: Duncan has previously served in managerial positions with Commodore's Canadian and Italian subsidiaries, and McIntyre was manager of the Canadian subsidiary. Their mandate, first and foremost, is sure to be this one thing: Increase U.S. sales. As long-time supporters of Commadore, we wish the new management team well.

What's of particular concern, of course, is whether this corporate upheaval will retard or destroy the chances for success of the new Amiga 500 and 2000 computers, and its potentaal negative impact on the continued success of the Commodore 64, 128, and PC10 systems. The life cycle of a personal computer can be a delicate one, and more than one machine's chances have been dramatically altered by market factors having nothing to do with the computer's inherent quality or valle to the consumer.

Were confident that Commodore has the talent and the computers to remain a key player in the personal computer field. However, the next months are likely to be bumpy at best. Even with renewed growth in the industry, this remains a period of transition and volatility for most of the major hardware companies.

What's next as Commodore and its rivals jockey for position and market share? Some hints are bound to surface at the Summer Consumer Electronics Show (CES) in Chicago, May 30-June 2, and the Computer Dealers' Exposiion (COMDEX) in Atlanta, June 1-4. In many ways, these two shows-very different in nature-are bellwethers of the computer industry for the all-important latter half of the year, the third
and fourth business quarters of 1987.
COMDEX is a huge all-computer show that focuses primarily on the business computing environment. CES, a massive consumer electronics showcase, has a computer component of 15-25 percent.

The new products, industry announcements, and general mood of these shows will all help to determine the direction of the computer industry for the remainder of 1987 and well into 1988. COMPUTE!'s editors will be at both shows, and next month we'll give you an overview of what we've seen and what we think it all will mean.

Until then, enjoy this issue of COMPUTE!.


Selby Bateman
Associate Publisher

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#### Abstract

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The Commodore 64 Pascal interpreter is not full-featured. but still a powerful implementation of pascal which suits the needs of most beginners.
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## User's Guide to GEOS: geoPaint and geoWrite $\$ 18.95$ <br> ISBN 0-87455-080-7

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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.

## The Logic Of Lines

How do you turn off the automatic scroll of text in Atari's graphics mode 0? My program puts a menu at the top of the screen and prints text on the next 18 lines. I delete the sixth line when the screen gets full, but everything scrolls up from one to three lines, instead of just one.

> John Pilge

The problem you are having is common on eight-bit computers with text mode. Although the screen display always contains the same number of physical lines- 23 lines, in the case you mention-it may contain a different number of logical lines at any given time. A logical line is a collection of one or more linked physical screen lines. When you clear the screen, every logical line is set to the corresponding physical line. But if printing overlaps from one line to another, the computer links the two physical lines into a single logical line. On the Atari, a logical line may contain as many as three physical lines. When you enter a program line, the computer rings a bell to warn you when you near the end of the third logical line; it's a warning to indicate that you're almost at the end of the legal size of a logical line.

Whether you're typing a program, running it, or entering direct commands, the logical line system is always enabled. That's why BASIC program lines or a typed response to an INPUT statement can be only three lines long. When the computer scrolls the screen, it scrolls an entire logical line, creating the effect you describe.

The easiest way to solve your problem is to limit the length of everything that's printed on the screen so that each logical line is only one physical line. If this is impractical, here's another solution:

## POKE 690,255:POKE 691,255:POKE <br> 692,255

Execute these statements in the program immediately before you delete a line.

They reset every logical line to one physical line. Although you might be tempted to experiment, it's better to avoid typing these POKEs in direct mode when you're editing a BASIC program. These statements split up all the lines on the screen that are longer than one logical line. If you then press RETURN over any of those partial lines, you may lose some of the program.

The Commodore 64 has a similar system of logical lines, except that its logical lines consist of either one or two physical lines. Here's an equivalent for the 64 to the three POKEs above:
FOR J=217 TO 242:POKE J,PEEK(J) OR 128: NEXT

On the Commodore 128, logical lines can normally be up to four physical lines long. However, the 128 allows you to disable line linking so that all logical lines are just one physical line long. Tum this feature on with

## POKE 248, PEEK(248) OR 64

To restore normal line linking, use
POKE 248, PEEK(248) AND 191

## Mismatched Monitor

I have a Tandy 1000 computer with monochrome monitor, and I would like to get a monitor with higher resolution. The Tandy VM-3 high-resolution monitor has a $720 \times 350$ screen for text and a $640 \times 350$ screen for graphics, but I have been told that I can't use that monitor. What's the reason for this? I thought you could use any monitor as long as you have the right cable to hook it up.

## Robert Estrada, Sr.

For computer graphics and text, the computer's display capabilities should match those of the monitor. For instance, if your computer generates a screen that's 320 dots wide and 200 dots high, any video monitor able to display a $320 \times 200$ screen can be used. A monitor capable of a higher resolution won't increase the computer's resolution. Check the specifications for your computer's video hardware; buying an expensive high-resolution monitor will be a waste of money if your system can't generate equivalent highresolution dispiays. The important factor is whether the computer and monitor can
display the same number of dots vertically and horizontally, using the same number of colors. If the two devices don't match in that way, it doesn't matter whether you can hook them up physically. If you connect a computer to a mismatched monitor, the picture may look garbled, or perhaps simply blank.

For the IBM PC and compatible computers like your Tandy 1000, it's often possible to upgrade the video hardware to get higher resolution. You may be able to replace the existing video hardware with a different graphics adapter card. Before investing in such a card, you should make sure that it is compatible with your computer and with the software you use most often.

## Disabling Control-Break On IBM PC And Clones

I have an IBM PCjr and I want to turn off the Fn-Break key combination so the machine ignores a break. Can you provide an assembly language routine to do this?

Kevin Neil
Like most IBM PC operating system functions, the Control-Break function (FnBreak on the PCjr) is controlled by an interrupt service routine. Briefly, an interrupt occurs when a special pin on the microprocessor receives a signal. At this point, the computer ceases execution of the program it is running, and a support chip feeds it the ROM address of the appropriate machine language subroutine which it then executes. This routine ends with an IRET (RETurn from Interrupt) instruction. After it performs IRET, the processor returns to running the original program.

Every keypress on an IBM PC causes such an interrupt. Normally, the computer decodes the keypress and places its ASCII value in the keyboard buffer for use by the program currently running. However, an interrupt caused by ControlBreak executes a special interrupt service routine-the effects of which are known to anyone who has ever pressed the ControlBreak key combination.

One advantage of using interrupts is that you can change the address of the service routine. This allows a program to divert the address of a service routine to

its own, custom-failored routine. If you replace the address of the Control-Break service routine with the address of another routine, that routine executes every time Control-Break is pressed. The BASIC interpreter itself makes such a change when it loads, changing the Control-Break routine to a routine which breaks the operation of a BASIC program.

The easiest way to disable ControlBreak is to divert the address of the Con-trol-Break routine to a do-nothing routine that contains nothing but an IRET instruction. While IRETs abound in the ROM, the exact addresses where they may be found vary depending on the ROM and DOS version and the make of the computer. It is safest to put an IRET in memory, and to point Control-Break to this instruction. The following BASIC program changes the address of the service routine (located at $\$ 006 \mathrm{C}-\$ 006 \mathrm{~F}$ ) to point to an IRET instruction which it places at address $\$ 0180$, a normally unused location.

```
O DEF SEG=0
    SEGMENT
10 POKE &H180,&HCF 'POKE 1日0
    WITH MACHINE INSTRUCTION FO
R IRET
20 POKE &H6C,&HED 'LOW BYTE
    OF 180
30 POKE &H6D,&H1 'HIGH BYTE
    DF 1日G
40 POKE &H6E,O *G'S FQR
SEGMENT
5% POKE &HGF,%
60 FOR I=1 TO 180g:PRINT I:NEXT
    - TRY AND BREAK IT
```

Here is an assembly language routine that does the same thing. It uses DOS service call $\$ 25$ to change the address of the Control-Break interrupt \$1B:
interpret if you're not familiar with BASIC.

First, you need to know where to look for the error. In line 70, the computer reads a series of numbers from DATA statements elsewhere in the program and POKEs those numbers into memory. This is a common method of transferring information (in this case, a machine language program) from BASIC program lines into the computer's memory. When line 70 is executed, the computer is actually looking at the DATA values that occur in later program lines. The READ statement begins with the first DATA value in the program and retrieves each DATA value in order. To track down the source of this error, you must carefully proofread every number in the lines that begin with DATA.

You also need to know what kind of mistake to look for. Because 255 is the largest value that a single memory location can hold, the POKE command can only store numbers in the range 0-255. The message ILLEGAL QUANTITY usually indicates that you are trying to POKE a number which falls outside that range-for instance, a negative number, or one that's greater than 255. Thus, you should look for numbers in the DATA lines that are outside the range 0-255.

In your case, BASIC correctly indicates that the error occurred while it was performing line 70. The POKE command that triggers the error is in line 70. But the illegal quantity that POKE can't handle was pulled from a different line of the program.

Perhaps the most common cause of ILLEGAL QUANTITY errors is leaving

MOV AX. if
MOV DS, AX
MOV Ex, D186h
MOV AX, GCFh
MOV [EX], AX
XCHG EX, DX
MOV AH, $1225 h$
MOV AL, B1En
INT 21h
INT 26
: SET DATA SEG READ-WFITE TO 0
: CHANGE LOCATION 18 g̈h
TO OPCODE FOR IFET
DOS NEEDS LOCATION FOF IRET IN DX
SETUF FOR DOS INTERRUPT CHANGING SERUICE ZSH
INTERRUPT NUMBEF TO EE CHANGED
DOS INTERRUFT
FETURN TD DOS

## Typing Proofreader Correctly

I have typed in the Commodore "Automatic Proofreader" program that appears in the back of your magazine. When I run the program, it stops at line 70 with an ILLEGAL QUANTITY ERROR message. Is this line printed correctly? I would appreciate any information that you can provide.

Stephen A. Kuhn
There are no mistakes in the Commodore "Automatic Proofreader" program or in the listing which appears in the magazine. The message you mention is due to a fairly common typing error which is tricky to
out a comma between two DATA values. The first DATA line of the Proofreader program, for instance, begins with these two numbers:

## DATA 120,169

If you forget to type the comma between 120 and 169, the READ statement interprets the number as 120169, which is much too big to be stored by POKE and triggers an ILLEGAL QUANTITY error.

The message ILLEGAL QUANTITY can also indicate that you're trying to POKE a value into some location that doesn't exist in the computer's memory. For instance, the statement POKE 65537, 12 causes an ILLEGAL QUANTITY error because, while 12 is small enough to fit in
a memory address, the Commodore 64 doesn't contain a location 65537 (the highest memory address is location 65535). This sort of error might occur if you mistype lines $10-60$, which detect the computer you are using and calculate addresses used by the Proofreader.

Typing mistakes also can trigger an OUT OF DATA error message. For instance, if you omit a comma between two small numbers, the wrong number that results may not be large enough to cause an ILLEGAL QUANTITY error, but the computer will run out of DATA items to read before it finishes the loop. For example, say that you omit the comma between the numbers 4 and 3 in line 160 of the Proofreader program. The computer dutifully POKEs the legal value 43, but now the program doesn't contain enough DATA items to complete the FOR-NEXT loop in line 70. Again, though the error message points to line 70 , the mistake itself is found in a DATA line.

Similar errors occur if you omit a number entirely or type a period instead of a comma. If you type DATA 120.169 in line 160 , for instance, the READ command in line 70 reads the fractional value 120.169 from that DATA line. However, the program doesn't stop with an ILLEGAL QUANTITY error, as you might expect. Since it's impossible to POKE a fractional value, BASIC automatically strips the fraction from the number and uses 120 , which is in the legal range for POKE. The effect is the same as if you leave out a number; the program stops and warns you that it is OUT OF DATA.

Another mistake involves typing an extra comma where no comma should appear. For instance, look at line 160 of the listing in the magazine. Because that line is too long to be listed in one column, the listing breaks at the right margin; as it happens, the break occurs in the middle of the number 169. A few readers have made the mistake of inserting a comma at the break, which changes the number 169 into two numbers: 16 and 9. Since the program now contains one DATA item too many, it won't generate an OUT OF DATA message. However, to help you find typing errors, the program also calculates a checksum based on the value of each DATA item and its position in the DATA list. If you add an extra comma, the program itself detects a mistake and warns you to check your typing. The same message appears if you simply mistype a number in a way that doesn't create an illegal quantity. For instance, typing 102 instead of 120 doesn't cause an ILLEGAL QUANTITY error, but the program detects that you made a typing error.

Typing mistakes in DATA statements can be difficult to spot. One useful debugging technique is to get a friend to read the magazine listing aloud while you compare
the listing on your screen. Another trick is to check each DATA value in reverse order, beginning with the last DATA value and working backwards to the beginning.

Other typing errors can be more difficult to spot, but just as insidious. If you scramble any of the variable names in the program, it probably won't work at all. For instance, if you type POKE AR instead of POKE ADR, or type SYS SS instead of SYS SA, don't be surprised if the computer crashes. (No real harm is done when the computer locks up; simply turn the machine off and on to regain control.) Likewise, the Proofreader can't possibly work if you leave out a program line altogether. There's no way to check for every conceivable typing error without writing a second Proofreader program to check the first Proofreader program-which goes beyond the point of diminishing returns.

If the Proofreader stops with an error message, it's important to reload it from disk or tape for editing, rather than trying to edit the lines that remain in memory. To simplify the process of running on five different computers, the Proofreader installs its machine language in the same memory area used by the first few lines of the BASIC program (which are no longer needed by the time the computer reaches line 70). For this reason, it's important that you not delete any of the lines in the program, even if you're certain that they don't apply to your computer.

## Sprites On The 64

I have a question about the Commodore 64. How do you display two different sprites at the same time? Also, how do you use multicolor sprites?

Ty Neyedli
All the Commodore 64's sprite features are generated by the computer's VIC-II video chip. That chip is controlled by registers that appear at memory locations 53248-53294. You manipulate sprites by POKEing values into these registers. For example, memory location 53269 is used to turn any of the 64's eight sprites on or off. Here is the general formula for turning on a sprite:

## POKE 53269, 2†SN

In this case, SN represents the number of the sprite you wish to turn on. The sprites are usually numbered 0-7. Thus, POKE 53269,1 turns on sprite 0. POKE 53269,4 turns on sprite 2 , and so forth. To turn on more than one sprite, you simply add the POKE values together. Thus, POKE 53269,5 turns on both sprite 0 and sprite 2. To turn on sprites 3,5 , and 7 , you would use POKE 53269, 168 ( $2 \uparrow 3+2 \uparrow 5$ $+2 \uparrow 7=8+32+128=168$ ) .

Even after you turn on a sprite, it won't be visible until you position it somewhere on the active portion of the
screen. Memory locations 53248-53264 control the sprite vertical and horizontal positions. The even-numbered addresses ( 53248,53250 , and so on) control horizontal positioning, while odd-numbered addresses (53249, 53251, and so on) are for vertical positions. Each sprite uses a pair of adjacent addresses. For instance, the horizontal position of sprite 0 is controlled by location 53248 and the vertical position by location 53249. If you don't care to memorize these locations, you can calculate the position location address for a given sprite with the formula $53248+$ SN * 2, where SN is the sprite number.

These program lines display sprites 0 and 1 in the middle of the screen:
10 POKE 53269, 3: REM $3=2 \uparrow 0+2 \uparrow 1$ 20 POKE 53248,90: POKE 53249, 150 30 POKE 53250, 130: POKE 53251, 150

Making things more complicated is the horizontal "seam" that runs down the right side of the screen. The active screen area is 320 pixels wide-more possible horizontal positions than can be specified with a single memory location (one byte can only hold values 0-255). Thus, it's necessary to use a second location that indicates whether a sprite is on the right or left side of the seam. Location 53264 works like the one that turns sprites on and off. To position a sprite on the right side of the seam, use

## POKE 53264, 2 2 SN

where $S N$ represents the sprite number. For example, you can display sprite 0 near the right border by substituting this line in the example program:
20 POKE 53248, 90: POKE 53249, 90:POKE 53264, 1

If you type in and run this program, you'll notice that the sprites have a random, disorganized form, because we haven't yet defined their shapes. Locations 2040-2047 contain pointers that tell the computer where each sprite's shape data is located. By POKEing different values in these registers, you can change a sprite's shape. While the sprites are on the screen, type in the following line and press RETURN:

## FOR J=0 TO 255:POKE 2040,J:NEXT

This line makes sprite 0 flip rapidly from one shape to another. Again, because we're pointing to memory areas that don't contain sprite shapes, these shapes will look random. Each sprite pattern contains 63 bytes of data. The easiest way to design sprites is with a sprite editor program such as "Sprite Designer," found elsewhere in this issue.

Sprite colors are controlled by locations 53287-53294. The color numbers for sprites are the same numbers used for screen and text colors. Thus, POKE 53287,0 turns sprite 0 black. POKE 53288,7 changes sprite 1 to yellow, and so on.

Multicolor sprites have four different colors, but only half the resolution of normal sprites, making them more colorful, but chunkier in appearance. Location 53276 controls sprite multicolor mode. This register works like locations 53269 and 53264. To set a sprite to multicolor mode, use POKE 53276, 2†1SN, where SN represents the number of the sprite you wish to change.

In multicolor mode, locations 53285 and 53286 determine the third and fourth colors for all the multicolor sprites. The first and second colors of the sprite are set by the screen background color register (53280) and the individual sprite color locations (53287-53294).

The following program displays and animates three multicolor sprites:

EB 10 REM POKE IN SOLID SPRITE PATTERN
HS 20 FOR I=832 TO 1023:POKE I .170:NEXT
QH 36 REM PUT IN STRIPE
HJ 40 FOR $I=0$ TO 5
XA 50 POKE 832+I+12,255:POKE B 96+I+36,255: POKE $960+\mathrm{I}+5$ 7. 255

HH 60 NEXT I
JA 70 REM PUT IN SECOND MULTIC OLOR STRIPE
CX 80 FOR $I=\emptyset$ TO 8
PH 90 POKE 832+I+18,85:POKE 89 6+I+42,85: POKE 960+I,85
AP 106 NEXT I
KA 110 REM $P()$ IS POINTER
SJ $120 \mathrm{P}(1)=13: P(5)=14: P(6)=14$
CQ 130 REM X() IS HORIZONTAL P OSITION
FF $140 \mathrm{X}(1)=90: \mathrm{X}(5)=200: \mathrm{X}(6)=2$ 80
RX 150 REM $Y()$ IS VERTICAL POS ITION
XC 16 g $\mathrm{Y}(1)=99: \mathrm{Y}(5)=88: Y(6)=77$
RE 170 REM TURN ON SPRITES $98=$ $2 \uparrow 1+2 \uparrow 5+2 \uparrow 6$
HE 180 POKE 53269,98
SA 190 REM MAKE THEM ALL MULTI COLOR
DF 200 POKE 53276,98
XP 210 REM SET MULTICOLORS TO \{SPACE \} YELLOW, BLACK
HM 220 POKE 53285,7:POKE 53286 . 0
DH 230 REM SET SPRITE PRIMARY \{ SPACE \} COLOR
EQ 240 POKE 53288,1:POKE 53292 , 2:POKE 53293.3
DK 250 FOR $\mathrm{SN}=0$ TO 7
GH 260 IF $\mathrm{P}(\mathrm{SN})=\varnothing$ THEN 360
JE $270 \mathrm{P}(\mathrm{SN})=\mathrm{P}(\mathrm{SN})+1: \mathrm{IF} \mathrm{P}(\mathrm{SN})=$ 16 THEN $P(S N)=13$
CK 280 POKE 2040 + SN,P(SN)
CR $290 \mathrm{Y}(\mathrm{SN})=\mathrm{Y}(\mathrm{SN})+2$
SS 300 IF $Y(S N)>255$ THEN $Y(S N)$ $=32$
MR 310 IF $\mathrm{X}(\mathrm{SN})>256$ THEN 340
AK 329 POKE $53248+$ SN * 2,X(S N) : POKE $53264, \operatorname{PEEK}(5326$ 4) AND ( $255-2 \dagger \mathrm{SN}$ ): GOTO3 50
SP 330 REM FAR RIGHT
FQ $340 \mathrm{~T}=\mathrm{X}(\mathrm{SN})-256:$ POKE 53264, PEEK (53264) OR $2 \uparrow$ SN
SQ 350 POKE 53249 + SN * 2,Y(S N)

MQ 360 NEXT SN:GOTO250

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## Signature:

Address entries to: PC Programming Contest

# COMPUTE's PC magazine 

# FOR IBM PCs AND COMPATIBLES 

A bimonthly magazine devoted exelusively to PC enthusiasts. If Includes a olisk centoining all of the programs found in each issue.

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# IBM Compatibles The Universe Expands 

Keith Ferrell, Features Editor

The compatibles are here. Offering options including large amounts of memory, bright colors and graphics, speeds sometimes in excess of the IBMs', and various software bundles, clone manufacturers are targeting American consumers with PCs that do more for less money. Will the PC become this year's hot electronic commodity? More than one manufacturer is betting on it.

Over the six years since IBM intro-duced its first PC, third-party manufacturers have cloned just about every part of it, including the name.

PC by now has come to stand for a computer capable of running programs that are managed by MSDOS—Microsoft Disk Operating System. And in the PC universe, MS-DOS-thanks to the dozens of manufacturers and hundreds of software developers and publishers who have made it the standardcould almost be an acronym for Microsoft's Dominant Operating System.

Today, with MS-DOS and PCs the most widely accepted operating and hardware systems in American business, a large segment of the public has been exposed to computers that combine extravagant amounts of mass storage, spacious RAM, high operating speeds, and a number of sophisticated software applications.

From the office PC, consumers have taken home terms such as spreadsheet, database, word processing, and desktop publishing. Now, as a result of sharp and ongoing declines in the prices of both memory and hardware, they are beginning to take home their own PCs. The Personal Computer is on the verge of acquiring a personal market.

By the end of this year, consumers will be able to select from a large number of low-priced, highpower machines produced and distributed by established, healthy players such as Tandy/Radio Shack; young and aggressive companies such as Leading Edge, PC's Limited, Franklin, Victor, and Blue Chip; plus companies new to the American market, such as Vendex and Amstrad. Of the companies already established among consumers, both Atari and Commodore have announced MS-DOS PC compatibles.

In large part, the spread of MSDOS machines to the home and personal market is being powered by inexpensive offshore manufacture, either of the entire system or of components that would be far more expensive from domestic sources. Some companies achieve additional cost savings-and consequently lower retail prices-by substituting plastic for metal housings, and by providing lower-cost keyboards, mice, and other peripherals.

Some firms-PC's Limited, for example-use higher-end components, but deliver lower prices through direct-to-customer marketing, eliminating the overhead that an in-place retail distribution system entails.

PC manufacturers will face their most severe test, though, in the retail marketplace-computer stores or mass market mechan-disers-and discover whether or not there really is a wide consumer demand for MS-DOS PCs.

That Commodore and Atari, the two veterans of the home market, are scrambling to establish themselves as compatibles contenders, is an indication of the seriousness with which MS-DOS computers are being taken.

Commodore already has its MS-DOS machines on the market. The computers have found solid consumer response in Europe and Canada for several years, although at $\$ 999$ for the single 360 K disk drive, 512K RAM (expandable to 640 K) PC10-1, and at $\$ 1,999$ for the twin-drive, 640 K RAM PC10-2 (monitors extra for either system), Commodore is priced higher than most of the newcomers to the market. Atari, on the other hand, has promised a package that undercuts even the lowest-priced compatibles.

Announced at last January's Consumer Electronics Show (CES), Atari's PCs come in two versions. For $\$ 499$, the company hopes to
deliver 512K RAM (expandable to 640 K on the motherboard), a separate 256 K RAM for video control, a single $51 / 4$-inch disk drive, and a built-in color graphics adapter. In its announced $\$ 699$ package, Atari will include a monitor and an enhanced graphics adapter (EGA), for a package more than competitive with any compatible on the market.

To compete, however, the machines must reach the market, and Atari has been plagued by delays in getting its hardware ready. Scheduled to appear on the market this spring, the roll-out date for Atari's PCs has been pushed back at least to late summer. And once the hardware is complete, there is a built-in 90 -day delay as the machine awaits FCC approval. If those delays pile up too much longer, Atari runs the risk of missing the all-too-crucial fourth quarter, with what is expected to be a high consumer demand for Christmas PCs.

Both Commodore and Atari are aware as well that there are literally hundreds of compatiblesmakers already on the market with low prices and increasingly aggressive marketing strategies. If this is the year of the PC, companies that don't get early exposure and shelf space, or are perceived as pricey, may find that a well-established name is not enough.

## Pricing And Personality

The main PC competition is found in the $\$ 500-\$ 2,000$ price range, with many manufacturers discovering the greatest action among fea-ture-loaded machines at the upper end.

PCs costing less than $\$ 1,000$ tend to offer a single disk drive, 512 K RAM, room for expansion both on the motherboard and through slots, and a monochrome monitor, along with software packages that usually include a version of MS-DOS, but otherwise vary from manufacturer to manufacturer.

The look and feel of the machines vary as well. Shoppers who take the time to learn their way around the various machines will discover that each PC has a personality of its own, reflective sometimes of manufacturing decisions, but also of the parent company's approach to the market.

Amstrad, for example, is an


Amstrad has already sold many PCs in Europe. Its 1512 series offers a small footprint, and two operating systems, including Digital Research's GEM.

English electronics company entering the American computer market this year after finding phenomenal success throughout Europe. Its PC 1512 series includes three 512 K RAM configurations priced below $\$ 1,000$ : the DM, with a single 360 K drive and monochrome monitor for $\$ 799$; the DD, with a dual drive and a monochrome monitor for \$899; and the SDC, with one disk drive and a color monitor for $\$ 999$. The company breaks the $\$ 1,000$ price point with a dual drive (and color monitor) for $\$ 1,099$. All Amstrad computers come with a large bundle of software, as well as a mouse.

One of the first things consumers will notice about Amstrad's PC 1512 series is the lightness of the computer's compact plastic box.

Weight and size reductions were achieved not only with plastic housing, but also by moving the computer's power source and fan into the monitor, which fits into a recess on top of the computer box. Design can have marketing ramifications as well-Amstrad buyers are locked into Amstrad monitors, and the company does not sell any of its components individually.
"Amstrad has a system not unlike racked stereo equipment," says Wally Amstutz, vice president of marketing. "Everything comes in two boxes-connect the system and plug it in, and you're ready to go."

The self-contained approach has paid off for Amstrad elsewhere. In England alone, Amstrad has achieved a PC market share comparable to IBM's, without shrinking IBM's share.
"There is a wide consumer base that IBM and the other highpriced manufacturers haven't tapped yet," says Amstutz.

Amstrad will be seeking to tap that market through a network of independent dealers that will include computer stores and specialty electronics retailers.

Some manufacturers feel that if the PC is to find a mass market measured in millions of units sold each year, PCs need to be sold through leading retail chains. That's the strategy being put to the test by Blue Chip Electronics, whose Blue Chip PC XT is currently sold in chains including Target and Caldor, with tests planned for marketing through Toys " $R$ " Us and the nearly 1,000-store Walmart chain.

Because it is seeking exposure through mass market retailers, Blue Chip hews more closely to lowerend price points than some of the other compatibles makers.

With 512 K RAM (expandable to 640 K on the motherboard) and a single $360 \mathrm{~K} 5^{1 / 4}$-inch disk drive, the Hyundai-built Blue Chip XT currently retails for $\$ 699$, with a green monochrome monitor available for
an additional $\$ 99$. The XT can also be used with a television set serving as its monitor.

Aware that the market is broadening and that price is a key factor, Blue Chip is planning some product changes for later this year. At press time, the nature of those changes had not been made final, but it is believed that they will include a price cut of at least $\$ 100$, enhancements of the hardware, and a bundled package of software.

Even the packaging will be designed with mass market retailers in mind, states Blue Chip founder and president John Rossi.
"It comes in a four-color box with a handle," Rossi says, "and, since it can be run on a television, is pretty much selfcontained." Rossi's hopes are that, since the box contains DOS and a large bundle of applications software as well, the Blue Chip will be seen as a onestop computer purchase.

Leading Edge has established itself over the past year as a contender with its $\$ 1,075$ Model D . Delivering 512 K RAM (expandable to 768 K ), two $5^{1 / 4}$-inch disk drives, a Selectric-style keyboard, and a monochrome monitor, the Model D also comes complete with MS-DOS 3.1 and Leading Edge's proprietary software bundle. The Model D is available in a color monitor configuration, although the company is planning to introduce a proprietary EGA monitor, with an anticipated retail price below $\$ 500$. John Sullivan, vice president of Leading Edge hardware products, notes that the company is marketing its computer through a combination of computer retailers, value-added resellers (VAR), specialty stores, and office products stores.
"Leading Edge has always based its marketing strategy on including in the basic package items that other manufacturers offer only as options," Sullivan states.

There is already one major player involved in the mass market retailing of PCs. That, of course, is Tandy; through its Radio Shack chain of electronics and computer stores, it offers potentially more than 7,000 outlets for Tandy's


Tandy feels confident that its PCs will find a large market through the company's huge Radio Shack chain of retail operations. The Tandy 1000 SX offers 384 K RAM (expandable to 640 K ), two 360 K disk drives, and is bundled with DeskMate II software.
busy seeking or shoring up their retail outlets, PC's Limited, of Austin, Texas, has found success with a wholly different approach.

The company eschews retail altogether, pursuing an aggressive direct-to-consumer marketing program based upon a heavy advertising presence in computer publications. The direct-response ads provide a toll-free phone number, putting the consumer in contact with the manufacturerand the manufacturer in contact with the actual end userallowing for custom configuration of each system, if desired.

In the under- $\$ 1,000$ market, PC's Limited offers its Turbo PC, which includes 640 K on the motherboard, two 360 K floppy disk drives, an AT-style keyboard, and a monochrome monitor.

Elimination of the overhead that accompanies distri-
computers.
Tandy's under-\$1,000 PCs include the 1000 EX, which delivers 256 K RAM (expandable to 640 K through Tandy's Memory PLUS Expansion Adapter) and a single $360 \mathrm{~K} 51 / 4$-inch disk drive for $\$ 599$, and the SX, with two 360 K disk drives and 384 K (also expandable to 640 K ) for $\$ 999$. Monitors are sold separately, in monochrome at \$150, and in color at $\$ 250$. A software bundle is included with the computers.

A marketing advantage that Tandy may enjoy in addition to its large retail presence is its existing penetration of the business community. Ed Juge, director of market planning, estimates that Tandy sold more than a quarter-million MSDOS computers in 1986, and anticipates even higher figures this year. Of those 1986 sales, a substantial percentage was to small and medium-sized businesses.
"We sold more MS-DOS business computers last year than anybody except IBM," Juge maintains.

Exposure to Tandy computers in the workplace will go a long way toward persuading consumers to shop Radio Shack for their home computer, the company feels.

While many of the.compatibles manufacturers and marketers are
bution through traditional retail outlets has enabled PC's Limited to retain metal housings and full-sized keyboards, two features that many compatibles manufacturers compromise in order to keep prices low.
"Our philosophy is to make the best computers with the best components, and make them affordable," says the company's founder, chairman, and chief executive officer Michael Dell.

While PC's Limited's primary market is the medium-sized business, the company has found some success among individual consumers as well.

A new player in the American market is Vendex Pacific, whose Turbo-888-XT was expected to be on sale in mid-May.

Harry Fox, Vendex's vice president in charge of U.S. operations, notes that the dilemma facing manufacturers seeking to tap the consumer market is that market's diversity.
"To succeed," Fox says, "a company has to have a machine that will serve the first-time user, but also meet the needs of the more experienced computer user."

Priced at $\$ 995$, Vendex's Turbo-$888-\mathrm{XT}$ is configured with 512 K RAM, two 360 K floppy disk drives, a full-size AT keyboard, MS-DOS

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Through direct-to-consumer marketing, PC's Limited has carved out a solid, primarily business market for its compatibles. PC's Limited model 286 includes "SmartView," a digital display that reports computing speed and diagnostics.


Vendex's computers, manufactured by Samsung of Korea, come complete with an onscreen manual, aimed at teaching the user while the computer is in use. The Turbo-888-XT features a full-size AT keyboard, 512K RAM, two 360 K floppy disk drives, and MS-DOS 3.2.
3.2 and a monochrome monitor.

The system is available with an RGB color monitor at $\$ 1,295$

Franklin Computer has been perhaps best known for its ACE series of Apple compatibles. With its $\$ 799.95 \mathrm{PC}-8000$, Franklin Computer is now positioning itself for the PC consumer. Offering two disk drives, 512 K RAM (expandable to 640 K ), and MS-DOS 3.1, the system is configured to support a monochrome monitor, available for $\$ 139.95$. Franklin also offers a single disk drive system, the PC-6000, for $\$ 699.95$.

Having achieved substantial success in the cash-register, addingmachine, and calculator markets, Victor Technologies is entering the PC field. Victor's under- $\$ 1,000$ PC, called Champion, offers 640 K RAM, DOS 3.1, and a single disk drive for $\$ 799$. A monochrome monitor is available for $\$ 119$.

## Bundles Of Software

Like many of the manufacturers pursuing the PC market, Vendex has added a bundle of software to its system including a tutorial aimed at assisting the first-time computer user.

Called Headstart, the proprietary software was designed for Vendex by Executive Systems, and includes popular applications such as word processing, spreadsheets, RAM-resident pop-up features, and a program designed to train the new computer user in the Turbo-888-XT's operation.
"Essentially," Fox states, "we've put the manual onscreen, letting the consumer guide himself through the tutorial using only the cursor and enter keys. The program lets consumers learn to use their computer by actually using their computer." Vendex hopes that the package will live up to its description as "user seductive."

Once acquainted with the operation, users can extend the "point-and-shoot" approach to utilities customized by Vendex for the Turbo-888-XT. Experienced computer users, of course, need not employ the tutorial.

Amstrad's approach to software includes bundling two operating systems-the traditional MSDOS 3.2, and Digital Research's DOS Plus and GEM (Graphics En-
vironment Manager), which together form a mouse-driven graphics package. Included in Amstrad's GEM are applications such as GEM Paint for creating pictures, and GEM Desktop, with pop-up applications including a calculator and a clock.
"We think the public will be very excited about the GEM environment," notes Wally Amstutz. "And Amstrad will also be offering a window-driven BASIC that should find a good consumer response."

Blue Chip is currently in negotiation for its software package, which, according to John Rossi, will provide a word processor and a database manager. MS-DOS is included. Through arrangements with software manufacturers, Blue Chip's customers will be able to use coupons toward the purchase of more complete manuals and support from the software vendors themselves.

Leading Edge includes DOS 3.1 and a proprietary word processing program in its Model D package.

At Tandy, the bundled software is called Deskmate II and comes complete with a word processor, spreadsheet, database, telecommunications program, calendar, and an electronic mail program. MS-DOS 3.2 is also included with Tandy computers.

PC's Limited, because of its targeting of the business market, includes only system software with its package.

Victor is providing word processing and spreadsheet software with its Champion computer.

Whether or not software bundles will contribute to increased sales remains to be seen, but the variety of bundles shows that each manufacturer is developing its own software, as well as hardware, profile.

Consumer response will finally determine what the public actually wants or will come to expect in terms of bundled software accompanying their computers.

## Memory

One thing that consumers do already seem to want from their PC is a lot of memory.

The PC industry standard now
is the 512 K RAM motherboard, but more and more companies are either offering initial 640 K motherboards, or are designing their machines to make them easily expandable to 640 K and higher RAM levels. That much memory is required to run large spreadsheet and text-processing operations along with RAM-resident programs which offer keystroke access to notepads, alarm clocks, calendars, and other conveniences without leaving the program being run.

If large amounts of RAM are vital to successful competition in the PC marketplace, vast amounts of storage are increasingly important. Many of the most popular PCs come with built-in hard disks capable of storing 10,20 , or more megabytes of programs and information.

Amstrad, for example, has already found the greatest consumer response to be for its 20-megabyte PC 1512 HDC with a color monitor, a configuration retailing for a stillcompetitive \$1,799.

Wally Amstutz notes that Amstrad has been pleasantly surprised by the enthusiasm for its larger configuration.
"Buyers are becoming more knowledgeable about what they want in a computer," he says, "and their awareness of the options a hard disk offers are coloring their decisions." Among those options are fast loading of programs directly from hard disk storage to RAM, and easy internal storage of both applications programs and their own work.

PC's Limited has found its greatest success with its 286 line of compatibles carrying an internal 30 megabytes of storage.

Franklin's PC-8000 is complete with a power supply able to support 10 - and 20-megabyte hard disks.

As Vendex prepares for the debut of its Turbo-888-XT, its emphasis is focused upon the introductory, floppy-disk-drive-only configuration.
"We are definitely planning to offer a hard disk configuration before the year is out," notes Vendex's Harry Fox. "And the system is set up now with five full expansion slots available for consumers who want to go ahead and install a hard card."

Leading Edge is taking mass storage one step further than hard cards or hard disks. Having upped its hard-disk option from 10 to 20 and again to 30 megabytes, the company is now offering what it calls the "Leading Edge Infinite Memory System." Rather than a hard disk, the Infinite Memory configuration employs a Bernoulli Box.

Developed by Iomega, and named for the eighteenth-century Swiss physicist and mathematician Daniel Bernoulli, the Bernoulli Box utilizes a fixed cartridge reader and removable mass-storage cartridges rather than fixed disks.
"Each Bernoulli cartridge holds 20 megabytes of memory," observes John Sullivan. Leading Edge provides two cartridges with the Infinite Memory System, which is an upgrade of the Model D PC. Additional 20-megabyte cartridges are available for $\$ 49.95$. The Infinite Memory System itself sells for \$1,995.

Also entering the removable mass-storage market is Victor, whose VPC III 286 carries a removable 30 -megabyte fixed disk drive, with 640 K RAM expandable to a megabyte. Victor anticipates marketing the VPC III 286 for $\$ 2,395$.

## Expandability

Another question addressed by the PC manufacturers is expandability. While few manufacturers as yet see the general public as eager to take screwdrivers in hand, open their computers, and begin swapping cards and chips, all are aware that a portion of their market is interested in performing its own upgrades.

Expansion slots, serial and parallel ports, and peripheral connectors are becoming important features emphasized in product literature.
"We took a lot of care," says Harry Fox of Vendex, "to offer every essential expansion option, and some extras."

Fully configured, the Vendex Turbo-888-XT leaves five standard IBM card slots open, allowing consumers to custom-configure their own upgrades.

Amstrad has eliminated the need for removing the computer housing. An access port is built into the top of the machine, enabling owners to add cards easily. The PC

1512 provides three expansion slots.
With the Leading Edge Model D, consumers have the option of upgrading with four IBM slots. Leading Edge will also be offering a proprietary EGA (Enhanced Graphics Adapter) within the next year.

Tandy expandability varies with the model purchased. Their model 1000 EX can be expanded only with Tandy's proprietary One PLUS and Two PLUS expansion boards, while the 1000 SX has five 10 -inch expansion boards available.

## Service

Manufacturers are increasingly aware of the premium consumers place upon service. This is especially true with electronic products, and manufacturers are responding to consumer expectations.

While PC's Limited, as a direct-to-consumer seller, has relied previously on telephone technical support for customer problems, the company is in the process of introducing an optional on-site service contract.
"For $\$ 35$ the first year, our customers will be able to have a service technician come to their site should there be a hardware problem," states Michael Dell.

Dell feels that service is essential for manufacturers who intend to grow with their market. "Customers have to be aware that there is more to your company than just 'Here's your box,' " he says.

Leading Edge dealers function as service centers for that company.

At Vendex, the on-site approach has been extended to the initial installation of the machines.
"We're aware of the trepidation that some consumers feel even after they've bought their computer," says Harry Fox. "And while we've addressed this with our onscreen training program, we're also offering on-site installation.
"For \$49.95, the customer can have a bonded installer come to his home or office and set up the computer, including an initial orientation to our configuration." Vendex will provide a toll-free number through which customers can arrange for further service.

Tandy customers have access to 166 service locations in the Radio Shack chain, Ed Juge notes. If one of those service centers is not nearby, the local Radio Shack can forward the computer to a service center.

Proud of this capability, Ed Juge says, "Tandy has the strongest support and service network of any PC manufacturer, even IBM."

Amstrad will be arranging service and support through its network of independent dealers.

At Blue Chip, service is currently accomplished at the company, but a service network will soon be in place nationwide.

PC warranties and guarantees vary from manufacturer to manufacturer, with most of them offering a one-year warranty on parts.

## Add-On Markets

As Vendex's Harry Fox has noted, personal computers serve a disparate market. While the immediate focus is tapping the large consumer audience, manufacturers are also aware of the potential for sales that can be found in schools and small businesses.

Tandy's Juge observes, "We have had a stronger presence in the schools than a lot of people realize." Stressing Tandy's ongoing commitment to the educational market, Juge points out that the company is offering the same 20 percent school discount offered by


IBM's new System / 2 computers are seen by some as an attempt to seal off the high-end business market, and by others as an invitation to create the next generation of clones and compatibles. The new Model 30 offers 640 K RAM, color graphics, and three slots.

Apple, widely recognized as the leading supplier of educational computers.

Amstrad, too, hopes to penetrate the school market, although Wally Amstutz notes that this may have to wait until the company's network of dealers is more firm. The company's preference is to permit its distributors to market to their local educational systems and institutions.

PC's Limited has always seen the non-Fortune 500 business market as among its prime customers, and will continue to do so, says Michael Dell, although he sees his company increasingly going head-to-head with IBM and Compaq for the upper-end business market as well. At present, the company's advanced 3086 line of computers is seen as offering business customers a cost-effective alternative to IBM and Compaq machines.

At Leading Edge, schools are seen as a natural market, especially as consumer awareness of MS-DOS widens. The feeling is that parents are going to want their children to learn computers that use the same operating system that they will face in the business environment.

## Whither IBM?

It was IBM that gave the Personal Computer its name in the first place. With the company's announcement of its new Personal System/2 and the Microsoft Operating System/2 that is being developed for it, many feel that IBM is ceding the personal computer market to the compatibles and clones.

IBM's twin $3^{1 / 2}$-inch, 720 K disk drive Model 30 provides 640 K RAM and is priced at $\$ 1,695$; with one disk drive and a 20-megabyte hard disk, it lists for $\$ 2,295$. Other System $/ 2$ models offer a megabyte or more of RAM, $31 / 2$ inch disk drives carrying 1.44 megabytes, and fixed-disk storage devices with as much as 115 megabytes of memory. Prices for the various IBM configurations climb quickly and steeply, reaching a whopping $\$ 10,995$ for the 2 -megabyte RAM (expandable to 16 megabytes), 115-megabyte hard disk Model 8580-111.

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One of the things IBM is offering for these prices is enhanced graphics, enabling both color and monochrome users to achieve sharper monitor images.

At the higher end as well, IBM is betting on business interest in increased speed, with the Intel 80386 microprocessor delivering operations at rates up to 350 percent faster than the current AT processor.

But enhanced graphics is currently a high-priority item among the clone and compatibles manufacturers, many of whom are already delivering low-priced machines that accomplish their processing tasks faster than do IBM ATs.

What prompted IBM to move its marketing away from the MSDOS standard?

Leading Edge's John Sullivan notes that IBM had seen its PC market share dwindle. "I think the new IBM machines are signs of the company taking a definite move to protect the market they have, and to buy some time to regroup and regain ground," Sullivan states.

Ed Juge of Tandy sees IBM in the process of circling its wagons and attempting to seal off the Fortune 500 market, which after all, has been the company's prime market throughout its history. Tandy sees IBM's new machines and operating systems exerting little effect on the broad consumer market for PCs.
"I don't see the new machines having much impact on the general consumer," Juge says. "For one thing, they're expensive. For another, it represents a departure from an existing standard in which people have a large vested interest in software and hardware."

One reason many compatibles manufacturers are sanguine about the new machines is that Microsoft is still refining the OS/2 software. Delivery of the finished software is expected to take at least another nine months, with some observers speculating that actual completion of the system could require years.

Michael Dell views IBM's announcement of its new machines as less a company marketing decision than a response to the latest advances at Microsoft. The software developer is now serving as the driving force in the PC environ-
ment, Dell feels.
Since his company is already a Microsoft OEM (Original Equipment Manufacturer), Dell does not feel threatened by IBM's announcement.

Among the advances being touted by IBM is the higher capacity $3^{1 / 2}$-inch disk. Do compatibles manufacturers feel obliged to follow IBM's lead with such disks?

PC's Limited already offers $3^{1 / 2}$-inch drives as an option, as will Vendex. John Sullivan of Blue Chip notes that his company has $31 / 2$ inch drives, and is enthusiastic because the manufacturing cost of such drives is less than that for traditional $51 / 4$-inch drives.

Sullivan also observes that before the $31 / 2$-inch drive becomes a feature demanded by the general consumer, the amount of software available for such drives will have to increase.

Amstrad is taking a wait-andsee attitude at the moment, although $31 / 2$-inch drives are an option it is considering. Wally Amstutz notes that as personal computer upgrades become more common, it should be easy for the consumer or his or her service center to enhance the system to meet new demands.
"If $31 / 2$ becomes something everybody wants," Amstutz states, "you can bet that there will be an upgrade kit on the market for a couple of hundred dollars."

Should the consumer be concerned that IBM is going to lead the industry away from MS-DOS machines?
"Not at all," says Michael Dell, adding that the OS/2 operating system is an evolution of the industry standard operating system rather than an abandonment of it.

At present, in fact, OS/2 is expected to accommodate most MSDOS software without difficulty.

## Clones II

If IBM does succeed in creating a new generation of machines and prompting a new generation of software, will the clone and compatibles manufacturers be able to follow its lead?

The attitude on the part of most manufacturers is a resounding yes. The feeling is that if the public should want the new system, then
the manufacturers will respond by making it affordable.

For the present, though, the emphasis is on establishing once and for all a market for the personal computer in the home.
"I think everybody needs to remember that this has been tried before," says Harry Fox, invoking Coleco's Adam and IBM's own PCjr. "Those failures set the industry back a couple of years, and we're really only just now recovering. But if we can deliver quality machines to the public, and show them that they no longer need to be afraid of computers, then I think the PC will be the success story of the next few years in home electronics."

For more information about the machines discussed in this article, the manufacturers may be contacted at the following addresses:

Amstrad<br>c/o Vidco<br>1915 Harrison Rd.<br>Longview, TX 75604<br>Atari<br>1196 Borregas Ave.<br>Sunnyvale, CA 94086<br>Blue Chip Electronics<br>7305 West Boston Ave.<br>Chandler, AZ 85226<br>Commodore Business Machines<br>1200 Wilson Dr.<br>West Chester, PA 19380<br>Franklin Computer<br>Route 73 / Haddonfield Rd.<br>Pennsauken, NJ 08110<br>International Business Machines Information Systems Group 900 King St.<br>Rye Brook, NY 10573<br>Leading Edge<br>21 Highland Cir.<br>Needham Heights, MA 02194<br>PC's Limited<br>1611 Headway Cir., Building 3<br>Austin, TX 78754<br>Tandy / Radio Shack<br>1800 One Tandy Center<br>Fort Worth, TX 76102<br>Vendex Pacific<br>40 Cuiter Mill Rd., Suite 438<br>Great Neck, NY 11021<br>Victor Technologies<br>380 El Pueble Rd.<br>Scotts Valley, CA 95066

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# TELECOMPUTING With The Online Services 

Selby Bateman. Associate Publisher


#### Abstract

Every day and night, thousands of computer users log on to one or more of a variety of major telecommunications services to get information, play games, send mail, buy airline tickets, chat with friends, and take part in a host of other activities. These national and international online systems have shown they're here to stay. Now they want to prove that they can attractand keep-an ever growing membership of computerists.


What will it take to get you to regularly $\log$ on to a telecommunications service with your computer? What combination of price, ease of use, services, features, and other attractions will bring the great majority of computer users into the online fold?

That's the big question that every telecommunications service would like to have answered. So far, there are many thousands of computer owners who regularly go online with services such as American People/Link, CompuServe, Delphi, Dow Jones, GEnie, PlayNet, QuantumLink, The Source, and others. But people who run those systems all know that they've just begun to tap the potential market out there.

What are the main stumbling blocks?
"There is a real fear of the whole process: of modems, of getting around in these services, and especially of getting a big bill at the
end of the month," says Steve Case, a vice president at Quantum, the company that runs QuantumLink, a Commodore-only telecommunications service.

But Case and officials at other major services are confident that they can solve these problems, that the future of online computing is bright. "The way these things tend to work is that there's a gradual building process, and then it takes off," he says.
"As with home video, videocassettes initially got a mixed reception. And then the machines got better and easier to use, and the prices came down, and it took off. There are increasing signs that this is going to happen in telecommunications. We're pretty bullish on the future of it, " says Case.

In order to make their services ever more palatable, online systems are continually altering the mixture of ingredients to discover just the right recipe. While some of the systems stress the multitude of different features they offer, others are trying to find certain niches of interest in which they can build electronic forums, marketplaces, and information centers.

Each service offers its own variation on a common group of features: special interest groups (SIGs) on a variety of topics, online gaming, travel information and scheduling capabilities, public domain software that can be downloaded and used by members, computer industry and technical
information, news and sports information, and many other items.

As the number of features offered is growing, telecommunications service prices-usually figured in terms of cost-per-minute-are generally coming down, either directly or indirectly, through alternate-pricing strategies. And the emergence of faster data transfer-through both improved software and modem speeds of 1200, 2400, and even 9600 baud-is changing the nature of working online.

## Fine-Tuning The System

For the newcomer, trying to understand just how an online service works and what it offers can be an intimidating experience. It's not that the systems are so difficult to use or that there is a scarcity of information on how to use them. On the contrary-virtually all of the systems are regularly covered in books and magazines, and there are even free demos offered by some services. The early intimidation seems to stem from the same problem facing people who've never touched a computer: You really have to use it a few times before you understand just how useful, entertaining, and versatile it is.

At the same time, however, the various services realize that in order to appeal to the broadest possible audience, they must construct systems that are both simple for beginners and yet flexible for experienced members. That equation is a diffi-
cult one, and almost all of the services are constantly trying to streamline procedures, simplify the commands used, and offer just the right mixture of help screens, menus, and keyboard shortcuts.

The end result of having a finetuned online structure should ultimately be to have the user able to achieve something specific rather than wandering around from menu to menu or getting lost in a succession of submenus, says John Gibney, national sales director for General Videotex Corporation's Delphi service.
"I see in that a very highperceived value for the user that is what this industry is all about," he says. "Get them on, get them to the information they want as fast as possible, and then if they want to get off, they can. We don't ever try to force-feed information that they have no interest in."

Many telecommunications services can be accessed via any of a number of terminal software programs. However, in certain cases, as with systems like QuantumLink that are dedicated to one computer, separate software is usually required to allow the user to include systemspecific features.

The large online services are also accessed by members through a local phone call to one of the major telecomputing carriers, such as Tymnet, Telenet, and Uninet. Rather than placing a long distance call, as you might to contact a remote bulletin board system (BBS), these local access lines substantially reduce your online charges.

## Bit By Bif By Bit

One of the biggest changes occurring now in telecommunications is the arrival of relatively low-cost modems capable of transmitting data at faster speeds. Many people who began using a modem at home, in school, or in a small business probably started with 300 baud, or bits per second (bps), transmission rate. Now, however, many people are using much faster speeds.

To understand the differences, consider that each character (for example, a letter or numeral) you send is normally composed of eight to ten bits of data, depending on your computer. If we start with the
assumption that there are ten bits per character you're sending or receiving, then 300 bps roughly equals 30 characters a second. At that rate, you can actually watchand even read-characters as they appear on your screen. But figures show that over the past year or so 300 bps has been giving way to 1200,2400 , and even 9600 bps. At that rate, information is transmitted much faster, and that can add up to considerable savings if you're paying by the minute to access material on an online service.
"There has been an impressive leap in 1200-baud usage during 1986 and the first half of 1987," says Bill Louden, general manager of General Electric's GEnie telecommunications service. "In January 1986, over 60 percent of our subscribers used 300 baud," he says. "By the end of 1986, over 90 percent used 1200 baud." Although 2400 -baud usage on GEnie is so far quite limited, Louden says that the company already has the capability to handle that speed in more than 70 major metropolitan areas.

Delphi's Gibney goes even further: "I think you're going to see 1200 baud disappear rather quickly. Right now, better than 60 percent of Delphi users are coming in at 1200 baud. About 30 percent are coming in at 2400 baud, and we're right now working on speeds higher than 2400 baud. We've been beta testing 9600 baud for some time."

External modems, and inter-nally-mounted modem cards, have dropped in price dramatically. A 1200 -baud modem that might have cost several hundred dollars just a year or so ago sells for about a hundred now. And these modems often come with a free membership to one or more of the major services, including a specified amount of free access time on the system to get you started.

Most of the services have been modifying their price structures to allow 1200 -baud usage at or near the same price per minute as 300 baud. Since online services will collect more revenue for material received at 300 baud than at 1200 , the services have in the past tried to make up for the difference by charging higher prices for the faster service. But, as noted, several of the major systems are now minimizing
the price differences on the theory that the lower prices and faster speeds will eventually make online membership far more popularand more profitable.

## The Flat-Rate Alternative

For computer users, one of the developments with dramatic longterm possibilities is the idea of flatrate online computing. In other words, rather than running up charges by the minute or hour of usage-like a taxi meter that's always on-the company would charge a flat monthly rate for its basic services, with an additional surcharge for premium services. Most cable television systems work that way, helping to take the sting out of the final bill and promoting wider usage.

QuantumLink has been using this system since it came into being. Members pay an initial fee of $\$ 9.95$ to purchase the system software and then a monthly fee of $\$ 9.95$ for basic services. The system's Plus Services carry a per-minute cost. This structure is one that Steve Case thinks is far more popular with users and is less inhibiting since there's no invisible clock ticking away money while the user is logged onto the system.
"I think it's very important, and will be increasingly used by other people," he says. "It allows you to provide a club of active members. People tend to want to keep coming back."

In a related area, GTE Telenet has been offering its PC Pursuit flat-fee system now in a growing number of metropolitan areas. With PC Pursuit, the computer user pays a monthly fee of $\$ 25$ to Telenet and has access without further charges to bulletin boards, other computer users, and noncommercial databases. This does not apply to the commercial online services, however.

Although there are literally hundreds of commercial online services, a half-dozen or so have developed that are used extensively by computer users in the home, in schools, and in small businesses. Without in any way attempting to cover all of what these services offer, here's a taste of how each approaches its market and what they have added recently.

## American PeopleLink

American Home Network has always stressed the social aspect of its online service, American PeopleLink. And the primary areas of focus include machine-specific and general-interest SIGs, message boards, a data library, and online chatting.

PeopleLink users, called PLinkers, were recently given access to several new services, an online travel agency, and the TWA online airline reservations service as well as an online shopping area.

The service offers a variety of rate structures, including a new fre-quent-use rate for those who are most active on PeopleLink. Supersaver (frequent-use) rates (Mon-day-Friday, 6 p.m. -8 a.m.; weekends, 8 a.m. -8 p.m.) are $\$ 3.95$ per hour for 300 baud, $\$ 4.95$ per hour for 1200 baud, and $\$ 11.95$ per hour for 2400 baud. Leisure-time rates (M-F, 8 p.m. 7 a.m.; weekends, 8 p.m. -8 a.m.) are $\$ 4.95$ per hour for 300 or 1200 baud, and $\$ 11.95$ per hour for 2400 baud. And prime time rates (M-F, 7 a.m.-6 p.m.) are $\$ 11.95$ per hour for 300 baud, $\$ 12.95$ per hour for 1200 baud, and $\$ 14.95$ for 2400 baud. (Illinois residents pay no prime time rates.)

The frequent-user rate system lets you pay a $\$ 10$ monthly fee that saves 25 percent on all per-hour rates. To become a "Frequent PLinker," there's a one-time $\$ 12.50$ signup charge unless you join when first registering to use PeopleLink. The service now offers both voice and modem signup procedures.

American PeopleLink, American Home Network, 350 N. Clark St., Chicago, IL 60610

## CompuServe

Online since 1979, CompuServe's main focus over the past year-as with many of the other serviceshas been centered on enhancing existing features rather than adding new ones. CompuServe calls itself the largest commercially available online information service in the world, with more than 350,000 subscribers split fairly evenly between business and consumer use.

Because of that broad base, electronic mail has always been an important feature of the system. CompuServe's own electronic mail,
called EasyPlex, has established ties with several other large communications companies-including MCl and Telex-allowing two-way messaging across these systems.

In addition to its many other services, CompuServe, in association with Addison-Wesley's Information Services Division, recently placed online Einstein, a gateway to some 90 databases selected for their usefulness to secondary school students and faculty. The databases include newspaper and wire services, articles, book reviews, and an online version of the Reader's Guide To Periodical Literature.

CompuServe has also been expanding its services for the at-home financial investor. One new feature, for example, lets users look at specific stocks through a detailed group of 24 analytical filters, including market/book ratio, cash flow, and four-year growth. Further tracking and analysis functions are available; and the information can be downloaded directly into a variety of software packages, including Lotus 1-2-3 and Symphony.

There is a $\$ 39.95$ registration fee to join CompuServe. Nonprime time rates are $\$ 6$ per hour at 300 baud and $\$ 12.50$ per hour at 1200 or 2400 baud. Prime time access is $\$ 12.50$ per hour at 300 baud and $\$ 15$ per hour at 1200 or 2400 baud. CompuServe recently reduced its 2400 -baud rates to the same level as that for 1200 baud.

CompuServe, P.O. Box 20212, Columbus, OH 43220

## Delphi

General Videotex's Delphi service has recently added several enhancements to its system, in addition to the electronic mail, teleconferencing, bulletin boards, and other features that have been a part of its offerings.

First, the company is issuing a revised and illustrated handbook, published by Simon \& Schuster. With purchase of the manual, a new user doesn't have to pay the service's $\$ 24.95$ registration fee.

Delphi officials expect to add the one-hundred-thousandth member to its service before the end of the year. Recent additions to the service include a personalized astrology service that has proven to be very popular and new auction
software that allows users to bid on products. Delphi hosted an online fund-raising auction for public television station WGBH in Boston that netted the nonprofit PBS station \$25,000.

New "Advantage" rates are available for as little as nine cents a minute, or $\$ 5.40$ per hour. To take advantage of those rates, a user simply agrees to use a minimum of $\$ 24$ a month in log-on time. The \$24 charge is applied toward your monthly usage, and there is a onetime fee of $\$ 19$ to use the Advantage rate. Prime time standard rates are $\$ 17.40$ per hour, while nonprime time rates are $\$ 7.20$ per hour.

General Videotex Corporation, 3 Blackstone St., Cambridge, MA 02139

## Dow Jones News/Retrieval

Dow Jones emphasizes its news and information for the business and financial community. There are more than 40 business and financial databases, and selected stories from the Wall Street Journal, Barron's, and the Dow Jones News Service.

You'll find a wealth of data on all areas of business, such as excerpts from SEC records, ownership information on more than 10,000 public companies, company profiles from Standard \& Poor's, research reports from brokerage houses, and 15 -minute delayed stock quotes with a special news alert feature.

The company recently introduced an enhanced version of the Dow Jones Tracking Service for automatic tracking and analysis by members through their own computers. The service lets them automatically retrieve stock prices from the Dow Jones Current Quotes Service and late-breaking news from the Dow Jones News Service for each company in the profile.

New stock analysis programs have also been recently made available for Macintosh computers, similar to those already offered for IBM PCs and compatibles, and the Apple II-family of computers.

The Dow Jones registration fee is $\$ 29.95$, with an annual $\$ 12$ fee (waived the first year). Non-prime time access ranges from 10 cents to 80 cents a minute at 300 baud, depending on which services are used. Prime time access ranges from 30 cents to $\$ 1.20$ a minute at

300 baud. The fee for 1200 or 2400 baud is 2.2 times the 300 -baud rate. Dow Jones News/Retrieval, P.O. Box 300, Princeton, NJ 08543

## GEnie

GEnie's round-table SIGs continue to be one of the most popular areas on the service. More than 40 of them are offered, focusing on all major brands of home computers and operating systems. GEnie has also added non-computer-related SIGs for photography, genealogy, scuba diving, and a host of other hobbies and interests.

The service, responding to requests for more online access to financial information, has begun offering GEnie Quote\$, a stock market utility that gives information on over 67,000 securities. Users can also put their personal portfolios online.

The company charges no additional fee for 1200 baud, and now offers 2400 baud in over 70 cities. Prime time access is $\$ 35$ an hour, but non-prime time access is only $\$ 5$ an hour. A one-time registration fee of $\$ 18$ is also required.

General Electric Information Services, 401 N. Washington St., Rockville, MD 20850

## PlayNet

PlayNet began operation in October 1984 with a primary audience of Commodore 64 owners who wanted to meet others online and to play games that incorporated color and sound. The non-prime time rate is a mere $\$ 2.75$ per hour, with a monthly maintenance fee of $\$ 12$ required. The registration fee is $\$ 19.95$.

PlayNet has recently undergone a streamlining of its system, remodeling the menus, bulletin boards, and other areas of the service. Improvements were made in the online conversation section, which continues to be the most popular area on PlayNet. There are 14 online games incorporating color and graphics, as well as three text-only games: bingo, poker, and blackjack.

The most recent addition to the service is the online shopping center. This shopping area focuses on small merchants, crafts people, and artisans, unlike most of the other services. There is also a new dis-
count shopping area in which nothing is priced higher than $\$ 9.99$.

PlayNet, 105 Jordan Rd., Troy, NY 12180

## Quantumlink

QuantumLink has become a focal point for a great deal of Commodore 64 telecommunications activity during the past year or two. Commodore itself has provided marketing and some funding for the service in trying to build a major Commodore forum.

The QuantumLink software that comes with membership means that the 64's excellent color graphics and sound can be included in all of the areas of the service. And QuantumLink follows a busy schedule with guest speakers and topical forums-all aimed at helping Commodore 64 users get more out of their machines.

QuantumLink has expanded its regular service to include online forums hosted by such major software companies as Electronic Arts, Timeworks, and other publishers; Commodore enhancement areas such as the GEOS forum developed in conjunction with Berkeley Softworks; and the recently added casino area in which you can play interactive, multiplayer blackjack and poker, as well as slot machines and other games of chance.

One of QuantumLink's most ambitious projects is called Habitat, a completely interactive world developed in association with LucasFilm. Users first log into Habitat and then can move throughout the world with their cartoon character personas, meeting others and building an alternate life. After considerable development delays, Habitat is still not ready for full use. But QuantumLink officials believe that, when all of the problems are worked out of the complex project, it will be a breakthrough in online gaming.

Quantum, the parent company, is now experimenting with the beta version of a similar service for Apple II owners. Apple owners who would like to apply to become beta testers for the planned service can log in through their modems at 1-800-833-9400. Note, however, that this service is not yet ready for full public use.

There's no registration fee to
join QuantumLink other than the $\$ 9.95$ software. Users pay $\$ 9.95$ a month for unlimited use of basic service, plus additional per-minute fees for some extra services they may want.

QuantumLink, 8620 Westwood Center Dr., Vienna, VA 22180

## The Source

The Source offers a wide variety of online information to both home and business users. In the consumer area, a games SIG has been added to other SIGs on personal computing, PC software, professions, and arts and entertainment. Two of the system's realtime conferencing capabilities, involving both public and private conferencing, have also been enhanced.

Several financial services have been added. The home investor may want to make use of Risk/ Reward Analysis, a decisionmaking support tool that provides analysis for stocks, bonds, warrants, and convertibles. Volatility data is drawn automatically from Standard \& Poor's.

A new tax service that's offered is a compilation of tax information and a tax question-and-answer service. A mutual fund analysis feature provides performance histories for more than 800 mutual funds and 40 different market indices.

The Source has also added MEDSIG for the discussion of chronic illnesses; COOKSIG for communication about cooking, recipes, and dietary concerns (part of these revenues go to the American Cancer Society); and Educators' Exchange, a professional exchange for teachers and administrators to share information, learn about educational software, and stay informed on educational issues.

A registration fee of $\$ 49.95$ is required to join The Source. A monthly fee of $\$ 10$ is also charged, although this is credited against the user's online time. Prime time access is 36 cents a minute at 300 baud, 43 cents a minute at 1200 baud, and 46 cents a minute at 2400 baud. Non-prime time access is 14 cents a minute for 300 baud, 18 cents a minute for 1200 baud, and 20 cents a minute for 2400 baud.

The Source, 1616 Anderson Rd., McLean, VA 22102

# Ring Quest 

Michael B. Williams

Requirements: Apple ll-series computer.

It's a beautiful day. You decide to stroll along the oceanfront, where you encounter a frail old man with a fascinating story to tell. He speaks of another land, a land where the Ring of Chaos and the lost Ring of Order rule supreme. But there is no order in this land, and you listen curiously to the old man's plea for you to find the Ring of Order and bring peace to this faraway world.

As you nod your head in consent; a feeling of drowsiness overwhelms you; and you lapse into an uncontrollable dream. When you awaken, you find yourself staring upward at purple skies decorated with red streaks. You realize that you are indeed in the land of which the old man spoke. You stagger to your feet and, accompanied by a native from the land, embark on your Ring Quest.

That's the story behind Ring Quest, a graphics adventure game from Origin Systems. In this adventure, you are the main character of the story. You don't just helplessly observe while the story unfolds in front of you. You actually make the decisions that determine the course of your character's life-or death.

You use simple English sentences to indicate what you want to do. If you see something interesting to the north, you simply type "Go north." If you need to get to the other side of a river, just type "Cross the bridge." But Ring Quest can also accept complex commands, such as "Get the sword, rope, and ring; then run north."

## What's A Manticora Look Like?

Ring Quest also has lively graphics-full-color pictures that enrich the scene with animation. Eyes bulge, claws clamp, hands grasp, and fire flickers, even as you ponder your next action.

Although the graphics are very good, Ring Quest is not just a graphics adventure. Its text descriptions, though not as descriptive as Infocom's all-text adventures, are vivid and interesting
enough to stand on their own. For those so inclined, the graphics can easily be turned off (and just as easily turned on again-you'll definitely want to see what a manticora looks like).

An unusual feature of Ring Quest is its inclusion of arcade sequences as a part of the adventure. It's rare for a textbased adventure game to contain any type of action-oriented challenge. And since diehard adventurers are likely to cringe at the thought of having to play an arcade game, the games can be bypassed altogether with one simple command.

The first game, Cliff Climber, requires you to dodge falling boulders, snakes, and rock slides while scaling the side of a chasm. In the second game, Flyer, you try to guide yourself down to a platform surrounded by a sea of flames.


Ring Quest for the Apple II has something for everyone: text and graphics adventure, animation, arcade action, and challenging puzzles.

Most of the time, though, you and your sidekick, Gorn, will try to pick up clues that will lead you to the Ring of Order. To win the game, you must first locate and nullify all the sources of an impenetrable force that prevents your access to the castle, where the formidable enchantress Lisa holds the Ring of Chaos.

Along the way, you'll have to deal with a greedy troll, an unforgiving werewolf, a wise old man (whose services do not come cheap), and a manticora (a cross between a man, lion, bat, and scorpion) who absolutely refuses to let you cross the bridge over a deep chasm.

## Charming Lisa

Those are but the least of your worries. The holder of the Ring of Chaos, the beautiful, but evil, enchantress Lisa, has a nasty habit of appearing out of nowhere and casting spells that make life difficult for you. She can instantly deplete your water supply, suddenly reverse your internal compass, or temporarily afflict Gorn with the intellect of a three-year old. But when she really means business, she'll utter "Teletrans!", and you'll suddenly find yourself randomly transported to some location usually miles away from where you were.

Ring Quest comes with a clever introductory adventure booklet, which interactively tells the story behind your quest. At the end of each passage, you have two or more options. Each leads to a different passage in the booklet and a slightly different story line. Origin Systems also provides a laminated, erasable map of the strange world. Some of the major landmarks are already drawn on the map; you can easily add others with the felt pen provided.

Despite the enchantress Lisa's unorthodox tactics, Ring Quest is not difficult to solve. It should make a good first-time adventure because of its pleasant, colorful graphics and its straightforward story line.

This game has something for everyone: vivid, descriptive prose for those who like reading, and colorful, animated graphics for those who don't; arcade sequences for those who like action, and engaging puzzles for those who don't. If you're looking for a little adventure, or action, you just might want to make a Ring Quest.
Ring Quest
Origin Systems
340 Harvey Rd.
Manchester, NH 03103
Distributed by Electronic Arts
1820 Gateway Dr.
San Mateo, CA 94404
\$19.95


Design pictures and graphics quickly and precisely. Unlike other drawing programs, you can produce exact scaled output on your printer. Design in the units of your drawing problem (feet, miles, meters, etc.) and send hardcopy to most printers. Uses either the keyboard, lightpen or 1351 mouse. Two separate work screens-transfer artwork from one screen to the other. Place text in four sizes anywhere in the picture-three extra fonts included; Old English, 3-D and Tech. "Try Again" allows you to undo mistakes. Draw solid or dashed lines, circles, ellipses at any angle, rays and boxes. Design fill patterns, fonts and objects. Cadpak is the full-featured design and graphics package for your computer for C-64 $\quad \$ 39.95 \quad$ for $\mathrm{C}-128 \quad \$ 59.95$

## Super C

C is one of today's most popular languages. It's easy to transport C source code from one computer to another. With Super C you can develop software or just leam C on your Commodore. Super C is easy to use and takes full advantage of this versatile language. Produces 6502 machine code and is many times faster than BASIC. Includes full-screen editor (search, replace and block

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# Two Views Of Outer Space: S.D.I. And Wanderer 

Neil Randall

Requirements: S.D.I.: Atari ST (reviewed here), IBM PC, Amiga, Apple IGS, and Commodore 64. Wanderer: Atari ST.
S.D.I. and Wanderer place you in the captain's seat of a space fighter. In S.D.I., your mission is to defend the United States against KGB rebel fighters and missiles, all for a chance to rescue your own true love, the commander of the Soviet space station. Wanderer presents another rescue mission, but this one is far more obscure. Here, you battle your enemies for the right to bring home your caretaker's cat. It seems she can't live without it, so until she gets it back, your apartment won't get cleaned. (And it's such an awful mess.)

The plots may be contrived, but the fact that the games in fact have plots marks them as something special in the arcade game field. Since the days of Space Invaders and Donkey Kong, arcade games have provided considerable excitement, but few have offered players an interactive story. S.D.I and Wanderer go a good way toward filling this gap. Both are arcade games, and both use the now-classic cockpit display, butunlike most arcade games-you can complete them.

## Dazzling Graphics

Graphically, both games have much to offer. S.D.I., a new offering in Mindscape's Cinemaware line of interactive fiction, uses some of the best graphics I've seen in any game. The display screens range from a control panel showing several global maps to the interior of the Soviet space station, as well as a silhouetted embrace with the gorgeous Soviet commander (your own true love, remember). The most frequent display, though, is the view from the cockpit of your fighter. You guide the fighter around the world, shooting down rebel KGB fighters, repairing your S.D.I. satellites, and docking with your space station for fuel and repairs. When you shoot down several fighters, the rebels will declare American aggression and start launching missiles from Russia. At this point, you dock with the space station (no mean feat), race into the Missile Defense screen, and prepare to knock the Soviet missiles out of the sky. If you succeed, you do it all over again, until at last you are informed that the Soviet space station has been captured by the KGB rebels. When
that happens, you attempt the rescue.
Wanderer's display also places you in the cockpit of a fighter, but the similarities pretty well end there. The reason is simple: Wanderer is in 3-D. Included in the package is a pair of redblue 3-D glasses, the kind used for such classic 3-D movies as The Creature From the Black Lagoon. When you put them on, the ST's screen appears threedimensional. After a few minutes of focusing, the stars recede into the background, and the display seems to achieve true perspective. When you enter warp drive, and the stars race past you in a swirling spiral, the effect is quite spectacular.

Surely one of the most unusual games I've seen, Wanderer has you move from planet to planet, offering the ruler of each planet a playing card to strengthen that planet's poker hand. (There's this galactic poker game going on, in progress now for centuries, and if you offer a helping card they will respond by paying you in cats. Yes, cats. If you collect enough cats, or if you manage to get one specific card, you can penetrate to the central sector and try to rescue your caretaker's cat.) It's all very complicated, but it's also a great deal of fun.

More fun, in fact, than S.D.I., which offers superb graphics, but in actual game play suffers from being too repetitive. After shooting down KGB fighter after KGB fighter, repairing damaged satellites, and intercepting KGB missiles with your strategic defense weapons, you are asked to turn around and do the same things over again. By the time you've hit the third round, the excitement begins to pale; once into the fourth, you begin to tire of it. You begin to wonder, in fact, if your own true love is really worth the effort.

What makes this strange is that arcade games, by their very nature, are repetitive. The good old ones, like Asteroids and Missile Command, had no conclusion, your goal being simply to chalk up hundreds of thousands of points. S.D.I., by offering a finish, ironically loses the appeal of racking up the points. The impetus behind shooting down KGB fighters is not acquiring points, but rather reaching the end of the plot. Wanderer, which also has a conclusion, suffers similarly, but Wanderer's conclusion is more difficult to reach. Its game play is somewhat more challenging, and getting killed is far easier.


The Atari ST version of S.D.I. from Mindscape offers outstanding graphics.

But game play itself is extremely enjoyable. S.D.I.'s graphics are so splendid that they more than atone for whatever the game play lacks, and you will find yourself booting up the game simply to see what your ST can do. Wanderer, with its workable 3-D display, is unique, and, like S.D.I., it is an excellent product with which to show off your ST to your friends. Played obsessively to a conclusion, both games will eventually become worn out, but if played as 1 think they are meant to be played, 30 minutes here and 30 min utes there, they will continue to draw your attention. Were I asked to recommend one over the other, I would suggest S.D.I., because graphically it is one of the best ST products on the market. But both games are worth a look, and both point toward an exciting ST future.
S.D.I.

Mindscape, Inc.
3444 Dundee Rd.
Northbrook, IL 60062
$\$ 34.95$ Commodore 64 version
\$39.95 IBM PC version
\$49.95 Macintosh, Amiga, ST, IIGs versions

Wanderer
EiderSoft USA
P.O. Box 288

Burgettstown, PA 15021
$\$ 39.95$

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## Moonmist

Neil Randall

Requirements: IBM-PC or compatible, Apple II series, Macintosh, Amiga, ST, Commodore. 64, 128, or Atari XL/XE computer.

By now it's probably safe to say that most computer owners have seen or played an Infocom text adventure. Zork I, II, and III, The Hitchhiker's Guide to the Galaxy, Infidel, Enchanter, Wishbringer, and Witness have all spent time on best-seller lists, and high-circulation magazines like Newsweek have printed articles about the company. Infocom has become famous for its interactive fiction, and its customers look to it not for new kinds of products but for variations to the old.

As pioneers of the sophisticated text adventure, Infocom is expected to set the standard for future text adventures. To this end, Infocom has introduced Interactive Fiction Plus, a line of text adventures designed especially to take advantage of machines with 128 K of memory (though they're also available for 48 K and 64 K machines). The differences are certainly not dramatic, and in many ways the games look the same as they always have, but Infocom's newest adventures are different from the old in several important ways.

Moonmist demonstrates the differences. Like all Infocom games of the past two years, it is superbly packaged, but unlike the earlier games, the packaging is needed to play the game. Infocom does not copy-protect its disks (and has certainly suffered its share of software piracy), so this reliance on the packaging is perfectly justified. Inside Moonmist's package are two letters from your acquaintance, Tamara, the latter of which suggests a murder plot against her. Also included is a brochure about Tresyllian Castle in Cornwall, where Tamara is staying, which provides many descriptions necessary to play the game. The documentation introduces the "Legendary Ghosts of Cornwall," and a Moonmist iron-on transfer is included for those who still own T-shirts with no writing on them.

## In The Castle

Your task is to uncover the murder plot, in the meantime dealing with some very interesting characters inside a well-described medieval castle complete with torture devices and a wandering ghost. You must collect clues, talk with the characters, survive an encounter with the ghost, and even figure out what outfit to wear at certain times.

Moonmist is an introductory-level adventure, so it moves along quickly and is not overly difficult; but the sheer number of things you have to do make it a long, challenging game.

The differences between Moonmist and earlier Infocom games are subtle. The parser-the part of the program that interprets your typed commandscontinues to grow more sophisticated, and more specialized. Room descriptions are more precise, more detailed, and more helpful, all of which gives you a stronger sense of your physical location. At each stage, too, there appears to be a greater choice of actions available, with fewer actions being blatantly wrong. And the characters in the story are, for the most part, genuinely interesting, even if they don't do as much as perhaps they should.

The must subtle change, though, and the most important, is in the role taken by the reader. In Moonmist, as in most of the newer Infocom games, you feel that a story is actually taking place, and that you are a part of it. In the earlier adventures, your actions forced the story from one point to the next, but unless you did something, nothing happened. While this is technically true of Moonmist, the authors, Stu Galley and Jim Lawrence, manage to make you feel that you are caught up in a story beyond your own actions. The time limit helps, of course, but somehow the castle seems far more "alive" than the caverns in Zork or even the spaceship in Starcross. The people in the castle all know more about it than you do, and the result is that you feel like an intruder. This effect is a good one.

For those who have not yet tried an Infocom adventure, Moonmist is a good introduction. It is challenging without being frustrating, and it offers what interactive fiction is supposed to offer: a chance to participate in an interesting story. For Infocom veterans, Moonmist demonstrates how text adventures have changed since the heyday of Zork.
Moonmist
Infocom
125 Cambridge Park Dr.
Cambridge, MA 02140
\$39.95 IBM-PC and compatibles, Apple II, Macintosh, Amiga, and Atari ST versions
\$34.95 Commodore 64, 128, and Atari XE/XL versions

## Parfner

Kathy Yakal

Requirements: Commodore 64 (reviewed here), 128 , or IBM-PC or compatible ( 256 K recommended but not required on MSDOS machines).

Throw away your card file. Toss out that old calculator you bought in 1975 when the price came down to $\$ 5.95$. Stop trying to decide which size paper you're going to write a memo on, and end the frustration of having to line up each mailing label when you're typing a bunch of them.

You can replace all these things with a single cartridge that does them all, and more: Partner, from Timeworks. Partner is one example of a genre of productivity software that offers several desktop accessories like a notepad, appointment calendar, calculator, and address/phone file in an invisible program that runs concurrently with other programs; that is, it remains in memory while you're using your word processor or sweating out cels in a spreadsheet or landing in San Francisco in Flight Simulator, and it pops up ready for use at the touch of a cartridge button.

Installing Partner, depending on which version you're using, involves little more than plugging it into an expansion port. Although you may not need to use all of its functions immediately, it's a good idea to run through the manual to make sure you know how to use all of them, saving time later.

Partner offers nine functions:
Appointment Calendar: Partner contains graphic calendar displays for every month from January 1987 through December 2099; by pressing a few function keys, you can enter, edit, and save information for any day in three areas-Key Tasks, a To Do list, and Appointments. Though the first two headings might seem to duplicate each other, they actually point out a very important time-management tool: separating goals from objectives. In the midst of doing all of the little tasks that make up your day, it's wise to keep the larger picture in mind.

If there are tasks you haven't completed when 5:00 rolls around, Partner lets you transfer them to the next day. The snafu here is that it is erases any items you've already entered for that next day. Another minor gripe in this area: When you're printing out a week or month's worth of days, the skeleton format (including headings and numbers) is printed for every day, whether or not you've entered anything there, wasting space and printer paper.

Memo Pad: Using simple textediting commands, you can dash off memos without losing your current program. The Typewriter feature here will print out one line at a time as you hit the return key if you like; you can also print out the whole thing when it's done.

Address List: Using the same textediting features from Memo Pad, this section is an electronic card file for storing, alphabetizing, displaying, and printing names, addresses, and telephone numbers. You can also print mailing labels within this section. This may involve playing around with the margin settings to zero in on the right spacing.

Phone List: This is an abbreviated version of the Address List. Since it contains autodialing capabilities, it's especially helpful for telecommunications applications. You can store phone numbers for often-called online services and let the program dial for you.

Calculator: When the boss drops a paycheck on your desk, you can break into this area and do a quick calculation of your checkbook balance. The program displays a graphic representation of a calculator with its standard functions, and includes a printout option.

Print Screen: Lets you print one screen from the program you're running, with the exception of graphics displays.

SwiftDOS: This section offers access to a variety of housekeeping commands for your disk operating system, like formatting, cleaning, and erasing.

Swiftlock: Data protection schemes like this insure that no one can peek at your work when you walk away from your desk to get coffee. Enter this section before leaving your terminal, and it freezes all active data until you enter your secret code.

Setup: Though it's listed last, this is probably the first area you'll want to dive into. It asks eight questions about your hardware configuration, letting you set addresses and margin spacing.

Partner also offers Swiftload, a fast-loading feature.

Partner is an excellent addition to any software library. It offers an uncomplicated command structure and clear, simple documentation. It provides quick, easy access to features often used during the business day; any of the program's functions is only a keypress away, and a display of the purpose of each function key runs along the bottom of the screen in each section. And Partner doesn't take up space with a lot of extras that often aren't necessary.

But the main advantage here lies in the fact that it runs concurrently with whatever software you're using: no need to save a document, power down, reboot, and so on. It's not meant to be used as a full word processor or database manager. It's an accessory-a partner, as its name states-and a good one.
Partner
Timeworks
444 Lake Lake Cook Rd.
Deerfield, IL 60015
\$59.95 Commodore 64 and IBM-PC/
PC-compatible versions
$\$ 69.95$ Commodore 128 version

## Realm Of Impossibility

Michael B. Williams

Requirements: Commodore 64, Apple II series, or Atari 8-bit computer.

Realm of Impossibility is a decidedly classic, run-as-fast-as-you-can, threedimensional arcade game with a goal: Enter the network of 13 dungeons and retrieve the seven crowns hidden within them. That would be a cinch were it not for the team of zombies, orbs, and spiders whose goal it is to prevent you from completing yours.

About the only things going for you in this Realm are your faster speed, the ability to fend off the creatures by throwing holy crosses in their path, and scrolls that give you spells to temporarily freeze or confuse your adversaries, or to protect you from them.

Otherwise, life is definitely not fair to you here. You can't kill the creatures of the Realm, although they can kill you. You only have one life to live, and each brush with a zombie, orb, or spider will cost you more of the precious hit points you need to stay alive.

Fortunately, you can enter the dungeons in any order, so you can build up hit points by tackling the easier dungeons first. Some of the dungeons are locked; these will need keys that are located in the other dungeons. In all, there are 129 different rooms to explore. Chances are you'll get to see all of them, since the prize in each dungeon is almost always at the end.

Realm of Impossibility has a threedimensional effect (like the threequarters perspective in Zaxxon) that is a pleasure to behold. You move up, down, and around three-dimensional structures that look more like a futuristic cityscape than an ancient dungeon. Unfortunately, what looks good is not
necessarily what plays well, as kamikaze Zaxxon players will attest.

## A Little Help From A Friend

What distinguishes Realm of Impossibility from the run-of-the-mill chase game is not the three dimensions, but one element: cooperation. In the typical arcade game, you are one person doing a job that would normally require an entire army to accomplish. At about the 1000th level, you start wishing you were an army-or at least that you had someone to help you play the game.

With Realm of Impossibility, you still won't have an army, but you can have a friend help you through each dungeon. Having two players on the field at once gives the zombies and his friends two targets instead of one, but it also gives you a chance to divert the menaces while your buddy safely snatches the key (or, preferably, you swipe the key while he acts as zombie bait).

An additional advantage of the two-player game is the ability to resurrect your partner whenever the little buggers finish him off. Of course, you've got to get over to him before they knock you off. In the one-player mode, once you're finished, so is the game.

When you play Realm (which, according to the developer, Origin Systems, can run in the Apple Ilgs's emulation mode), you must use a joystick; a second player may use either the keyboard or a second joystick. Learning to navigate the 3-D rooms is a bit tricky no matter which you use. Until you become proficient at it, don't worry too much about running into walls-it's the zombies, spiders, and orbs you need to avoid.

You'll enjoy the four difficulty levels (from easy to severe), the online instructions (no more lost manuals), and the cute touches (the player waves "Hello!" at the entrance to each dungeon), but the game's musical score will cause you to reach for the sound toggle after a bar or two. A single keypress will cut off the sound (or turn it back on).

By far the best thing about Realm of Impossibility is its two-player mode. Forget its wonderful three-dimensional color graphics. The ability to work together with a friend, instead of competing against one, makes this a game even an arcade-game hater could lave.
Realm of Impossibility
Origin Systems
340 Harvey Rd.
Manchester, NH 03103
Distributed by Electronic Arts
1820 Gateway Dr.
San Mateo, CA 94404
$\$ 14.95$

# Weather Wizard 

John R. Wetsch

This weather forecasting program is written entirely in BASIC and can be adapted to run on virtually any computer with BASIC. The original version is written for the IBM PC/PCjr. We have added translations for the Commodore 64, Amiga, Atari ST, Apple II, and Atari $400,800, \mathrm{XL}$, and XE .
"Weather Wizard" is a simple, easily modified BASIC program for forecasting the weather. Because every version is similar, we've published one main program and provided line changes and modifications for each individual machine. Begin by typing in the main program (Program 1). When that's done, add or modify the lines listed for your specific computer. After you have typed the complete program for your computer, save a copy to tape or disk before you run it.

Atari ST users should note that several lines must be deleted from the main program to produce a proper display. See the REM statement in line 1 of Program 6 for details. Amiga users should remember that Amiga BASIC does not automatically arrange numbered program lines in numerical order. Be careful to type the lines of the main program in the order shown. The extra line in Program 7 must be added as the first line of the program.

## Entering Data

Weather Wizard is largely selfprompting, so you will not need
extensive instructions to use it. The program begins by asking you to enter several items of information about current weather conditions, beginning with the current month, day, and year. Enter a number from 1 to 12 for the month, a number from 1 to 31 for the day, and so on.

The program then displays instructions for entering the next item of information, the wind direction. This is done by typing a number according to the categories shown on the screen.

Next, you must enter the current barometric pressure, expressed in inches of mercury. This will be a number in the range 27-33.

After the barometric pressure, you must enter the barometric activity (whether the barometer is steady, rising fast, and so forth). Again, the computer displays a menu indicating which number to type.

The next item of information is the prevailing cloud type. As prompted by the computer, enter a 1 for cirrus clouds, a 2 for cumulus, and so on. If you are not familiar with the various cloud types, refer to the brief explanations at the end of this article.

Finally, enter the current humidity and temperature when prompted. When you are finished entering data, the computer prints a complete forecast for a 6 - to 36 hour period. The period of the forecast depends on what sort of weather is expected. To calculate another forecast, answer $Y$ at the final prompt.

## Cloud Types

Cumulus clouds are puffy, white, and cottonlike in appearance with a clearly defined outline. Perhaps the most familiar cloud type, these are usually found at lower altitudes, with cloud tops seldom exceeding 5,000 feet.

Altocumulus clouds are small, semitransparent, cumulus-type cloudlets that appear in layers. This type of cloud evolves from the lifting of lower clouds. They often appear connected, and you can see the sky through them. Rounded and regularly arranged, they are usually found at an altitude of $10,000-$ 17,000 feet.

When a cumulus cloud develops both extreme height and mass, it evolves into a cumulonimbus cloud. Although it makes up the most beautiful cloud mass, sweeping up into a towering column, these are the most dangerous clouds. Capable of producing heavy rain, hail, lightning, and strong, gusty winds, these clouds occasionally mask a tornado. These clouds may be easily identified by their massive appearance, vertical development (often in excess of 20,000 feet), anvil-shaped top, and thunder and lightning. Occasionally the tops of extremely powerful cumulonimbus clouds will exceed 30,000 feet.

Stratus clouds are gray, featureless sheets, sometimes layered in appearance. This type of cloud produces only light precipitation, if any, and may reveal the sun through its thinnest parts. When in
contact with the earth（at an alti－ tude of 50 feet or less）this cloud type is called fog．The tops of stratus clouds rarely exceed 10,000 feet， although one variety，nimbostratus， may have cloud tops reaching to 15，000 feet．

The word nimbus is a Latin word which means violent rain or black rain cloud．Nimbostratus clouds produce continous precipita－ tion．This cloud type is often gray and is always thick enough to ob－ scure the sun．Nimbostratus clouds are usually found near weather fronts，and although classified as a middle－altitude cloud，with tops ranging to 15,000 feet，the cloud base may be quite low．

Altostratus clouds are a smooth，uniform，gray sheet of cloud cover，and consist mostly of ice crystals，although the lowest portion may be water droplets．The sun may appear as though seen through ground glass，and objects on the ground will not cast a shad－ ow．Any precipitation associated with this cloud type is continous． Altostratus clouds are considered middle－level clouds，and generally occur between 6,500 and 23,000 feet in altitude．

Cirrostratus clouds are thin， white clouds that appear in sheets． The sun and moon are hardly ever obscured by these clouds which often indicate severe weather to come．They are typically found high in the atmosphere，usually above 25,000 feet．

Cirrus clouds are wispy and white，generally occurring between 16,500 feet and 45,000 feet．A buildup of cirrus clouds may indi－ cate an approaching warm front．

Before entering this program．carefully read the typing instructions in the article．

## Program 1：Weather Wizard－ Main Program

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

[^2]er）＂：iMIN＝1：MAX＝12：BOSUB 139
E：M＝E
90 PRINT＂Enter Day＂！：MIN－1：MAX －31：BOSUB 1391：D $=E$
1 1月g PRINT＂Enter the Year＂；iMIN ＝0：MAX＝2160：GO8UB 139月：Y－

E
116 BOSUB 1520
128 PRINT＂Plaase input number
whmen prompted by ？＂
136 PRINT
146 PRINT＊From the menu enter the number correne＂
150 PRINT＂ponding to the wind dirmetion
160 PRINT
176 PRINT＂Nm North，gm Eouth， Em East，Wm Werst＂
18：PRINT＂（Nate：The direction E are whore the＂
196 PRINT Mwind comen from，not where it it gating．＂
296 PRINT＂80，＂NE＂meant a win d blowing out of＂
210 PRINT＂the northeast．）＂
228 PRINT
230 PRINT
TIDN MENU $\qquad$ －WIND DIREC

246 PRINT
25ø PRINT＂1．N＂gPC（4）＂2．NE＂SP C（3）＂3．E＂
260 PRINT
270 PRINT 4．SE＂SPC（3）＂5．S＂SP C（4）＂6．8W＂
2日® PRINT
29先 PRINT＂7．W＂BPC（4）＂日．NW＂gP C（3）＂9．NO WIND＂
360 PRINT
316 PRINT
320 MIN＝1：MAX－9：GOSUB 1396：$w=$ E
336 GOSUB 1526
340 PRINT＂Enter barometric pre हesure＂：PRINT＂in incher of $H$
g（ex．29．95）＂
356 MIN＝27：MAX＝33：GOSUB 1489：BP －E
366 EOSUB 1526
376 PRINT＂Please enter the num ber that describen＂
3日g PRINT＂current barometric a ctivity．＂
39\％PRINT＂Barameter iss 1．Ete ady＂
490 PRINT SPC（14）＂2．riE1ng fas t＂
410 PRINT BPC（14）＂3．Elawly ris 1ng＂
42も PRINT SPC（14）＂4．falling fa st＂
430 PRINT SPC（14）＂5．Elowly fal 1ing＂
$44 \sigma$ PRINT
450 MIN＝1：MAX－5：GOSUB 139б：BD＝ E
46ڤ B0sUB 1526
470 PRINT＂Please enter thi num
ber for the madn＂
480 PRINT＂cloud type for your location．＂
490 PRINT
500 PRINT＂1．Cirrus＂sPRINT＂2． Cumul onimbue＂：PRINT＂3．Stra
tus＂
510 PRINT＂4．Nimboetratus＂sPRI NT＂5．Altowtratus＂：PRINT＂6．
Al tocumulus＂
52ø PRINT＂7．Cirrostratu®＂：PRI NT＂日．Cumulus＂：PRINT＂9．No clouds＂：PRINT
538 MIN＝1；MAX＝9：GOSUB 1390：C＝ E
540 GOSUB 1520
558 PRINT＂Input Humidity＂：PRIN

TM（Ex．input 5\％for 56\％hum
idity）＂
568 MIN＝0：MAX＝108：G0SUB 1486：H
$=E$
570 GOSUB 1520
5 Sg PRINT＂Input Temperature in
Fahranheit＂\＆PRINT＂（ax．63
＝ 63 deg．F）＂
599 MIN＝－136：MAX＝130：GOSUB 1489
：T－E
6 GD GOSUB 1520
610 REM FORECASTS
620 IF BP $>29.9$ THEN 715
63 IF（W）＝1 AND W＜-5 ）AND BD＝4
AND BP＞29．7 THEN 860
645 IF（ $W>=6$ AND $W<=8$ ）AND（BD）
$=1$ AND BD $(=3)$ AND $T>75$ AND
H＞GE THEN 915
65® IF（ $W>=6$ AND $W<=B$ ）AND（BD＝
2 OR BD＝3）THEN 930
660 IF BP $>29.7$ THEN B16
676 IF（BD＝2 OR BD＝3）THEN 1640
6日g IF（W）＝1 AND $W<=5$ ）AND BD＝4 THEN 1110
690 IF（W＝2 OR Wm3）AND BD＝5 TH
EN 1120
701 BOTD E10
710 IF（ $W$ ）$=6$ AND $W<=\theta$ ）AND（BD＝
1 OR BD＝3）AND T＞75 AND H＞7
9 THEN 950
720 IF $(W\rangle=6$ AND $W\langle=8)$ AND $(B D=$ 1 OR BD＝3）THEN 976
736 IF Wس 4 AND BD $=5$ THEN 1 100＠
748 IF W＝4 AND BP＞36．5 AND（BD．
4 OR BD＝5）THEN 1 E26
75 IF IF $(W=4$ OR $W=5)$ AND $B D=4 \mathrm{TH}$ EN 1869
768 IF（WE4 OR W＝5）AND ED＝5 TH EN 1689
778 IF（Wm3 DR W＝4）AND BD＝4 TH EN 1096
7日の IF W＝5 AND（BD＝4 DR BD＝5）T HEN 86\％
790 IF $(W=1$ QR $W=2)$ AND $B D=4 \mathrm{TH}$ EN $114 \%$
日en IF（ $W=1$ DR $W=2$ ）AND $B D=5 \mathrm{TH}$ EN 1166
816 ON C BOTO 1185，1216，1266， 1280，1300，日20，1310，840
－ 840
826 LF T＞75 AND H＞68 THEN 959
日36 GOTO 131』
Q49 IF T＞75 AND H＞6E THEN 1336
850 GOTD 1340
8Gd PRINT＂FORECAST：STRONG WIN DS and HEAVY＂
87g PRINT＂PRECIPITATIDN CAN BE EXPECTED within＂
8日g PRINT＂the naxt 6－24 hours．
Lower tempera－＂
B9\％PRINT＂tures are also forec ant．＂
906 GOTO 1530
910 PRINT＂LBMALL CHANCE OF THU NDERGTORMS TODAYJ＂
920 PRINT
938 PRINT＂FORECAST：FAIR weath or can be expectad＂
946 PRINT＂for the next 24 to 3 6 hours＂：GQTO 1530
959 PRINT＂［SLIGHT CHANCE OF TH UNDERSTORMS TUDAYJ＂
968 PRINT
976 PRINT＂FRRECAST：Continumd
FAIR wrather for＂
9日® PRINT＂thi naxt 24 hours．
Tmmperaturen will＂
998 PRINT＂remain nearly conimb nt．＂：GOTD 153\％
1091 PRINT＂FORECAST：PRECIPITA TIDN can be expected＂
1010 PRINT＂in 24 － 48 hre．＂ 880 TD 1536
1020 PRINT＂FORECAST：WARMER te


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mperaturen for the＂
1830 PRINT＂next 24 hourn．＂： $80 T$ 0 1530
$164 \%$ PRINT＂FGRECAST：Clear wea ther ahead with＂
1050 PRINT＂cooler temperatures ＂ 1 EOTO 1530
1666 PRINT＂FDRECAST：HIGH WIND 3 and PRECIPITATIDN＂
167！PRINT＂within 12 hours．＂： B OTO 1536
1 10日G PRINT＂FORECAST：PRECIPITA TIDN within 24 hours．＂：GOT
0 1535
109円 PRINT＂FORECAST：HIGH WIND 9 and PRECIPITATION＂
1100 PRINT＂within 24 hourn．＂： 3 QTO 1530
1110 PRINT＂FORECAST：SEVERE we ather：stormy with＂：PRINT＂
high minde．＂：GOTD 1530
1126 PRINT＂FORECABT：Continuin －precipitation can＂
1130 PRINT＂be expected for the next 12 to 24 houre．＂：GOT
－1530
1148 PRINT＂FORECAST：GTORMS WI th HIGH WINDS within＂
1250 PRINT＂24 hours．Cooler $t$ emperatures as woll．＂a GOTO 1536
116 PRINT＂FORECASTi Prmcipita tion within 24－36＂
1170 PRINT＂hours，elightly coo 1 ar temperatures．＂sGOTO 15
30
1180 PRINT＂FORECAST：If cirrus cloudn are＂
1190 PRINT 1 increasing and beco ming more dominant＂
1200 PRINT＂WO can Expect warme $r$ wnather．＂ıGOTO $153 \%$
1210 PRINT＂FORECAST：50－Bg\％ch ance of preci－＂
1229 PRINT＂pltation within the next 24－36 houris．＂
1230 PRINT＂Chance of precipite tion will increase＂
1249 PRINT＂with the accumulati on of more cumulo－＂
1250 PRINT＂nimbus type clouds． ＂：BOTO 1530
126．PRINT＂FORECAST： $10-26 x$ ch ence of＂ 3 IF $T>35$ THEN PR
INT＂showern＂：GDTO 1538
127 PRINT＂snow flurrias＂：GOTO 1530
1286 PRINT＂FORECABT：96\％chanc －of HEAVY precipi－＂
1290 PRINT＂tation within 12－24 hours．＂：BOTO $153 \%$
1360 PRINT＂FORECAST：Chance of light pracipitation＂：GOTO 1530
1316 PRINT＂FORECAST：PRECIPITA TION With HEAVY＂
1326 PRINT＂winds in 24－4B hour E．＂s GOTO 1530
1339 PRINT＂［POSSIBILITY OF THU NDERBTORMS TODAYJ＂
1340 PRINT＂FORECABT：FAIR weat her today with 11 ght＂
1359 PRINT＂to moderate winds．＂ ：BOTD 1530
1365 REM integer input routine
1376 PRINT＂enter an integar be
twem＂；MIN；＂and＂${ }^{\text {max }}$
138 m PRINT＂，try againn＂

1408 IF Emg AND LEFT $6(E, 1)<>^{n} \Leftrightarrow$ －THEN 1376
1416 IF Eく＞INT（E）THEN PRINT＊p leace enter an intmaer＂ic $0 T 01386$

1420 IF MIN CE THEN PRINT＂too 1 Ow＂： 2 BOTO 1380
1430 IF EPMAX THEN PRINT＂too h 1gh＂：BOTO 1 JBg
1445 RETURN
1459 REM real number input rout
ine
1466 PRINT wenter a number betw
－an＂；MIN：＂and＂；MAX
147\％PRINT＂，try again＂

9 AND LEFT ${ }^{(E)}(E)$ 1）＜＞＂g＂THE
N 1460
1498 IF MINDE THEN PRINT＂too 1 OW＂：\＆GOTD 1470
1592 IF EPMAX THEN PRINT＂too h
igh＂： 8 GOTO 1478
1516 RETURN
1526 CLI：RETURN
1536 PRINT\＆PRINT M；＂／＂：D；＂／＂ $\mathrm{Y}_{\mathrm{\prime}}$ PRINT
1540 PRINT＂Tmmperature in：＂：T ＂deg．F＂：PRINT
155e PRINT＂Humidity is：＂；H；＂X ＂：PRINT
1560 PRINT＂Barometric Preseure iE：＂｜BP；＂in． $\mathrm{Hg} "$
1578 FOR J＝1 TO 35G8：NEXT J
15日6 PRINT ：PRINT \＆PRINT：PRINT
IPRINT
1590 PRINT＂PRESS 〈RETURN＞to m ake another forecast
1609 INPUT P
1610 E0SUB 1520
1620 GOTD 120

## Program 2：IBM PC／PCjr Line Changes

5 KEY OFF：DEF SEG＝6：POKE 1947，P EEK（1047）OR 64：WIDTH 4月：LOCA TE ：，$\sigma$

## Program 3：Commodore 64 Line Changes

$1390 \mathrm{E} \$=\mathrm{C"}:$ INPUT $\mathrm{E} \$: \mathrm{E}=\mathrm{VAL}(\mathrm{E} \$$ ）
$1480 \mathrm{ES="*}:$ INPUT E ：$: E=$ VAL（E ）：IF E＝0 AND LEFTS $(E \$, 1)<>"$ 0 ＂THEN 1460
1520 PRINT CHR\＄（147）：：RETURN
Program 4：Atari 400，800， XL，and XE Line Changes

E 5 DIM E（16），T\＆（14），P©（9） ：POKE 82，$£ 2$ POKE 日3，39
36 FOR J＝1 TO 999：NEXT J
KO 250 PRINT＂1．N
（4 SPACEB）2．NE
（3 BPACE日） $3 . E^{*}$
Cl 278 PRINT M4．BE （3 SPACE8）5． 3 （4 SPACES\} 6. SW"
61 290 PRINT＂ 7 ．W （4 SPACES）日．NW （3 SPACES39．ND WIND＂
 4 BPACES
MC 401 PRINT T＊I＂2．RISINB F AST＂
DA 416 PRINT T象；＂3．GLOWLY R ISINE＂
KH 420 PRINT T象：＂4．FALLINB FAST＂
of 434 PRINT T\＆：＂5．SLOWLY F ALLING＂
 ＞＂9＂OR E¢く＂も＂THEN 1378

DE 149 E EVAL（E $)$
 ＞＂9＂DR E象く＂${ }^{\prime \prime}$ THEN 1469
PI 1485 E＝VAL（E ）
A 1520 ？CHR（125）：RETURN
HN 157 FOR J＝1 TO 999：NEXT J

## Program 5：Apple II Line Changes

1520 HOME ：RETURN

## Program 6：Atari ST Line Changes

| 1 | rem delete $160,240,266,28$ 6， $3 \varnothing 0$ |
| :---: | :---: |
| 5 | fullw 2 |
| 120 | ？＂Input numbers when prom pted by ？＂ |
| 130 | ？ |
| 1520 | clearw 2：gotoxy 6，$\sigma$ ：retur n |
| 1588 | P：7：？ |

## Program 7：Amiga Line Changes

5 SCREEN 1，320，200，4，1：WINDOW 3， ＂＂，$(0,0)-(311,186), 16,1:$ WINDOW O UTPUT 34
4
4

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## Advancing Technology

Several years ago I finally bought a color television set. Prior to that time I had been content to watch TV on an old black-and-white model that had served me well. My reluctance to purchase a color TV didn't come from a lack of money; it came from a much more debilitating source-fear of obsolescence by advancing technology.

It seemed that every time I turned around, televisions were getting better. I was afraid that, as soon as I bought a TV, there would be another quantum leap in technology and I would be stuck with an "old" model. Of course, by procrastinating, I was missing out on the enjoyment that would have come from seeing my favorite shows in color. But still my fear of being stuck with old technology kept me from making a purchase.

By the time I finally bought a color TV, it had become apparent to me that electronic technology was in a continuous state of refinement and improvement, and no amount of time would be sufficient to insure that the technology had matured. I also discovered that, no matter what technology was in vogue at the time, color TV was pretty good!

## What About Computers?

I was reminded of my color-TV experience when I heard a presentation by David Moursund from Oregon State University at a conference I attended a few months ago. David's point was that computer technology is advancing at such a rapid pace that, in a mere seven years, the price one has to pay for a given amount of computing power decreases by a factor of ten.

The accompanying figure shows what I mean. Let's suppose that we can define six classes of computer technology ranging from the $\$ 10$ million super computer to the $\$ 100$ calculator. If we start our
chart at 1980, we find that in 1987 we can get mainframe power for what we use to spend for a minicomputer, a personal workstation for the price of a mini, and so on down to the ubiquitous calculator. It doesn't matter if the number is exactly seven years for all classes of machine, the point David made is well taken-computer technology is not standing still, and it probably never will.

The recent announcement of the Macintosh II-a workstation for the price of a microcomputermerely adds one more data point to the graph to help confirm the observation that we are getting more and more for less and less.

## Protecting Your Investment

While it is nice to be able to stand back and look at the tremendous rate of technological advancement, the consequences of this rapid development are less than benign for many personal computer purchasers. Many people who invested in 8bit micros a few years ago are now finding that 32 -bit machines are available for the same price they paid for a fraction of the power. Because computers are thought of as long-term investments, many computer users have invested as much in their hardware as they have in their cars. It is easy to see why many people get frustrated when a new computer hits the streets. After all, at the time of the original purchase, we each bought the best technology we could afford, and it is frustrating to see that our neighbor down the block can now spend the same amount of money for ten times the technology.

I have talked with some people who "knew this would happen" and who chose to sit out the computer revolution until "things settled down." If I thought that things were going to settle down, I would
sympathize with their plight. But, just as I missed years of enjoyment from color television, those who would continue to sit out the computer revolution are missing many opportunities for benefitting from whatever technology they can afford at the time.

## If It Isn't Broken, Don't Fix It

 If you have ever felt frustrated by finding the latest technological wonder a few months after purchasing last year's model, ask yourself this question: Does the computer you bought meet your needs? If it does, then it will continue to meet them no matter what new technology appears on the scene. If your original computer doesn't do what you wanted it to do, then you probably shouldn't have bought it in the first place.I continue to use my old Apple II for some tasks, even though I have many other more powerful computers at my disposal. For the tasks I had in mind when I bought it, my Apple II still performs well. The same can be said for my Atari 800 and my Commodore 64. Just because these machines aren't glamorous any more doesn't mean that they should be junked.

Software developers bow in front of the deity of the "installed base." The massive number of Commodore 64 s and Apple IIs insures that software will continue to be available for these machines long after they have faded from the marketplace.

## The Jalopy Of The Future

I envision an entire software industry springing up around the older computer technologies just as an industry has been created to meet the needs of those who collect old cars. By the year 2000, tinkering with eight-bit computers will be as popular as working with old Che-
vies is today. And, unlike classic cars, the low maintenance requirements of computers will guarantee that there will be enough of them around to support this industry quite well.

## Planned Obsolescence?

There are still some who subscribe to the "conspiracy" theory in which they see a bunch of greedy manufacturers who have conspired to parcel out technology piecemeal just to take perverse pleasure in yanking the public around.

This isn't what is happening at all. The simple fact is that the underlying technology behind today's computers is continuing to advance at a rapid pace, and the computer manufacturers are racing each other to bring the best possible products to the market. For example, I have wanted an Al workstation for years. Prior to the introduction of the Macintosh II, the only workstations that did what I wanted had price tags of $\$ 40,000$ or more-far outside my modest budget. As a result of new technology, I am now able to get the workstation I wanted for one-fifth of this price.

Whenever an advance of this magnitude appears, it has several consequences. One of the most important consequences is that it brings computing power into the price range of those who couldn't afford it before. This continuing downward migration of cost has long-term consequences of great value to society.

## PC's Of The Future

To take one example, let's look at the field of artificial intelligence and
expert systems. Computer science researchers have spent many years developing computer programs that are able to assist people in making complex decisions by modeling the behavior of human experts in various fields.

One characteristic of these programs is that they tend to require fast computers with a lot of memory. When Al workstations had $\$ 40,000$ price tags, the only people who could afford high-quality expert systems were the universities and large corporations. Now that the price for this type of technology has been slashed (and it will be slashed again), small companies are able to have access to the same computer power as their larger counterparts.

## Education

The one market that seems to be hit the hardest by the advance of technology is education. Our schools have to scrimp and save to purchase what few computers they have, and it is easy to see why schools are frustrated by the rapid rate of advancement in computers. It would be one thing if computers just burned out every few years, but they don't. As a result, it is very hard for administrators to get funding for new computer labs when the old computers are still working.

At the same time, there is another problem lurking in the background. Today's second grader will be finishing college in 14 yearsthe same amount of time it takes for two of Dr. Moursund's technology leaps to occur. This means that today's second grader will be entering a work force where micro-
computers will have the power of today's $\$ 100,000$ minicomputers like the DEC VAX. Will today's children be exposed to new technology as it becomes available, or will they still be using outdated computers and thus be ill-prepared for the reality into which they will be graduating?

I once asked Andy diSessa (from UC Berkeley's School of Education) why he was developing computer languages for children on $\$ 60,000$ computers. "Because," he said, "this class of machine will be priced properly for the school market by the time we finish."

He is right, of course. The key question is simply this: Would you want it any other way?

Dr. Thornburg's most recent product is Callioperw, a "nonlinear" idea processor for the Apple IIe, c, Gs, and Macintosh computers. He welcomes letters from readers and can be reached in care of this magazine.

## Attention Programmers

COMPUTEI magazine is currently looking for quality articles on Commodore, Atari, Apple. and IBM computers (including the Commodore Amiga and Atari ST). If you have an interesting home application, educational program,
programming utility, or game. submit it to COMPUTEI, P.O. Box 5406, Greensboro, NC 27403. Or write for a copy of our "Writer's Gụidelines."

You've probably already heard this from Radar O'Reilly-IBM has recently announced a new line of personal computers, completely replacing the first-generation PCs. Our unabashed dictionary defines an IBM product announcement as the event which officially marks the end of the six-month period of wondering what IBM is going to announce, and the beginning of the six-month period of wondering what exactly those announcements mean. So once again, it's time to drag out the crystal ball, and explain the true meaning of the IBM Personal System/2.

First of all, let's make it clear that none of the new computers that IBM announced-with the possible exception of the 80386 models that cost as much as a new car-do anything that the current generation of PC clones can't. Not yet, at any rate. The low-end Model 30 is an 8 MHz 8086 machine, just like the under- $\$ 1,000$ Amstrad and dozens of other clones. The AT replacements, Models 50 and 60, are 10 MHz 80286 computers, like most of the current AT clones. They all still run Microsoft's MS-DOS (now up to version 3.3 to accommodate yet another raft of minor changes). They use exactly the same software as the current PCs.

IBM has magnified the few changes made in the machines to industryshaking proportions:

- Hot New Technology. The new computers use a lot of custom IBM parts (as opposed to the off-theshelf PCs). These parts are put on the circuit boards using surfacemount technology, rather than sticking the components through holes in the board. This means that the new computers will be more reliable, and can be built by robots in an automated factory. All of the subsystems are on boards that plug
together like Lego ${ }^{\text {TM }}$ blocks. But even though the new IBM systems will be cheaper to build, they're still priced much higher than clones made the old way.
- A New System Bus. The 80286 and 80386 machines include new 16/32 bit expansion slots. This expansion architecture is extremely fast, and will provide a lot of unspecified benefits, as soon as a new line of peripherals arrives in support of it. It will even be able to configure itself for use with expansion cards so users won't need to set switches - just as they don't with a Macintosh or Amiga.
- IBM Invents The $31 / 2$-Inch Disk Drive. All of the new computers come with $31 / 2$-inch floppies as standard equipment. Of course, the Macintosh used them first, then the Atari ST, the Amiga, and even the Commodore 64.
- IBM Invents The Analog Color Monitor. The new IBMs all have built-in display adapters that support a brand-new display standard, VGA. They'll be able to display 256 colors at once in $320 \times 200$ mode, and 16 colors at once in $640 \times 480$ mode. The colors can be selected from a palette of $256 \mathrm{~K}(262,144)$ available colors. Of course, none of these computers will work with current digital IBM monitors. They all need new analog monitors, either color or black-and-white ( 64 gray scales). The Atari ST and Amiga have used analog RGB color monitors all along, although the many gray scales are an improvement over current monochrome modes.
- IBM Invents Built-In Peripheral Ports. The new IBMs all come with a minimum of 640 K memory, and built-in serial, parallel, and mouse ports. Of course, the Mac, ST, and Amiga all have. .. .

In short, IBM has updated its computer lineup to current standards. In some cases-as with its
new graphics adapter, and optional high-density 1.44 -megabyte $31 / 2$ inch floppy disk drive-it has actually advanced the state of the art. This is not to be sneered at, considering that IBM usually likes to stay several months in back of the cutting edge of technology.

So what effect will these machines have on the rest of the industry? First, they signal the triumph of the $31 / 2$-inch floppy disk. A few die-hards may fight it, but they'll eventually have to join the parade. This means that price levels for $31 / 2$-inch disks may soon drop to meet those of $51 / 4$-inch disks. Second, these machines should pave the way for higher graphics resolution modes on less-expensive home computers. A minimum resolution of $640 \times 480$ appears to be the new standard. Third, the next generation of PCs should be compact desktop units like the new IBMs, instead of the sprawling monsters built in the image of the old IBMs. Other than that, these new computers shouldn't prove to be "clone killers." IBM hasn't switched to a proprietary operating system, nor has it lowered prices anywhere near enough to cut into the home segment of the clone market.

Where IBM hopes these new machines will have an impact is with the large corporate customers. By stressing "connectivity" with their bigger computers, IBM is suggesting that everybody who owns an IBM mainframe had better stick with IBM PCs. Though their $\$ 800-$ version of DOS that interfaces with mainframe databases may be years away, they still are playing on the fears of corporate America that they may miss out on big innovations unless they remain true-blue. The rest of us who don't own an IBM mainframe can heave a sigh of relief, and go ahead and buy any computer that we want to buy. ©


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That digitized image is like a little electronic "you," and when it journeys out of your computer and into the phone system, you feel that you are going with it-riding the wild electrons.

## The "One Million Stories" Newsletter

I have ridden the wild electrons, and so have several teachers and students. It all began the other day when Sandra Pilley and her third graders sat down at their Apple computer at Hewitt Elementary School in Birmingham, Alabama, and typed in a two-page Newsroom newsletter. (Newsroom is available for $\$ 49.95$ from Springboard Software, 7808 Creekridge Cir., Minneapolis, MN 55435.) The newsletter was entitled "One Million Stories" and was written by Sandra's Skies and Wings Group. The stories were illustrated with Newsroom Clip Art cartoons.

Typical of the stories was one written by Kris Roberts called "The Loc Nas Monster." According to Kris: "It all began in the biggest swamp ever in the hotel front yard on a summer day. Snakes dropped out of trees of course. Alligators swam everywhere. Mostly some turtles looked like rocks." Crouching down in the belly of the story was a picture of a big, ugly monster, presumably the dreaded Loc Nas

## Monster himself.

After creating the story and laying it out in the Newsroom Layout work area, Sandra ejected the disk from the computer and took it home after school. That night, she booted up Newsroom on her Apple Ilc and entered the Newsroom Wire Service work area. After answering questions (like at what baud rate she planned to transmit), she typed in my telephone number and then hit Return. The computer signalled the modem plugged into Sandra's home phone, and the modem dialed my telephone number.

At my end, the telephone began ringing. Sandra had taken the precaution of calling me before she got her computer to phone me, so I was ready. I had booted up Newsroom on my home computer (it was an Apple, but it could have been a Commodore 64 or an IBM PC or compatible). My computer was in Answer mode, 50 as soon as it received the phone call, it signalled Sandra's computer that it was ready to receive Newsroom files. Sandra's computer complied, and within seconds the screen began filling up with the names of photos, banners, page layouts, and text panels from the "One Million Stories" newsletter.

After only a few minutes of transmission (at 1200 baud) I had received the entire newsletter. I told the Wire Service program to hang up my phone, and I turned on my printer and printed out the newsletter to make sure it was safe and sound.

It looked great-especially when I thought how just a few seconds before it was lots of little wild electrons riding the phone line across central Alabama.

## A Grinning, Bearded Man-Over The Wires

Sandra and her kids had left the last panel of their newsletter blank so I
could put something in it and transmit it back. I wanted to send something special, so I booted up my ComputerEyes/2 digitizer program (for more on this, see my April column). I pointed my little JVC camcorder at myself, fiddled with the controls, and captured myself on the computer picture screen-a grinning, bearded man making a $V$ sign for victory. Using ComputerEyes/2, I saved my picture as a Newsroom Photo file, and then booted up Newsroom. I added a caption to the photo, and, in the Layout work area, I tucked the photo onto the tail end of the Skies and Wings' newsletter.

A moment later I was on the phone calling Sandra's house. I couldn't wait to tell her. I was ready to send back the entire newsletteralong with my digitized photo. I had forgotten only one thing: It was almost one in the morning-on a school night!

A sleepy Sandra Pilley came to the phone and then turned on her computer and booted up Newsroom one last time. Five minutes later I entered the Wire Service and told the computer to dial Sandra's number and send the newly modified newsletter.

And it was sent-without a hitch. For the first time ever, Sandbox Fred got to ride the wild elec-trons-along with the Loc Nas Monster, the Magic Rock, and Mr. Fuzzy the spider (who lived in Kris Roberts' desk and ate Mrs. Pilley's lunch).

I was dying to find out if Sandra had received the newsletter successfully and if she liked my digitized photo.

But I wasn't brave enough to call back that night. No sir.


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## Three Questions

I have received a fair number of letters from 8 -bit owners in recent months, and most people ask one of these three questions: "Where can I find a book that tells me . . . ?" "Do you know of any program that will . . . ?" "How do I convert my Atari BASIC program to assembly language so that I can . . . ?"

Although all your questions are slightly different, I have a few answers that will work for most of you, regardless of the ending you would like to put on any of the questions.

First, it is an unfortunate fact that many of the best books for the 8 -bit Atari computers (400, 800, and $\mathrm{XL} / \mathrm{XE}$ series) are no longer in print. I would like to hope that some enterprising publisher might decide to reprint a few of the best of these in limited editions, but I am not going to hold my breath until that happens. In the meantime, your best bet is to try to track down a copy now, while there are still a few in dealers' hands. What books am I referring to? There are so many books that would make my "nice to have" list that I can't possibly list them here, so, instead, here (reluctantly) is a limited list of what I consider my own, personal "basic necessities" library.
For all programmers:

- COMPUTE's Mapping the Atari and then either
- Your Atari Computer by Lon Poole or
- $A B C^{\prime}$ s of Atari Computers by Dave Mentley
For BASIC neophytes:
- Atari BASIC for Kids 8 to 80

For assembly language neophytes:

- Atari Roots by Mark Andrews
- Programming the 6502 by Rodney Zaks
For those who are really serious:
- Atari Technical Reference


## Manuals from Atari

and, perhaps the hardest to find:

- Atari Graphics and Arcade Game Design by Jeff Stanton

Some of these are still pretty easy to find. Others have all but disappeared. Still, every so often I hear of dealers who have a nice stock of one or more of them. For example, you may have read in the May issue of COMPUTE! that B\&C ComputerVisions of Santa Clara, CA, has a stock of De Re Atari (which just barely failed to make my essentials list). I have just learned that they also have a good stock of the Atari Technical Reference Manuals. Dealers rarely advertise that they have a certain book-by the time the ad appears, they may be sold out with no way to get more copies. So call around, ask around, check with your local bulletin board, and/or leave a message or two on some of the national time-share systems that have Atari interest areas (for example, CompuServe, Genie, and Delphi).

## Ask

By now, you probably won't be surprised to find that the answer to that second question is about the same: Ask. About the only kind of programs you can not find for your 8 -bit Atari are what I call "heavyduty" programs. For example, I have yet to see a good, complete civil engineering package. Or an off-the-shelf order-entry system. The primary limitations of these small machines have always been their slow disk I/O speed and limited disk space. (Historically, there has been a more important limitation that I'll address in a future column. Ironically, I am writing this column on an 800 XL connected to a Supra 10-megabyte hard disk using ICD's SpartaDOS, and I find that this system now does everything I need. But a large percentage
of Atari owners have only one floppy disk drive, which is simply not enough for most business purposes.)

One amazing aspect of Atari software is the amount of usable public-domain software available. But until you join a user group-or, perhaps, buy a modem and call some BBSs or one of the national time-sharing systems-you will be cut off from this free software.

## Converting BASIC To ML

The final question listed above is actually the most interesting to me: "How do I convert my Atari BASIC program into machine language?" The first and most obvious answer: Buy a BASIC compiler. I don't want to belabor this topic now, but you should know that Atari BASIC is an interpreted language. It is not fast. If you could compile your program into machine language, it would run much faster. (Of course, getting a better BASIC interpreter will also speed up your programs.) Remembering my advice above about finding Atari software, you might be able to find such a compiler. But even compiled BASIC doesn't come close to what is possible in assembly language. (Did you notice my shift from machine to assembly language? There is a technical difference between the two, but it is one we can ignore.)

Many, many articles have been written that provide you with handy machine language subroutines that you can call with Atari BASIC's USR function. For example, also in the May issue, Rhett Anderson presented a set of routines for doing bitwise operations via USR calls. The problem with most of these routines: They all tend to reside in the same hunk of Atari memory (the so-called Page 6, memory locations $\$ 600-\$ 6 \mathrm{FF}, 1536-$ 1791 decimal), so you can use only one or, perhaps, two at a time.

What happens when you need about 20 or 30 machine language subroutines? I did a whole series of articles, once upon a time, on writing self-relocatable code, machine language routines that can be loaded anyplace in memory; but it seems I was fighting a losing battle. In truth, though, it may be just as well: If you are ready to use 20 or 30 major assembly language routines, why not write the entire program in assembly language?

To do so, you need to learn two things: First, how to program in assembly language. Second, how BASIC performs its various operations. The first of these needs is answered by the books I mentioned in the first part of this article. And some of those books also go far, far beyond what Atari BASIC is capable of. But nobody seems to have written a book that shows, in a simple direct manner, how to convert the most common and useful operations of Atari BASIC into assembly language.

In particular, the topic of Atari graphics is poorly covered. There have been volumes written on display-list interrupts, playermissile graphics, custom character sets, and so on. But how does one do a simple little PLOT in assembly language? Finding the answer to that is like looking for the proverbial needle in a haystack.

When I first saw how welldesigned the Atari Operating System (OS) was, I was impressed. That was more than eight years ago, and I still think it is the best OS in the world of small machines. I think you'll agree when I show you next month how little work Atari BASIC must do to perform such seemingly complex operations as GRAPHICS, PLOT, and DRAWTO.

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## 三्डCAPUTE!

## Atari Laser Chess

A number of lines appear twice in the listing for the Atari version of this game from the June issue. When entering Program 3, simply ignore the duplicate lines 2002021060 on page 48.

## Applesoft Memory Management

The "Readers' Feedback" column from the June issue included a question about moving an Applesoft BASIC program in memory to the area above high-resolution screen page 1. There is an error in the program line provided in the answer to this question (p. 52). The final command in the line should be RUN rather than LOAD. The complete line should read as follows:
5 IF PEEK(104)<>64 THEN POKE 104,64: POKE 16384,0: PRINT CHR\$(4)"RUN PROGRAM"

## Font Printer For The IBM PC/PCjr

There are no corrections for any of the programs that accompany this article from the May issue (p. 79). However, the instructions for using the printing segment, Program 2, neglected to mention that disk drive names (A:, B:, and so forth) should always be entered in uppercase. Although the computer understands that A: and a: both refer to the same drive, the program does not. Also, the article states that, when using the same drive for document and font disks, the program will beep twice when it's time to change disks. Actually, only one beep is sounded.

## Using Variables

I've recently had several letters asking about variables, so we'll examine that topic this month.

A variable name is a label given to a value that represents a number or string. The value of the variable may change while the program is running.

For example, in the early part of a program you may define $N$ to be 5 ( $\mathrm{N}=5$ ), so variable N will have the value of 5 . Later in the program you may redefine N with $\mathrm{N}=8$. You may also use an expression such as $\mathrm{N}=\mathrm{N}+1$. This expression means to replace value N with $\mathrm{N}+1$. If N was 8 , it becomes $8+1$, or 9 .

You will want to use a variable name whenever you are working with numbers or strings that could change. For example, you could use the variable $S$ for Score. As points are made, you increment $S$.

A string variable name ends with a dollar sign. For example, you may read in from DATA a value for NAME\$, print NAME\$, read in another NAME\$, and so forth.

## Variables And Constants

Many statements specify parameters which may be numeric constants or variables. Using variables allows changes to be made rather easily. For example, consider drawing graphics on the screen. Let's say you want to draw a train car that has four wheels visible. The center of the first circle can be specified with variables X and Y . The center of the next circle can be relative to the first, with $X+20$ and $Y$. The third circle may be $X+80$ and $Y$, and the fourth may be $X+100$ and Y. Before you draw the four circles, you need to define $X$ and $Y$, so you can use the CIRCLE command to draw the wheels. Now let's suppose the wheels are not positioned quite right. They need to be higher and a bit more toward the center of the screen. If you had used con-
stants in the CIRCLE commands, you would need to change the constants in the four CIRCLE commands. However, by using variables, all you need to do is change the definitions of $X$ and $Y$.

Another place I like to use a variable is as a timing function in music commands. Use a variable such as N for a quarter note. An eighth note would be $N / 2$, and a whole note, $\mathrm{N}^{*} 4$. You can write all the sound commands in terms of that variable duration and define N at the beginning of the program. To speed up or slow down the whole piece, you simply need to change one statement defining the duration N -not every sound command.

Another example of variable usage is to define the variables and then call a subroutine that uses them. For example, you might have a subroutine that draws a hexagon with a starting point of row R and column C and with the length of a side equal to $S$. To draw a hexagon on the screen, simply define $\mathrm{R}, \mathrm{C}$, and S; then GOSUB for the drawing routine. To draw another hexagon, redefine $R, C$, and $S$; then GOSUB.

## Naming Variables

How do we name variables? Most versions of BASIC specify that a variable name must contain alphanumeric characters (letters plus numbers) and must start with an alphabetic character. Some BASICs allow certain symbols such as the underline or the at sign (@) to be part of the variable name.

There are just a couple of restrictions. Some computers recognize only the first two characters of a variable name, even though the name may actually be longer. In such a case, the variables BLACK and BLUE would be considered the same variable-BL. Some computers do not allow a variable name to contain a reserved keyword. For ex-
ample, FORK, KNIFE, and SPOON would not be acceptable variable names because they have the embedded keywords FOR, IF, and ON. Newer computers are allowing longer variable names and aren't so picky about embedded words.

Also, BASIC does not recognize a difference between lowercase and uppercase letters. Thus, STARSHIP, Starship, and starship all represent the same variable.

Many of the early BASIC programmers started programming in FORTRAN. Any integer variable in FORTRAN had to start with $I, I, K$, $L, M$, or $N$. Out of habit, the programmers carried over that tradition to BASIC and used those letters for variable names in FOR-NEXT loops or as counters or flags. You can choose much more meaningful variable names, such as FOR ROW $=1$ TO $24 \ldots$ NEXT ROW.

Another habit from the early days of micros was using $A$ for the first variable used in a program, $B$ for the second, and so on. Back when computers had small memories, it really helped to use variable names with just one letter. I also recall that some of the early machines tracked the variables in alphabetic order, so it was faster to use variables from the first part of the alphabet.

Now, with faster and largermemory computers, the trends for naming variables are changing. Most programmers like to use variables that mean something. Rather than $A, B, C, X$, and $Y$, you might see names such as AREA, LENGTH, NUMBER, FLAG, SCORE, and HIGH_SCORE. This is a way of documenting your program. Also, you'll find it much easier to keep track of variables if you name them meaningfully-and using meaningful variable names is one of the advantages often listed for programming in Pascal. Now you can do the same in BASIC.

## Computer III-The Verdict

Good news for telecomputers comes from Washington, D.C. In April, the Federal Communications Commission ruled on two items that were of keen interest to online computer users. The FCC ruled against regulation of networkbased information services and prohibited the Bell Operating Companies (a.k.a. the phone companies) from offering information services of their own.

This means that commercial information services and services such as Telenet's PC Pursuit will not be forced to pay access charges for interconnecting their private networks to the local phone system. It was widely felt that the access charges would have been passed on to the consumer in the form of higher hourly connect-time rates. The FCC ruled that, since there is currently no competition for local phone service, the BOCs would have an unfair competitive advantage over independent information providers. Apparently, the FCC noted the influx of mail from the telecomputing community. Many thanks to the readers of this column who wrote the commission to express their views on Computer III.

## Exchange Shut Down

Even without new regulations from the FCC, PC Pursuit is still experiencing some growing pains. Pursuit recently had to axe 20 exchanges from its San Francisco service area because of higher-than-expected costs. If local phone companies in other cities raise their rates, service to more exchanges may have to be dropped. Some users have also been grumbling about the lack of 2400 bps service on Pursuit. Implementation of 2400 bps Pursuit links is still in beta test and over a year tardy. Rumor mongers claim that the holdup is throughput little better than the current 1200 bps due to
network congestion and delays.

## Going Once, Twice . . .

Reader's Digest has apparently decided to forego the videotex market and stick with the printed page. In April it sold off The Source to a group of venture capitalists. Although the author of this column could not contact any of the parties involved, they would have surely stated "By George! Some fellow at COMPUTE! predicted that this would happen last January!"

## Daylight Savings Time

CompuServe subscribers may not have to wait until dinner is over to link up with the service at budget rates. As of late the service has been experimenting with lowering its daytime hourly connect charges. During April and May, prime time rates were made the same as standard evening and weekend charges ( $\$ 6$ per hour for 300 bps and $\$ 12.50$ per hour for 1200 and 2400 bps ). If the trial is successful, don't be surprised if the lower daytime rates become permanent.

## Polly Want A Modem?

Last month's column briefly touched on the new wave of compact, battery-powered modems that are finding favor with laptop computer users. Novation, a long-time manufacturer of data communications equipment for the computer hobbyist, has just upped the ante in the compact modem market. Novation's new "Parrot 1200 " is a $300 / 1200$ bps unit that supports the Hayes "AT" command set and is roughly the size of an audio cassette. The Parrot sports four indicator lights and a speaker for monitoring the progress of calls, and it requires no batteries or AC power transformer. When the modem is activated, all required power is drawn directly from the RS-232
port. The most impressive feature of the Parrot 1200 is the suggested list price of $\$ 119$, well under the $\$ 200-\$ 260$ price of its competitors.

## So Sue Me ...

Having grown tired of letting spreadsheet software firms hog the "Lawsuit of the Month" spotlight, communications firms struck back in April.

A U.S. District court ruled that Softklone Distributing's Mirror infringed on the copyright of a screen display of Crosstalk, a popular communications program for the IBM PC and compatible computers. The hot issue was one screen of Mirror, which was virtually identical to Crosstalk's primary status screen display. At best, the court's ruling was a modest victory for Crosstalk distributor DCA, who had sought a more extensive "look and feel" infringement ruling. Softklone responded by immediately shipping a new version of Mirror in which the structure, capitalization of words, and highlighting of the screen in question had been modified.

No sooner had Mirror vs. Crosstalk been put to bed than another U.S. District Court ruled that US Robotics and Hayes Microcomputer Products will duke it out in the courts. The court refused to dismiss antitrust charges brought by USR against Hayes, who had asked that the suit be tossed on the grounds of improper filing and bogus claims. The US Robotics suit charges Hayes and Business Computer (Bizcomp) with attempting to monopolize the personal computer modem market. It's likely that the dust won't begin to settle until the summer of 1988, at which time the ghost of Herman Hollerith will likely appear and sue the computer industry at large for appropriating the "look and feel" of the ASCII character set.

## Using Your Printer With The Amiga


#### Abstract

One of the most misunderstood aspects of the Amiga is how its printer device works. Most computers use a "dumb" printer device, like the MS-DOS device PRN:, that sends each character to the printer exactly as it receives it. When you want to make your printer perform a special function, like underlining or boldface print, you use this device to send a special sequence of characters to the printer. Such a sequence of characters is sometimes called an escape code, since most start with the escape (ESC) character, ASCII character 27. Escape codes vary from printer to printer, so the command to start underlining on one printer may not mean a thing to another printer. So every IBM program has to know the specific codes for your printer in order to activate its special features. For example, each word processor comes with its own collection of printer driver files that tell it how to use the special features of each printer. Since there's no standard format for IBM printer driver files, the WordPerfect printer drivers won't work with Microsoft Word.


## The Amlga's Answer

The Amiga, on the other hand, has a "smart" printer device called PRT:. This device uses the settings that you've saved with the Preferences program to find out all about your printer (these preferences are saved in a file called System-Configuration in the Devs directory of the Workbench disk). PRT: checks to see which printer you've selected from the Change Printers screen of Preferences. The device reads in the printer driver file whose filename corresponds to the printer you've selected (it looks for this file in the Devs/Printers subdirectory). This printer driver file tells PRT: what special features your printer supports and how to access them. It also
contains a program for printing screen graphics on your dot-matrix printer.

With the Amiga's smart PRT: device you don't have to know the printer-specific code for each special feature. Instead, you send it an Amiga-specific code, and PRT: translates that into your printer's own code. If your program wants the printer to start underlining, for example, it sends the Amiga-specific code ESC[4m to PRT:, and PRT: sends your printer the correct code to start underlining. The important thing to remember is that not only will the PRT: device not respond to your printer-specific escape codes, it will also not even pass them on to your printer. Any escape code that PRT: doesn't recognize will be ignored.

Of course, you can still send escape codes directly to your printer via the Amiga's dumb printer device, PAR:. This device sends characters straight through to printers connected on the parallel port. The SER: device sends them to serial printers. But if at all possible, you should try using the Amiga's codes and PRT:. That way, your program will work with any printer, and, should you happen to switch printers six months down the road, you won't have to rewrite the program completely.

The following short BASIC program shows you how to send commands to your printer through either the dumb or smart printer devices. Since the Toshiba printer that I use is not that common, odds are the sample codes used for the PAR: device won't work with your printer. But, the PRT: version should work with any printer, provided that the proper printer driver is installed from Preferences.

[^4]Toshibs printers
OPEN "PAR:" FOR OUTPUT AS 14
$\mathrm{FS}=\mathrm{CHRS}(27)+{ }^{4}["+\mathrm{AS}+$
$\mathrm{G} \$=\mathrm{CHRS}(27)+"] "+\mathrm{BS}+\mathrm{CHRS}($ 13) 4

GOSUB DoPrint 4
4
PRT: device - works with ANY $p$ rinter
OPEN "PRT:" FOR OUTPUT AS 14
FS $=$ CHRS $(27)+{ }^{16}\left[4 w^{\prime \prime}+A \$ 4\right.$ $\mathrm{GS}=\mathrm{CHRS}(27)+{ }^{\prime \prime}\left[3 w^{\prime \prime}+6 \$ 4\right.$ GOSUB DOPrint: END4

DoPrint: 4
PRINT 1 : : PRINT \#1, FS:G\$
CLOSE \#1 : RETURN4
A full list of Amiga printer escape codes can be found on pages 22-25 of "Introduction to Amiga Update" in the manual that comes with Version 1.2 of AmigaDOS. Here are a few of the more commonly used codes. Remember that ESC stands for CHR\$(27), the escape character.

| Feature | On | Off |
| :--- | :--- | :--- |
| Italics | ESC[3m | ESC $[23 \mathrm{~m}$ |
| Underline | ESC[4m | ESC $[24 \mathrm{~m}$ |
| Bold | ESC[1m | ESC[22m |
| Expanded | ESC[6w | ESC[5w |
| Condensed | ESC[4w | ESC[3w |

The secret to using PRT: is having the correct printer driver file installed on your Workbench disk. What if you have an odd printer that isn't supported directly? First, you might try finding a public-domain driver on a BBS or an information service, or a commercial driver from a software company. But if you can't find one, you might try making one yourself with a shareware program called PrtDrvGen by Jorgen Thomsen. This impressive program can help create a driver for almost any conceivable printer, from 8 pins to 24 pins, black-and-white or color. The program comes with a fantastic set of help screens that give a great deal of insight into how PRT: uses the printer drivers. At a suggested donation of $\$ 10$, it's the best software bargain of the year. You can contact Jorgen on CompuServe (ID 71310,2206) or PeopleLink (J.THOMSEN).

## Journey From The Center Of The ST: Part 2

Our tour of the ST's system software began last month with a look at the three elements of its operating system: BIOS (Basic Input/Output System), XBIOS (Extended BIOS), and GEMDOS (GEM Disk Operating System). This month we'll conclude by examining GEM, the user interface that lets you control the operating system.

## Who Needs An Inferface?

An operating system, as we noted earlier, gives the computer the basic equipment needed to perform useful work. But without a user interface of some kind, you still can't make the system do your bidding. In older systems such as $\mathrm{CP} / \mathrm{M}$ or MS-DOS, the user interface is the notoriously unfriendly command line, which waits for you to type in some magic words and responds with an electronic raspberry if you use the wrong lingo or make a typing error. GEM replaces the command line interface with a graphics interface. As on the Macintosh or Amiga, the screen depicts a work surface populated with graphic objects whose form suggests their purpose: The trash can is where you discard unwanted material, for instance. And this interface is mouse-driven instead of keyboarddriven: Rather than type arcane commands on a keyboard, you use a mouse pointer to manipulate graphic shapes.

In terms of ultimate results, the GEM desktop doesn't differ notably from, say, the MS-DOS command line: Both interfaces allow you to run programs, shuffle files around, and find out what's on a disk, for example. But the way you do those jobs is very different. By substituting a set of related visual metaphors for a list of gobbledygook commands, GEM, the Graphics Environment Manager, creates a coherent little world in the computer which is certainly easier to learn, if not inher-
ently more efficient, than the old command line environment.

GEM is composed of three major parts, known as VDI (Virtual Device Interface), GDOS (Graphics Device Operating System), and AES (Applications Environment Services).

## VDI

VDI, which includes well over 100 functions, is concerned mainly with drawing and text operations. There are VDI routines to draw points, lines, and polygons, fill enclosed areas, display and manipulate text, control screen colors, and so forth. The name Virtual Device Interface underscores an important characteristic of GEM, which is that it's designed for device-independent graphics output. Unlike the Macintosh and Amiga graphic interfaces, GEM was not written with a specific host computer in mind. In theory, at least, it can work on a variety of machines, which may have different screen sizes, numbers of colors, and so on. Accordingly, VDI allows you to write programs that aren't tied to specific hardware. Thus, rather than program specifically for a particular device like the ST color monitor (although that's always an option), you can program for a virtual, or ideal, display device, unconcerned about such details as the number of dots or colors on the physical screen. In effect, a deviceindependent program says to the system, "I don't care how you get it done, just do it."

## GDOS

It's the task of GDOS, the Graphics Device Operating System, to help translate ideal, device-independent graphics requests into output on an actual device. Just as a disk operating system mediates between a program and file-storage hardware, GDOS mediates between a program and graphics hardware. As an
example of what GDOS does, consider a desktop publishing program, which needs to support a variety of printing devices and a number of different text fonts. GDOS allows such a program to load fonts and device drivers as needed, and to access them once they're in memory.

## AES

At the top of the GEM/TOS software hierarchy is AES, which stands for Applications Environment Services, This group of routines gives life to the surface characteristics of GEM: the mouse pointer, menus, windows, icons, and interactive dialogs.

A single AES routine can do a lot, and it may call on several other levels of system software. Consider, for instance, the familiar file-selector dialog used to choose a filename in GEM applications. To create this dialog, GEM must first save the contents of the screen underlying the dialog box and draw the box with all of its gadgets in place. Then it must respond to your manipulation of the box, displaying the contents of whatever disk and subdirectory you choose. When you choose OK, GEM remembers the DOS path and filename that you have chosen and erases the box, restoring the image that previously occupied that area. All this is done with just one call to the AES routine known as fseL input. In addition to such large-scale routines, AES has routines to handle GEM's smaller details, like the shape of the mouse pointer.

We've covered a lot of ground. There still are a few minor items floating around at the operating system level (line A exceptions, for instance, or intelligent keyboard processing). But if you understand what makes up TOS and GEM, you know basically what's inside the ST.

# Fishing in The Washington Post 

If you think that Dow Jones News/ Retrieval is a source for business and financial information, you're right; but it also has a considerable amount of general information such as book and movie reviews, weather reports, sports scores, and even a discount shopping service. And there's one rich deposit of consumer information that's often overlooked because it's stashed away with the business data.

The DJNR has a full-text search and retrieval service for a variety of business and financial publications including The Wall Street Journal, The Dow Jones News Service, Forbes, Barron's, and The American Banker. It also has electronic copies of The Washington Post dating back to January 1984, and the issues of that newspaper are full of consumeroriented columns and features.

Let's check out what the Post has to say about saltwater fishing. We'll assume that you have a modem, communications software, and an account with Dow Jones News/Retrieval, and that you know how to use all three. If not, you can open a News/Retrieval account by by calling 1-800-257-5114 (toll-free) or 1-609-452-1511 (in New Jersey). After signing-on to DJNR, type / /TEXT to bring up the text-retrieval database and to display the opening menu. This is the point where you select The Washington Post-number 3 on the menuas the source you want to search.
//TEXT prompts for your input by typing a number; you may enter queries in upper- or lowercase letters, but do not use any punctuation like commas or periods. The DJNR Guide shows many examples of how to enter search terms. The first thing I do in //TEXT is turn on the detail switch so I can see the particulars of a search. Notice that //TEST commands begin with two periods; this is to distinguish them
from search terms.
1: ..set detall=on
Next we want to look for arti-cles-documents is the term DJNR uses-that have to do with fishing. These could contain the word fish, fisherman, fishing, or some other variation of fish, so we'll use the //TEXT wild-card symbol to look for fish with any ending. (This works much like the * symbol in DOS DIR.)
1: fishs
DJ/NRS
PAGE 1 OF 11
00001 FISHS
E1417 • TOO MANY WORDS FOR FISHS-
QUERY ACCEPTED WITH WORDS AND
COUNTS FOR TERM ONLY UP TO THE
OVERFLOW.

FISHS

| FISH |  |
| :--- | ---: |
| FISH.FROM | 3816 DOC |
| FISHIN | 1 DOC |
| FISH- | 2 DOC |
| FISH-AND-CHIPS | 1 DOC |
| FISH-AND-LEMON-GRASS | 1 DOC |
| FISH-AND-VEGETABLE | 1 DOC |
| FISH-BELLY | 1 DOC |
| FISH-BONING | 1 DOC |
| FISH-BOWL | 1 DOC |
| FISH-BUYLG | 1 DOC |
| FISH-CLEANING | 1 DOC |
| FISH-COUNTER | 3 DOC |
|  | 1 DOC |

After a minute, DJNR reports more than three thousand documents in The Washington Post database that contain fish in the text. It then it starts to list the first of 11 pages. Obviously, this is too many for us to review; we need to narrow our search to a more manageable size. Let's try entering (SPORT OR SPORTS) SAME AS FISHING for a search term. This says we're looking for all articles that have the words sport or sports in the same paragraph as the word fishing. The results are:

2: (sport or sports) same fishing
DJ/NRS SEARCH MODE
00002 (SPORT OR SPORTS) SAME FISHING

| SPORT | 3062 DOC |
| :--- | :--- |
| SPORTS | 28586 DOC |
| FISHING | 1904 DOC |

RESULT 143 DOC
Now we're down to something
more manageable, but we still can't review 143 documents. Suppose we also restrict the search to those articles that contain the word saltwater. We don't have to reenter the search term used in number 2, but rather we can add to it as follows:
3: 2 same saltwater
DJ/NRS SEARCH MODE
000032 SAME SALTWATER
2 (SPORT OR SPORTS) SAME
SALTWATER
RESULT
143 DOC
114 DOC
5 DOC
Now we're down to just five articles. We could print all of these and use the capture feature of the communications software to save a copy in a disk file for leisurely reading when we're offline. But downloading even five documents can take a long time, and, since DJNR charges by the minute, we want to minimize the length of time we're connected. Instead, we want to review the headlines (HL) of these five documents along with the dates (DD) they were written, then decide which ones are worth a further look.

An alternate strategy is to read the first page of each of the five articles and then make a decision. I suppose a professional researcher would choose that method since it's more thorough, but it does take longer-and I've had very good results looking at just the headlines. It's very important to include the accession number (AN) in the display because, once we've decided on an article, we can use that number to retrieve the document without having to redo the search.

We'll use the ..CP (Continuous Print) command so the display won't pause at each screen-however this command is dangerous to use for anything that might produce a large amount of output because there's no way to stop it. Even if we hang up the telephone, the computer will continue to
"print" the information and we'll get charged for a lot of time. The ..P (print) command pauses after each screenful of information, giving us a chance to stop the printing. Nevertheless, ..CP is safe enough for just printing headlines.
4: ..CP HL,DD,AN/DOC=1-5
DOCUMENT 1
AN 840323-0057.
HL INFORMATION FOR FISHERMEN:
THESE FOLKS CAN HELP YOU OUT
DD 03/23/84
To save space, I've included only the first headline, but some of the other titles were "Fishermen Take Last Legal Rockfish" and "Sporting Life." We can print this article now by entering ..CP $/ \mathrm{DOC}=1$ (don't forget to turn on capture so you'll save a copy to disk), or we can logout of Dow Jones News/Retrieval and go back next week or next month to print the article. For example, there's no need for you to reproduce the search if you'd like to read this piece: Just enter a search term to locate the article by its accession number (1: 840323-0057.AN.), and then'enter the ..CP /DOC=1 command to print it.

Using the //TEXT database can be a little intimidating for firsttime users, but the key to successas in most things-is advanced planning. Write down search terms and commands before you call DJNR, and leave the capture active during the entire session. That way you'll have a record of everything. Good fishing.
Donald B. Trivette is the author of A Guide to Dow Jones News/Retrieval published by COMPUTE! Books. ©

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# P/M Magic 

Gary Costanza


#### Abstract

"P/M Magic" is a complete tool for the Atari BASIC programmer who wishes to use Player/Missile ( $\mathrm{P} / \mathrm{M}$ ) graphics. It's a machine language program that enables fast movement and animation of both players and missiles from BASIC. With this system, you can create arcade-quality graphics and animation without being a machine language expert.


" $\mathrm{P} / \mathrm{M}$ Magic" is designed to handle all the aspects of arcade graphics that BASIC can't handle. And because it runs as a background task, during the computer's vertical blank interrupt, $\mathrm{P} / \mathrm{M}$ Magic is invisible to BASIC, doing its work without slowing down BASIC operations. Here are some of the features that P/M Magic provides:

- High-speed animation of two players
- Eight-direction missile firing logic for two players
- Player and missile movement limits
- Missile collision detection and automatic missile reset
- Two players control with one joystick
- Multicolored, double-width, or shadowed players
- Detailed and realistic explosions
- Variable speed for players and missiles
- Works with any graphics mode, in one- or two-line resolution


## Typing In P/M Magic

To show what $\mathrm{P} / \mathrm{M}$ Magic can do, this article includes three demonstration programs. Before you can use any of them, you must type in Program 1 and LIST it to disk or tape. This program is a loader which puts all of the P/M Magic machine language routines in memory. It's important to use LIST instead of SAVE when saving Program 1, because you will later need to use ENTER to merge it with the three demonstration programs. Don't try to run Program 1; it isn't designed to be a stand-alone pro-gram-it's a subroutine to load the P/M Magic routines into memory.

After you enter Program 1 and LIST it to disk, type in and save Programs 2-4. The lines from Program 1 must be merged with each of these programs in order for them to work. Thus, to run Program 2, you would load Program 2, then ENTER Program 1 to merge its code with the program lines already in memory. When that step is complete, run the program. For example, if you saved Program 2 on disk with the name DEMO1 and Program 1 with the name PMMAGIC, then the steps for running Program 2 would be as follows:

## LOAD "D:DEMO1" <br> ENTER "D:PMMAGIC" <br> RUN

The same process is used for Programs 3 and 4 . If you like, the complete, merged versions of Programs 2-4 can be saved for future use.

This will eliminate the step of having to ENTER the lines from Program 1 each time.

We'll discuss each demonstration program in detail later in this article. In order to understand them fully, however, you should first note a few facts about the way that $\mathrm{P} / \mathrm{M}$ Magic uses the computer's memory. This information is vital if you wish to use this utility in your own programs.

## Memory Management

As noted earlier, P/M Magic works in the background, allowing you to run BASIC programs while it is active. To communicate with $\mathrm{P} / \mathrm{M}$ Magic, you must place information somewhere in memory where the utility can find it. P/M Magic uses most of memory page 6 (locations 1536-1699) for this communication. By PEEKing or POKEing certain locations in page 6, you can tell P/M Magic exactly what you want done. The locations and their usage are detailed in Figure 1 and in the table.

P/M Magic resides at the high end of RAM and requires 4 K (4096 bytes) of memory. To protect this memory area, you should perform POKE 106,PEEK(106)-16 before POKEing the machine language into memory. That statement moves the computer's RAMTOP pointer 4 K lower in memory, making the computer think it has 4 K of memory less than it actually has.

As shown in Figure 1, this 4 K memory block will hold three

things: the $\mathrm{P} / \mathrm{M}$ Magic machine language program itself, data which the program uses for player animation, and $\mathrm{P} / \mathrm{M}$ RAM. The program itself occupies about 1.5 K and starts at the beginning of the 4 K block. The animation data area begins 1.5 K higher in memory (point A in Figure 1). The amount of memory available in this zone depends on the $\mathrm{P} / \mathrm{M}$ resolution, which is 1280 bytes for one-line resolution and 1920 bytes for two-line resolu-
tion. The $\mathrm{P} / \mathrm{M}$ RAM area starts at either point $B$ or $C$, using eight 2 K for one-line resolution and 1 K pages for two-line resolution. Since a certain amount of P/M RAM is unused (the first 384-768 bytes, depending on resolution), it is used for animation data storage.

## Running The Demos

With that information in mind, let's examine the demonstration programs. Note that all of them begin

## Important Memory Locations

1536 Player 0 animation; POKE with frame number
1537 Player 1 animation
1540 POKE with 1 to disable Missile 0
1541 POKE with 1 to disable Missile 1
1542 Missile 0 's X offset from Player 0
1543 Missile 0's $Y$ offset from Player 0
1544 Missile 1's $X$ offset from Player 1
1545 Missile 1's $Y$ offset from Player 1
1546-47 Player 0's left limit; Player 0's left limit plus 1
1548-49 Player 0's right limit
1550-51 Player 0's top limit
1552-53 Player 0's bottom limit
1554-55 Player 1's left limit
1556-57 Player 1's right limit 1558-59 Player 1's top limit
1560-61 Player 1's bottom limit
1562-63 both missiles' left limit
1564-65 both missiles' right limit
1566-67 both missiles' top limit
1568-69 both missiles' bottom limit
1570 POKE with 1 to allow Player 1 to be program-controlled
1587 X position of Player 0
1588 Y position of Player 0
1589 X position of Player 1
$1590 Y$ position of Player 1
1591 X position of Missile 0
1592 Y position of Missile 0

1593 X position of Missile 1
$1594 Y$ position of Missile 1
1600 Player 1's change in $X$ position; use when under program control (POKE with $0,1,2,3,255,254$, or 253)
1601 Player 1's change in $Y$ position
1610-1625 players' horizontal speed
1626-1641 players' vertical speed
1642-1657 missiles' horizontal speed
1658-1673 missiles' vertical speed
1674 POKE with 1 to stop Player 0
1684 Missile 0 to Playfield 0; collisionsPOKE with 1 to enable
1685 M0 to PF 1
1686 M0 to PF 2
1687 M0 to PF 3
1688 M1 to PF 0
1689 M1 to PF 1
1690 M 1 to PF 2
1691 Ml to PF 3
1692 M0 to Player 0
1693 M0 to P1
1694 M0 to P2
1695 M0 to P3
1696 M1 to P0
1697 M1 to P1
1698 M1 to P2
1699 M1 to P3
1744 POKE with 1 to disable P/M Magic
by performing some setup tasks. The screen appears blank during this process, which takes about one minute.

Program 2 demonstrates several basic features of $\mathrm{P} / \mathrm{M}$ Magic. After a delay of about one minute, it displays a helicopter-shaped player on the screen, complete with a realistic shadow. Plug a joystick into port 1 , and you will be able to move the helicopter in any of eight directions (up, up and left, left, and so on). Notice that the helicopter has definite horizontal and vertical limits; when you reach the edge of the screen, it simply stops moving.

Line 10 of Program 2 reserves 4 K of memory for the purposes explained above. In line 20, RAMTOP is the first address of our reserved 4 K block, which is used to call the P/M Magic machine code. Lines 30 and 40 both compute the address where P/M RAM begins and POKE it into the $\mathrm{P} / \mathrm{M}$ hardware register, telling the computer where that zone is located. Lines 60 and 62 compute the address where our $\mathrm{P} / \mathrm{M}$ data begins.

Lines 70 and 75 set up a GRAPHICS 0 screen and temporarily turn off the screen to make the computer run a bit faster. Note that you always should perform a GRAPHICS statement after modifying the RAMTOP pointer (as in line 10); that action causes the computer to set up its display list and screen below the new location of RAMTOP, protecting your reserved memory area.

Figure 2: Player Data


Line 80 calls the subroutine that POKEs the P/M data into the area defined in line 62. In this case, each DATA line containing the $\mathrm{P} / \mathrm{M}$ data consists of 14 numbers, which contain pixel data for each of the 14 lines in the player shape (see Figure 2).

This particular player is 14 bytes tall, so each 14 -item DATA line represents an entire player shape. Once these shapes have been stored in memory, we can display any shape at will, or flip through an entire series for animation. In effect, each 14 -byte data set is one "frame" of an animated series. To switch to a new shape, POKE its frame number into location 1536 (for player 0) or 1537 (for
player 1). Frame numbers correspond to the position of the data sets in memory. For instance, the data in lines 9010, 9020, and 9030 represents frames 0,1 , and 2, respectively, and so on. Frame 0 (in line 9010) contains all zero values; it can be used to erase either player.

Notice that every player data set must have a "cushion" of two extra zeros both at the top and at the bottom of the shape (see Figure 2). This cushion is counted as part of the player's height and is necessary for $\mathrm{P} / \mathrm{M}$ Magic to function.

Line 90 of Program 2 calls a routine that POKEs some important information into the page six storage area (Figure 1). P/M Magic allows you to set horizontal and
vertical movement limits for both players and missiles. Locations 1546-1569 contain these limits, but you'll notice that two locations are provided for each limit. Simply make the second number one larger than the first, as shown in line 10010. Horizontal limits can be anything in the range $0-228$, while vertical limits can range from 0-191 for one-line resolution or 0-95 for two-line resolution. The extreme upper left corner of the screen is represented by coordinate 0,0 .

Locations 1610-1673 determine player and missile speed, and are divided into four 16-byte sections. To change the speed of any of these sections, simply change the values they contain. Two speeds are possible. For normal speed, the sections should contain 0,1 , and 255 values in the order shown in lines 10040-10060 of Program 2. For fast speed, change every 1 in those lines to 2 , and change every 255 to 254 (leave the 0 values unchanged).

Line 100 calls the routine (from Program 1) that POKEs the P/M machine code into memory. Line 120 disables missiles 0 and 1 and sets the colors for player 0 and the background. Line 122 turns on players and missiles and clears the P/M Magic disable flag. Line 123 clears all of P/M RAM and then, since the setup is complete, turns the screen back on.

At this point, we are ready to enable P/M Magic, a task that is done with USR. Here is the general form for the USR statement:
X=USR(RAMTOP,POX,POY,P1X,P1Y, HEIGHT,FLAG,RESOLUTION)

Here is an explanation of the values you must supply in the USR statement:
RAMTOP
start address of $\mathrm{P} / \mathrm{M}$ Magic
POX $\quad X$ position of player 0
POY $\quad Y$ position of player 0
P1X $\quad X$ position of player 1
P1Y $\quad Y$ position of player 1
HEIGHT height of taller player; add zeroes to bring the shorter player up to this height
FLAG set flag to allow one joystick to control two players
RESOLUTION 1 for one-line, 2 for twoline
Once $\mathrm{P} / \mathrm{M}$ Magic is enabled, a number of interesting effects are possible. For instance, the first two
demonstration programs take ad－ vantage of the feature that lets you control two players with one joy－ stick．In the first example，the play－ ers are arranged vertically to create a shadow under the helicopter．In the second case，the players are placed side by side to create an extra－wide walking figure．By over－ lapping two players，you can create the appearance of a player with three colors．

Locations 1562－1569 define the limits of a missile＇s travel． When it exceeds these bounds，it is reset automatically．Locations 1542－1545 define the missiles＇off－ sets from their respective players； when a missile is unfired，these off－ sets center a missile underneath its player，making it invisible．

The final demonstration pro－ gram moves player 1 under pro－ gram control．Locations 1600－1601 control the player＇s speed and di－ rection，using the same scheme de－ scribed earlier for locations 1610－1673．

Location 1693 is used to detect collisions between missile 0 and player 1．To enable detection， POKE a 1 into this address．When this type of collision occurs， $\mathrm{P} / \mathrm{M}$ Magic first checks location 1693 to see whether detection is enabled， then resets the missile and stores a zero in the same location．After de－ tecting a collision－with PEEK （1693）－you should store a 1 in this address as soon as you want to detect collisions again．

Avoid using the GRAPHICS statement or executing PRINT ＂\｛CLEAR\}", or the equivalent PRINT CHR $\$(125)$ ，after P／M Mag－ ic is enabled．Any of these activities can clear the RAM above the RAM－ TOP pointer，where P／M Magic re－ sides．If you must perform one of those commands，disable P／M Mag－ ic with POKE 1744，1；then reinstall the $\mathrm{P} / \mathrm{M}$ Magic machine code and activate it with USR．

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

Program 1：P／M Maglc Loader
CF 2日G日日 REM＊＊＊P／M MABIC＊ ＊
HC 200日1 REM COPYRIEHT 1987 CDMPUTE！PUBLICATID NS，INC ALL RIGHTS REGERVED．
明 $2601 \%$ FOR A＝RAMTOP TO RAM

TOP＋135日：READ BAPOK E A，BzNEXT A
CE 20020 DATA 216，104，104，10 4，141，51，6，199，6，6， 141，55，6，104，164，14 $1,52,6,109,7,6,141$ ， 56，6，104
AH 20030 DATA $104,141,53,6,1$ $09,8,6,141,57,6,164$ ，104，141，54，6，109，9 ，6，141，5日，6，104，104 ．141．59
 61，6，104，104，201，2， 208，31，165，156，24，1 05，14，133，204，133，2 ©6，133，223，133，221
 1，169，12日，133，205，1 33，222，133，229，169，
6，133，263，246，33，16
5，106，24，105，13，133 ，206
LP 20060 DATA $133,204,133,22$ 3，133，221，198，223，1 98，223，19日，221，198， 221，19日，264，169，16，1 33，203，133，295，133， 222，133
AI 20670 dATA 220，160，6，185， 220，6，153，204，6，200 ，192，4，200，245
PC 25080 DATA $166,106,160,15$ 4，169，7，32，92，228，1 69，64，141，14，212，96 － 216
KH 20090 DATA 160， $2,185,220$ ，
6，153，206，6，206，192 ，4，26日，245，160，0，18 5，264，6，153，220，9，2 00，192，4，208，245
E120100 DATA 173，208，6，248， 13，169，233，141，37，2 ，169，5，141，36，2，76． 98，228
OE 20118 DATA 174，120，2，189， 74，6，141，62
IE 20120 DATA 6，189，90，6，141 ，63，6，173，34，6，208， 3日，173，61，6，201，1，2 6日，16，173，62，6，141， 64，6
MA 20130 DATA 173，63，6，141，6 5，6，169， $0,240,15,17$ 4，121，2，189，74，6，14 1，64，6，189，96，6，141 ，65，6
M 20140 DATA $173,49,6,240,2$ 0，173，129，2，201，15， 200，61，173，2，6，249， 56，169，6，141，49，6，1 41，2，6
NE 20150 DATA $173,132,2,20 \theta_{\text {。 }}$ 31，173，120，2，201，15 ，240，24，169，1，141，4 9，6，174，129，2，189，1 66，6，141，66
明 2016 DATA 6，189
OC 20170 DATA 122，6，141，67，6 ，167，6，240，12，173．6
2，6，141，66，6，173，63
，6，141，67，6，173，132 ，2，20日
HK 2018 DATA $26,173,4,6,269$ ，21，169， $0,141,62,6$ ， $141,63,6,173,61,6,2$ $40,8,169,0,141,64,6$ ， 141
PFI 2019 DATA 65，6，173，50，6， 240，20，173，121，2，20 1，15，280，61，173，3，6 ，240，56，169，0，141，5 ©，6，141

CC 20280 DATA $3,6,173,133,2$ ， 20日，31，173，121，2，20 1，15，249，24，169，1，1 41，5も，6，174，121，2，1 89，106，6
HE 20210 DATA $141,68,6,189,1$ 22，6，141，69，6，169，0 ，240，12，173，64，6，14
1，68，6，173，65，6， 141 ，69，6
H 20220 DATA $173,133,2,200$ ， $13,173,5,6,208,8,16$ 7， $0,141,64,6,141,65$ ，6，173，51，6，24，109， 62，6
CI 20230 DATA 141，60，6，160，0 ，185，10，6，205，60，6， 240，15，200，192，4，20 8，243，173，60，6，141， 51，6，192
EC 20240 DATA 4，240，10，173，4 9，6，201，5，169，6，141 ，66，6，173，52，6，24，1 09，63，6，141，65，6，16 － 0
的 20258 DATA 185，14，6，205，6 0．6，249，15，296，192， 4，298，243，173，65，6， 14＇1，52，6，192，4，24 10，173，49
E0 20260 DATA 6，20日，5，169， 5 ， $141,67,6,173,53,6,2$ $4,109,64,6,141,60,6$ ，160．8，185，18，6，295 ，6も
4 2027 D DATA 6，24
DH 20280 DATA 15，206，192，4，2 ©日，243，173，60，6，141 ，53，6，192，4，240，19．
173，56，6，208，5，169； 0，141，6日
KE 20290 DATA 6，173，54，6，24， 109，65，6，141，66，6，1 69， $0,185,22,6,205,6$ 6，6，246，15，20\％，192， 4，2曰日
KH 203旬 DATA 243，173，60，6，1 41，54，6，192，4，240，1 0，173，50，6，20日，5，16 9，8，141，69，6，173，55 ，6，24
DE 20310 DATA 109，66，6，141，6 6，6，168， $5,185,26,6$ ， 205，60，6，240，14，200 ，192，4，298，243，173， 60，6，141
OD 20320 DATA 55，6，24，144，5， $169,1,141,2,6,173,5$ $6,6,24,109,67,6,141$
,60,6,160,0,185,30,
6

朋20330 DATA 285，60，6，240， 1 4，201，192，4，20日，243 ，173，66，6，141，56，6． 24，144，5，169，1，141， 2，6，173
AH 20340 DATA 57，6，24，109，68 ，6，141：60，6，160，0，1 85，26，6，295，65，6， 24 5，14，260，192，4，208， 243，173
0126350 DATA 65，6，141，57，6． 24，144，5，169，1，141， 3，6，173，58，6，24，109 ，69，6，141，65，6，160，
© 20365 DATA 185，30，6，205，6 6，6，240，14，260，192， 4，298，243，173，64，6， $141,58,6,24,144,5,1$ 69，1，141
＊20370 DATA $3,6,162,8,173$ ， 0，208，168，41，1，240，

18，189，14日，6，24B，13 ，205，49，6，20日，8， 141 ，2，6
日 2038．DATA 169，
हु 2039 DATA $157,148,6,152$ ， 74，232，224，4，203，22 6，173，1，26日，168，41， 1，240，18，189，148，6， 24币，13，205，50
EN 20400 DATA $6,208,8,141,3$ ， 6，169，0，157，14日，6， 1 52，74，232，224，8，20日 ，226，173，日，26日，168， 41，1，249
IC 20410 DATA $18,189,148,6,2$ 40，13，205，49，6，208． 8，141，2，6，169，0，157 ，148，6，152，74，232，2 24，12，208
EM 26420 DATA 226，173，9，208， 168，41，1，240，18，189 ，14日，6，240，13，205，5 0，6，26日，8，141，3，6，1 69，8，157
KG 2 6430 DATA $149,6,152,74,2$ 32，224，16，26日，226，1 69，1，141，39，298，173 ，2，6，248，8，169，0， 14 1，39，6，141
OF 2 244 DATA $48,6,173,72,6$ ， 245，8，169，0，141，39， $6,141,45,6,173,3,6$ ， 246，8，169，0，141，45， 6
HP 20450 DATA $141,46,6,173,7$ 3，6，240，8，169，0，141 ，45，6，141，46，6，173， 51，6，141， $0,208,173$ ， 53，6
kF 20460 DATA 141，1，200，173， 55，6，141，4，20日，173， 57，6，141，5，200，174， 6，6，169，0，133，286，1 33，209， 224
GE 20470 DATA 0，240，17，165，2 68，24，169，59，6，133， 208，144，2，230，297， 2 02，224， $0,208,239,16$ 5，106，24，105，6
JK 20480 DATA 27，101，209，133 ，209，165，208，24，109 ，59，6，141，70，6，172， 52，6，162，0，161，20日， 145，203，230，20日
BB 2049 DATA 208， 2
ME 2050．DATA 230，209，200，16 5，208，205，70，6，26日， 231，174，1，6，169，10，1 33，208，133，209，224， 6，2411，17，165，26日
MA 20510 DATA 24，109，39，6，13 3，200，144，2，230，289 ，202，224，0，208，239． 165，166，24，105，6，24 ，101，269，133，209
0D 2052：DATA $165,201,24,109$ ，59，6，141，71，6，172， 54，6，162，0，161，201， 145：205，230，20日，28日 ，2，236，269，206
0p 2053 DATA 165，29B，285，71 ，6，208，238，172，56，6 ，162，0，177，222，41，2 52，29，37，6，145，222， 20．，232，224，6
PO 20540 DATA 20日，241，172，5日 －6，162，0，177，220，41 ，243，29，43，6，145，22由，290，232，224，6，20日 ，241，173，2，6
FA 2055．DATA 20日，7，173，72，6 ，20日，2，249，32，173，5 $1,6,24,169,6,6,141$ ，

55，6，173，52，6，24，10 9，7
FO 20560 DATA 6，141，56，6，173 ，62，6，141，66，6，173， $63,6,141,67,6,169,3$ ，141，39，6，141，40，6， 173
PD 20570 DATA $3,6,201,7,173$ ， 73，6，268，2，240，32，1 73，53，6，24，109，8，6， 141，57，6，173，54，6，2 4
JP 205日の DATA 169，9，6，141，5日 ，6，173，64，6，141，6日， 6，173，65，6，141，69，6 ，169，12，141，45，6，14 1，46
E！20590 DATA 6，173，4，6，24日， 5，169，1，141，4，28日，1 73，5，6，249，5，169， 0 ， 141，5，20日，173，61，6， 248
8020600 DATA 5，169
JB20610 DATA 5，141，5，20B，16 7， $0,141,72,6,141,73$ －6．248
KE 20620 DATA 16\％， $0,185,226$ ， 0，153，204，6，200．192 ，4，298，245，160，5，18 5，200，6，153，220，©， 2 09，192，4，20日，245，76 ，98，229
ML 2663』 RETURN

## Program 2：Hellcopter Demo

© 5 PRINT＂（CLEARJCOPYRIGHT 1987＂： PUBLICATIONS，INC．＂：PRI NT＂ALL RIBHTS RESERVED

BK 8 FOR $X=1$ TO 1 日eg：NEXT $X$
PE 10 POKE 106，PEEK（1由6）－16
EE 20 RAMTOP＝PEEK（166） 2256
FB 30 A＝PEEK（196）+ B
HL 46 POKE 54279，A
AC 5D PMBASE＝A：256
FC 6 © $A=P E E K(106)+6$
GL 62 FRAMES＝A：256
0170 BRAPHICS
JK 75 POKE 559，${ }^{\circ}$
L8 日g BOSUB 990日
HK 90 gosur 10000
AD 100 BOSUB 20000
KE 120 POKE 1540，1：POKE 1541 1：1POKE 784，14日：POKE 716． 6
MA 122 POKE 53277，3：POKE 174 4，8
J 123 FOR R＝PMBASE TO PMBAS E＋2047：POKE R，D：NEXT R：POKE 559，62
用 $125 \mathrm{X}=\mathrm{USR}$（RAMTOP， 100,100 ， $0,0,14,0,1)$
PF 127 POKE 1536， 1
GL 130 END
GE 86OD REM＊

日H 900ø FDR I－FRAMES TO FRAM ES＋b9iREAD A：POKE I， AINEXT I
MA 9010 DATA $\sigma, \infty, 0,0,0, \infty, \infty, 0$ ，$\oplus, \varnothing, \infty, \sigma, \oplus, \varnothing$
FL 9620 DATA $0,6,31,4,78,189$ $, 79,6,10,30,7,0,0,0$
HC 9030 DATA ©， $0,4,4,142,125$ $, 143,6,10,30,7,0,0,0$ 019040 DATA 0， $0,248,32,114$ ， 189，242，94，89，129，22 4， $\operatorname{D}, \mathrm{D}, \mathrm{D}$
K6 905 DATA $0,0,32,32,113,1$ 90，241，96，80，120，224 －ஏ，ø，$\varnothing$

LA 9978 RETURN
 USAGE＊
㿟10000 FOR A＝1546 TO 1673： READ B：POKE A，B：NEX T A
PA1001ø DATA 46，47，284，205， 30，31，212，213，48，49 ，206，207，38，39，220． 221，40，41，210，211，2 5，26，225，226
AK 10020 DATA $0,6,0,0,0,3,3$ ， б， $0,0,0,12,12,0,0,6$
IC 10030 DATA $\sigma, \infty, \varnothing, \varnothing, \sigma, \sigma, \varnothing$ ， $\varnothing, \sigma, \varnothing, \varnothing, \infty, \infty, \infty, \infty, \infty, \varnothing$ $, \infty, \infty, \infty, \infty, \infty, \infty, \infty$
M 10035 REM PLAYER SPEED
PS 10040 DATA $0, \varnothing, \varnothing, \varnothing, \varnothing, 1,1$, 1，0，255，255，255，0，0 ， $0,0,0,0,0,0,0,2,25$ 4，ロ，ஏ，2
01 10045 DATA 254， $0,0,2,254$ ， ■
明 10047 REM MISSILE SPEED
PP 10050 DATA $0,8,0, \infty, 8,2,2$ ， 2， $0,254,254,254,0,0$ － $0, \sigma, \square, 0,0$
 $2,254,0,0,2,254,0$
MI 10070 RETURN

## Program 3：Street Scene Demo

EC 5 PRINT＂CCLEARJCOPYRIEHT 19日7＂：PRINT＂COMPUTE！ PUBLICATIONS，INC．＂：PRI NT＂ALL RIGHTS RESERVED

㫙 E FOR $\mathrm{X}=1$ TO 1000：NEXT $X$
PE 10 POKE 106，PEEK（106）－16
EG 20 RAMTOP＝PEEK（106）：256
f月 30 $A=P E E K(106)+\theta$
AL 40 POKE 54277，A
6C50 PMBASE＝AE256
fC 6 g $A=P E E K(106)+6$
6162 FRAMES＝A $\$ 256$
IH 63 GRAPHICS 23：POKE 559，0
HE 64 POKE 5325ø，120：POKE 53 251，120：POKE 53254，100 ：POKE 53255，14ø
J090 POKE 623，17：POKE 53277 ，3：POKE 53260，96：POKE 542日6， 32
DE 100 FOR I－PMBASE $+\varnothing$ TO PMB ASE＋2047：POKE I，©iNEX TI
BA 120 FOR Y－PMBASE＋800 TO P MBASE＋日B9：POKE Y，24\％： NEXT Y
AF 130 FOR R＝PMBABE＋898 TO P MBASE＋946：POKE R，192： NEXT R
KH 150 FOR T－PMBASE＋169B TO PMBASE＋1707：READ A：PO KE T，AsNEXT T
WH 160 FOR X＝PMBASE +1960 TO PMBASE＋1976：READ S：PO KE X，S：NEXT X
60 170 DATA 16，56，124，124，25 4，124，16，2，3，2
FL 186 DATA 15B，124，124，124， 124，124，124，124，254，5 6．${ }^{6}$
F6 190 FOR I＝764 TD 711：READ A：POKE I，A：NEXT I
I 20b DATA 64，84，14，236，22， 146，152，2
FK $210 \mathrm{~K}=140: \mathrm{L}=10 \mathrm{D}$ ：J＝212
H 220 DL＝PEEK（560）＋256 PEEK （561）
EN 222 DL82＝DL＋82：LBYTE＝4．
FC 224 POKE DL＋81，77：POKE DL ＋82．4D：POKE DL＋B3，PEE

OC $226 \begin{gathered}\mathrm{K}(\mathrm{DL}+5)+12 \\ \text { GOSUB BO日G }\end{gathered}$
of 228 gosub $9 \varnothing 0$.
AB 230 gOSUB 100008
AJ 232 日0SUB 20068
LC $24 \%$ POKE 1744， $0_{2}$ PDKE 1540 ，1：PDKE 1541，1：POKE 5 59，62
KJ 260 X＝USR（RAMTOP，120，180， 12日，18日，26，1，1）


H1 30\％T＝6：SPEED＝6
KE 316 FQR I＝1 TO 5：POKE 153 6，I：POKE 1537，T：T－T＋1 ：IF PEEK（632）＝11 THEN SPEED＝12
L\＆320 IF PEEK（632）＝7 THEN 5 PEED＝ø
M 3 30 $K=K-1: I F K=44$ THEN $K=$ 212
BJ 34\％L＝L－0．75：IF Lく44 THEN L－212
＊）350 J＝J－1：IF J＝44 THEN J＝ 212
BK 36＠FOR P＝g TO SPEED：NEXT POKE 5325\％，J：POKE 532 51，J
小 3B0 POKE 53255，K：POKE 532 54，L
AB 39\％LBYTEMLBYTE＋D．25：IF L BYTE＝5® THEN LBYTE＝1g
时 40．PDKE DLB2，LBYTE
M 410 IF PEEK（158日）＜181 THE N POKE 623， 24
w 415 IF PEEK（1588）＞181 THE N POKE 623，17
BO 425 NEXT I
88430 BOTO 300
EB70®D REM twt \＃DRAW PLAYF

H3 日ø®ठ COLDR 1：PLOT 159，39： DRAWTD 159， $8:$ DRAWTD ©，D：POSITION ©，39：PO KE 765．2：XIO 18，\＃6， ，8，＂5：＂
 DRAWTO 159，49：DRAWTO g．40：POSITION 6，47： POKE 765，3：XIO 1e，＊6

KB 8020 PLOT 159，95IDRAWTO 1 59，6日：DRAWTO D，68：PO SITION 5，95：XIO 18，＊ 6，©， 0,1 ：＂＂
OC 日030 COLOR 2：PLOT 159，51： DRAWTO 159，4日，DRAWTO 0，4日iPOSITION E，51： POKE 765，2：XIO 18，\＃6


JF 日e日® FOR I＝1 TO 6：PLOT 99 ，79＋1：DRAWTO 99＋W，79 ＋I：W＝W＋2：NEXT I
If 809 COLOR 2
HO日100 FRR I＝g TO GIPLOT 73 ，78＋1：DRAWTO 9B，78＋1 1 NEXT I
HE B110 COLOR 1
BOB12 FOR I口f TO 24 STEP 4 ：PLOT 75＋1．89：DRAWTO 75＋1，84：NEXT I
PBBI30 FOR I＝g TO 13JREAD A －B：PLOT A，B＋25：NEXT 1
Pf 8149 FOR I＝g TO EIREAD $A$ ， B，C，D：PLOT A，B＋25；DR AWTO C，D＋25：NEXT I
圱日150 DATA 77，58，77，56，76， 58，78，56，85，56，85，58 ，86，57，86，55，86，59，8 9，59，93，56，93，56，93．

59，97，55
PP 日16 DATA 74，54，74，69，81， 55，81，58，89，55，89，57 ，96，57，96，59，98，57，9 9，59，75，60，112，60，11 2，69，99，54，75，65，75， 54
B0 日170 DATA 75，54，99，54
L8 818G RETURN
FP90®® REM \＃＊： DATA 新樴事
J19010 FOR I－FRAMES TO FRAM ES＋2日5：READ A\＆POKE I ，A：NEXT I
BB9020 DATA $0,0,0,0,0,0,0,0$ $, \infty, \infty, 0, \infty, 0,0,0, \infty, \infty, \infty$ $, 0,0,0,0,0,0,0,0$
KP9030 DATA $9,0,0,0,0,0,0,0$ ，0，0，8，0，0，3，15，29，5 9，51，7，7，15，252，224， 112，4日，
OA 9®4® DATA $\oplus, \infty, \infty, \infty, \infty, 8, \infty, \varnothing$ ，0，0，0， $0,8,1,7,15,31$ ，55，55，7，111，125，24日 ，192．65， 8
日 9ヵ50 DATA $\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, 0, \varnothing, \varnothing$ ， $0,5,8,5,3,7,15,31,3$ 1，31，31，222，254，251， 231，206，15，
WH 906 DATA 0， $0,0,0,0,0,1,3$ ，3，3，1，7，15，31，30，62 ，62，63，63，68，124，120 ，112，112，252，0
W9670 DATA ©， $0,0,0,0,0,0,0$ ，1，1，1，0，7，31，31，31， 31，31，15，15，13，31，12 3，112，124，
M 900 D DATA ©， $0,0,0,0,0,0,2$ B，62，62，62，28，240，24 6，240，248，251，255，22 1，192，192，227，118，60 ，24，${ }^{\circ}$
U9090 DATA ©，©，6，©，\％，0，0， 6 ，56，124，124，124，56，2 24，224，224，224，246，2 54，192，128，192，224，2 24，248， 0
H6 9100 DATA $0,6,6,0,0,0,0,1$ 12，248，248，248，112，1 92，192，128，128，12日，2
24，224，©，0，0，0，0，12 ． 6
CB 9110 DATA ©， $0,6,8,0,8,192$ ，224，224，224，192，8，8
 ，8， 0,0
 24，240，240，249，224，1 2日，129，12日，12日，176，2 40，©，128，192，128，192 ，128，0．0
KN 9136 RETURN
PO 9290 REM zisti PAGE \＆MEM －USAGE 䇆童
PF 1 1060 FOR A＝1546 TO 1641： READ BiPOKE A，BiNEX T A
w 1 Oges REM PLAYERS LIMITS
J6 10010 DATA 46，47，194，195， 154，155，195，196，54； 55，262，203，154，155， 195，196
HO 10015 REM MEMORY USED BY PMMAEIC
ON 10020 DATA $\varnothing, \sigma, \theta, 0, \sigma, \theta, \varnothing$ ， $0,0, \theta, \theta, \theta, \oplus, 3,3, \infty, \infty$ ，0，0，12，12， $0,0,0$
 $\oplus, \oplus, \infty, \sigma, \sigma, \theta, \sigma, \sigma, \sigma, \infty$ ，©，©，©，©，©，©
JF 1 10035 REM PLAYERS SPEED
PA 1 ©048 DATA $8,0,0,0,0,1,1$ ， 1，©，255，255，255，©，

0， $0,0,0,0,0,0,1,25$ $5, \varnothing, 8,1$
Of 1 0050 DATA 255，© ，©，1，255， ©

## M！ 10070 RETURN

## Program 4：Arcade Game Demo

©C5 PRINT＂CCLEARJCDPYRIGHT 1987＂：PRINT＂COMPUTE！
PUBLICATIONS，INC．＂：PRI
NT＂ALL RIBHTS RESERVED
BK日 FOR X＝1 TO 1日もO\＆NEXT X
PE 10 POKE 1回，PEEK（106）－16
EE 2\％RAMTOP＝PEEK（1』6）\＃256
FB 3ヵ A＝PEEK（196）$+B$
AL 40 POKE 54279，A
BC5 PMBASEMA：256
FC 68 A＝PEEK（166）+6
GL 62 FRAMESmA 256
BA 64 GRAPHICS 1：POKE 5324日，
 252，0：POKE 53253， 6
KB65 ？＂\｛7 SPACES\}HOW MANY TAREETS＂：
FL 66 INPUT BIIF B＜1 THEN 66
HC 67 ？＂（G GPACES）TAROET 9 PEED（1 QR 2）＂：IINPUT
F：IF F＞2 OR F＜1 THEN 6 7
OD 6B ？；＂ $\mathbf{C 5}$ SPACES\}1=EASY ; 2－DIFFICULT＂；：INPUT N ：IF N＞2 OR N＜1 THEN 6B
B $0 \varnothing$ ？＂$\{日$ GPACES\} SCREEN W ILL BLANK＂：？；＂
（11 SPACES）TEMPORARILY＊ ！
EH 82 FOR T＝1 TO 130日：NEXT T
IH 84 GRAPHICS 1＋16：SDUND $0^{\circ}$ ． ©，©，
6190 POKE 559，0：POKE 623，49 ：POKE 53277，3：POKE 532 56，1：POKE 5325日，$\varnothing$ ：POKE 53259，${ }^{\circ}$
DE 100 FOR I PPMBASE $+\mathscr{D}$ TO PMB ASE＋2047：POKE 1，D：NEX $T$ I
MI 190 POKE 704，148：POKE 705 ，69：POKE 767，232：POKE 796，66：POKE 7E8，152： POKE 710，146
CI 240 POKE 1542，7：POKE 1543 ，6：POKE 1744，g
OK 241 FOR I＝1 TO 22 STEP 3： $X=$ RND（ 0 ）： $6:$ POSITION $x$ ，I：？\＃6；＂．＂
HE 242 ZmRND（D）：6：POSITION 6 ＋Z，I：？6；＂：＂：Z＝RND（O 1＊7：POSITION 12＋2，I：？ ＊क：＂
HP 243 NEXT I：RESTORE
DF 244 FOR T＝g TO 511：POKE 3 276日＋T，PEEK（57344＋T）： NEXT T：POKE 756，12日
IS 245 FOR T－3276B＋24 TO 327 6B＋47：READ B：POKE T，B ：NEXT T
LC 246 DATA $\quad 0,0,0,0,0,112$, $24 \mathrm{~B}, 124,126,127,255,2$ 55，255，255，255，255， 25 5，255，255，255，255，255 ， 255
JE 247 FOR T＝日 TO 19：POSITIO N T，21：？6；＂悪＂ NEXT TiPOSITION D， 22
NA 248 FOR T＝も TO 19：？W6；＂ ＂： 2 NEXT TiPOSITION 0. 23
 ＂；：NEXT T
DC 252 日03U日 9690

AK 254 日0sub 10000
AP 256 BOSUB 280．
PM 260 POKE 1585， $8: X=U S R$（RAM TOP， $118,120,10,100,14$ ，$\quad$ ，1）
PP 28б POKE 559，62：T＝1：M＝2：A B－क』M198＝
00 290 POKE 1549，6：POKE 157も ，1：POKE 1537，1：POKE 1 536，3：PDKE 77．ø
06295 IF PEEK（53279）－6 THEN 302
㫙30』 IF PEEK（53279）m3 THEN POKE 1744，1：POKE 532 48，a：POKE 53249， $6: 80 T$ 064
PJ 301 POKE 16日も，D：日OTO 295
CL 302 POKE 16日®，FiPOKE 1601 ，1：POKE 1693，1：IF N＝1 THEN POKE 1601， 0


KF 304 E－STICK（ø）IIF E＜B THE N POKE 1536，T＋4：M－4IG OTO 310
BD 306 IF E＜12 THEN PDKE 153 6，T＋21M－2igOTO 3iø
330日 POKE 1536，T＋M
K 310 POKE 1537，TiIF PEEK（1 693）$=0$ THEN POKE 1693 ，1180SU日 801：
M0 320 IF PEEK（53260）＝2 THEN POKE 154色，i：EOTO 日5＊ $\theta$
© 350 IF PEEK（1596）＞199 THE N POKE 1681，255
IP 360 IF PEEK（159\％）＜ 30 THEN POKE 1601，1
Fl390 T＝T＋1：IF T＝3 THEN T＝1 CA 400 IF PEEK（1589）＞24』THE N MISSmMISS＋1：AB＝AB＋1
，POKE 15日9，10：IF AB－G THEN POP ：BOTO 5\＄0
BH 436 BOTO 304
 ＊＊＊＊＊
PO 500 POKE 1537，1：POKE 1536 ，M＋1
OE 505 POSITION 5，0： $2 X=$（（G－M
 2X）i：？W；＂PERCENT＂
PC 519 POKE 1744，1
08520 IF PEEK（53279）＝6 THEN 540
B6 530 IF PEEK（53279）＝3 THEN POKE 1744，1：POKE 532 48， 01 POKE 53249， 61 GOT 064
64 535 G0T0 520
kJ 540 POKE 53248，© ：POKE 532 49，क：POKE 53252， 61 IPOK E 53253，0：POKE 1744，8 IPOSITION 5，Di？Wil＂ （14 SPACES）＂
MP 550 FOR T－PMBAEE 76 TO P MBASE＋1535：POKE T，DiN EXT T：BOTO 260
K0 $8 \varnothing 0 \%$ REM TARGET EXPLOS

M 8010 POKE $1536,1+M$
EA B615 FOR 2＝7 TO 11：POKE 1 537，2：sOUND ©，200，8， 22－2：2：FOR I＝1 TO 10 ：NEXT IINEXT 2
 1：IF ABEB THEN POP： GOTO 5®0
KH 8030 POKE 1537，DiIF N＝2 T HEN $804 \pi$
태 8032 L＝PEEK（53770）：IF L＜3 6 OR L＞190 THEN 8032 EFE034 POKE 1590．L

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# PFkey 64 

Jeffrey D. Partch

If you're a 64 programmer, or a 128 programmer who feels a little lost when you switch modes, this comprehensive utility is well worth adding to your library. "PFkey 64" makes many 128 -specific features available when you are using BASIC 2.0 on the Commodore 64.

It's no secret that the Commodore $128^{\prime}$ s BASIC 7.0 is one of the most powerful BASICs available on any microcomputer. But the Commodore 64 is still very popular, and many 128 owners spend a significant amount of time computing in 64 mode. "PFkey 64" allows you to use many BASIC 7.0 features on the Commodore 64, including programmable function keys, reserved variables, disk drive commands, special functions, and a number of BASIC 7.0 utility commands.

PFkey 64 is written entirely in machine language, so you'll need to use "MLX," the entry program found elsewhere in this issue, to type it in. Please read all of the instructions for using MLX before you get started. You must make one temporary change to MLX before you begin entering the data for PFkey 64. MLX does not normally permit the entry of data at addresses which correspond to BASIC or Kernal ROM. However, a portion of PFkey 64 is designed to reside in RAM beneath BASIC ROM. Thus, you must disable MLX's address error-checking feature before you begin entering data. (If you don't, you'll get an error message when
you try to begin entry.) To turn off the address testing, place a REM before the first statement in line 1040 of the MLX program. This is just a temporary patch for entering the PFkey 64 data; do not make this a permanant change to MLX.

When you first run the modified MLX program, you will be asked for starting and ending addresses for the data you'll be entering. For PFkey 64, respond with the following values:
$\begin{array}{ll}\text { Starting address: } & \text { BF40 } \\ \text { Ending address: } & \text { CFFF }\end{array}$
After you've entered all the data for PFkey 64 and have saved a copy, you can load it into memory at any time. (BASIC programs currently in memory will be preserved.) Use the syntax LOAD "PFKEY", 8,1 for disk or LOAD "PFKEY", 1,1 for tape. (If you saved the program with some other filename, use that name in place of PFKEY.) To activate PFkey 64, simply type SYS 49152.

PFkey provides several kinds of enhancements to Commodore 64 BASIC: new commands, new reserved variables, new functions, and new DOS commands. Like other BASIC keywords, these can be typed in abbreviated form; see the table accompanying this article. Here is an explanation of each group of BASIC enhancements.

## Utility Commands

QUIT. This command disables PFkey 64 and reclaims the memory previously occupied by the PFkey code. It works in both program
mode and direct mode. You should always use this command before loading another machine language program that occupies the same memory area as PFkey 64 (see "Program Notes" below). To restart PFkey 64, you must reload the program and use a SYS as described above.

BANK. The BANK command allows you to PEEK and POKE memory areas that are normally hidden from BASIC. This is done in part because PFkey itself occupies a substantial amount of the 64's memory; making other memory areas available compensates for the loss to some extent. BANK must be followed by a number in the range $0-4$. For instance, BANK 0 resets the 64 to its normal memory configuration. Here is an explanation of all the BANK commands.

- BANK 0 is the normal configuration. This configuration is reset whenever the computer enters direct mode (when the READY prompt reappears after you exit a program, for instance).
- BANK 1 allows you to PEEK values stored in the RAM underlying the BASIC ROM (Read Only Memory) chip at locations 40960-49151.
- BANK 2 allows you to PEEK values stored in the RAM underlying the Kernal ROM at locations 57344-65535.
- BANK 3 affects only the POKE command, and allows you to POKE into areas used by PFkey itself. (See "Program Notes," below.) You should rarely, if ever,
have to do this, but the capability is there for advanced programmers.
- BANK 4 allows you to read the character shape data stored in ROM at locations 53248-57343.

SYS. Although it is not a new command, SYS has been modified to work as it does in BASIC 7.0. If you supply additional values after the address parameter, SYS stores those values in the processor's internal registers. Here is the syntax to use:

## SYS address, $A, X, Y$, status

The last four parameters are optional and can be used to store values in the A register, X register, $Y$ register, and status register, respectively. This assumes, of course, that you are calling a machine language program that expects those registers to contain certain values. The SYS command accepts any number or numeric variable in the range $0-255$ for these parameters. It's not necessary to supply values for all parameters, but to specify a value for any parameter, you must supply values for all preceding ones. For example, if you wish to supply a value for the Y register, you must also provide values for the A-register and X-register parameters, but it is not necessary to provide a value for the status register.

RREG. The RREG (Read REGisters) command returns the values of the processor's internal registers. One use for this command is to pass information from a machine language routine back to BASIC. The registers are read in the same order as that used for SYS. (See above.) Here is the basic syntax:

## RREG var1, var2, var3, var4

You can use any numeric variable for the four parameters. For instance, the command RREG AR, XR, YR, SR assigns the contents of the $A, X, Y$, and status registers to the variables $A R, X R, Y R$, and $S R$, respectively.

KEY. This is one of the most versatile and useful commands provided by PFkey 64 . With it, you can assign commands to any of the computer's function keys. As on the 128, default commands are assigned when you first run PFkey. To display a list of the current func-tion-key assignments, type KEY
and press RETURN without typing anything else. You also can create your own function-key assignments, using this general syntax:
KEY number, commands
The number parameter tells PFkey which function key to define; this must be a value in the range $1-8$. The command $\$$ parameter must be a string containing the command or commands you wish to assign to that function key. For instance, say that you want function key fl to execute these commands each time you press it:

## PRINT CHRS(147):LIST

The first command prints a CLR/HOME character, which clears the screen, and the second lists the program in memory. These commands assign this definition to the fl key:
AS="PRINT CHRS(147):LIST" + CHRS (13)

KEY 1 , AS
Note that we added a carriage return (character 13) to the end of the command string A\$. This causes the computer to "press RETURN" at the end of the command. In some cases, you might not want a carriage return; for example, in a load command, you might want the computer to first print LOAD followed by one set of quotation marks, and then to allow you to type in the rest.

You can use the CHR\$ function to include any nonprinting characters, such as quotation marks, in the command string. The command string can be a single BASIC statement or several BASIC statements. However, BASIC itself limits the length of an input line to 80 characters, so you should not attempt to create a function-key definition longer than that.

DELETE. This command deletes a single program line or a range of program lines. Here are two simple examples:

## DELETE 100

DELETE 100-200
The first command deletes line 100 from the program in memory. The second command deletes every line from 100 to 200 , inclusively. This command works only in direct mode (when you're not running a program) and does not accept numeric variables in place of line
numbers. You must always specify two line numbers for a range (for example, DELETE - 100 is invalid), and the command does not work unless both line numbers in the specified range exist.

HELP. This command provides a shortcut for locating program errors. When a program stops with an error, type HELP and press RETURN. PFkey 64 lists the line where the error occurred and highlights the erroneous statement in reverse video. (In a few cases, the statement which generates the error is not itself wrong. For example, while it READs values from DATA statements and POKEs the values into memory, a program might stop with an ILLEGAL QUANTITY error in the line that contains the POKE. But the illegal quantity is actually contained in the DATA value which the computer was reading at the time.)

AUTO. The AUTO command eliminates the drudgery of typing line numbers by hand as you enter a program. To turn on automatic line numbering, type AUTO followed by an increment value in the range 1-63999. As soon as you press RETURN at the end of a program line the computer automatically types the next line number. For instance, this command causes the computer to print line numbers in increments of 10 :
AUTO 10
If you execute a direct-mode statement, or press RETURN on a blank line, the computer suspends automatic numbering until you enter another program line. Automatic line numbering is turned off if you type AUTO and press RETURN without typing anything else, or when you run any program.

RENUMBER. This command renumbers the BASIC program in memory. It can be used in two different ways. If you simply type RENUMBER and press RETURN, PFkey renumbers the first line of the program as line 10 and renumbers all remaining lines in increments of 10 (the second line is 20 , the third is 30 , and so on). You can also specify the initial line value, the increment, and the line on which to start renumbering. Here is the general syntax:
RENUMBER newline, increment, oldline

For instance, this command tells PFkey to start at existing line 200, renumbering that line with the new number 1000, and numbering all successive lines in increments of 20:

## RENUMBER 1000, 20, 200

The RENUMBER command operates only in direct mode and does not accept variables in place of its parameters. This command renumbers all internal references preceded by GOSUB, TRAP; RESUME, RUN, THEN, GOTO, GO TO (as two keywords), and ON GOTO. RENUMBER stops without harming the program if the renumbering would create a reference to a nonexistent line, create a line number higher than the legal limit (63999), corrupt the chronological order of program lines, duplicate an existing line number, or create a program too large for PFkey's memory.

TRAP, RESUME. These close-ly-related commands allow you to respond to many BASIC errors that would otherwise cause a program to stop.

TRAP permits you to regain control of the computer when a BASIC error would normally cause execution to cease. TRAP must be followed by the number of the program line where you want to branch when a BASIC error occurs. For instance, the statement TRAP 5000 causes the computer to branch to line 5000 whenever any error occurs. At line 5000, you would place the routine that takes whatever action is necessary to correct or respond to the error.

The RESUME command allows you to reenter the main program after executing a TRAP routine. This command can take either of two forms:

## RESUME NEXT

## RESUME linenumber

The command RESUME NEXT causes the computer to resume execution at the statement immediately after the one which triggered the error. You ordinarily would use this syntax for errors that can be cured completely by the TRAP routine. The second form of trap allows you to branch to the line specified by linenumber. This option is appropriate for more serious situations-for instance, when an error requires
that you terminate the program completely or restart it, rather than continue where the program left off.

Both TRAP and RESUME are valid only in program mode, and neither command accepts variables as line numbers or nonexistent line numbers. Keep in mind that TRAP and RESUME turn each other off. In other words, TRAP is not reinstated automatically after a RESUME; if you wish to turn error trapping back on after RESUME, you must do so with a second TRAP statement. Similarly, RESUME is invalid unless a TRAP is in effect; executing RESUME before you perform TRAP, or executing two RESUMEs in a row, causes an error.

TRAP and RESUME are very useful for catching errors, particularly in programs designed for beginners or unsophisticated computer users. However, most programmers wait until a program is finished and debugged before inserting TRAPs. In that way, you can prevent a TRAP from confusing you, the programmer, unnecessarily.

TRON, TROFF. This pair of related commands turns trace mode on and off. TRON (TRace ON) turns the trace feature on, while TROFF (TRace OFF) disables it. Neither command accepts any parameters. When a program is running in trace mode, the current line number is listed just prior to the execution of each new statement. Although there are limitations to this method-the trace display occupies the same screen that may be used for your program's output, and may not be visible at all if the computer is not in text mode-this feature can be quite useful if you suspect a problem with a program's logic.

## Reserved Variables

PFkey 64 provides you with four reserved variables taken from BASIC 7.0. You already may be familiar with ST, TI, and TI\$, which are reserved variables in BASIC 2.0 . Reserved variables are set aside for the computer's own use and cannot be assigned a new value with LET, GET, or any other BASIC assignment statements. Keep in mind, however, that this limitation applies only to variables of the same
type. For example, although the floating-point variable EL is reserved (see below), you can still use the string variable EL\$, the integer variable EL\%, and so on, because BASIC can distinguish those variables on the basis of their types.

All of the new reserved variables are reset to their default (normal) values after you execute a CLR command, or perform any action that edits a program. Here is a list of the reserved variables:

EL, ER. These two numeric variables are particularly useful in TRAP-handling routines. EL (Error Line) stores the number of the program line where the most recent BASIC error occurred, and ER (ERror number) holds the error number for the most recent error.

DS, DS\$. This pair of reserved variables holds information about disk operations. The string variable DS \$ holds the text of the most recent error message from the disk drive command channel, while the numeric variable DS holds the error number for the most recent disk error. The next time the error light starts to blink on your drive, try typing PRINT DS,DS\$ and pressing RETURN. If DS equals 0 , and DS\$ prints OK, the drive's status is normal.

## Functions

Like all BASIC functions, the new functions provided by PFkey 64 require some additional information inside parentheses.

HEX\$. This function converts decimal (base 10) numeric values into their hexadecimal (base 16) equivalent. The number inside parentheses must be in the range $0-65535$. For instance, the statement PRINT HEX\$(255) yields 00FF. Note that the result is returned as a string four characters long; after you execute $X \$=$ HEX $\$(254)$, the string $X \$$ contains the four-character string 00FE.

DEC. The DEC function does the opposite of HEX\$, converting a hexadecimal string into a decimal numeric value. Again, the value must be in the range $0-65535$. DEC accepts either string variables or literal strings. For instance, after you execute the statement $x=$ DEC ("FF"), the numeric variable X holds the value 255. You do not
need to supply leading zeros for a hex number of less than four digits; for example, DEC("FE") works just as well as DEC("00FE').

ERR\$. The ERR\$ function prints the text of BASIC error messages. It is especially useful in conjunction with the reserved variable EL and the commands TRAP and RESUME. (See above.) You must supply ERR\$ with a numeric value in the range $1-31$ (error 34 is also valid). A typical use of this function is to display error messages from within a trap routine. To demonstrate this function, enter NEW in direct mode, followed by NEXT; then enter this line in direct mode: PRINT ER, ERRS(ER)

POINTER. The POINTER function expects you to supply the name of a variable used in the current program. It returns the memory address where that variable's descriptor can be found. For instance, the statement ADDR-
$=\operatorname{POINTER}(X)$ assigns to the variable ADDR the address of the variable X's descriptor. This function is useful primarily to advanced programmers who wish to examine how a particular variable is stored internally. If the variable has not yet been used, POINTER returns a zero. The variable's name is located in the two bytes immediately preceding the returned address. Be careful when using array variables, because this function creates a new, single-dimension, 11 -element array if you have not previously performed DIM. Dan Heeb's book Tool Kit: BASIC (available from COMPUTE! Books), contains a detailed description of the structure of BASIC variable descriptors.

XOR. This function requires two numeric values in its parentheses. It performs an exclusive OR operation on the bits of the first value, using the bits in the second value. Both values must be in the range $0-65535$. For instance, the statement PRINT XOR $(1,255)$ yields 254.

## DOS commands

PFkey supplies several new commands which simplify the use of a floppy disk drive. These differ from the commands available in BASIC 7.0 because no provision is made for a double disk drive (two disk
drives in one case, which are addressed as drive 0 and drive 1). All of the current Commodore disk drives-the 1541 and 1571-are single drive units which are addressed as drive 0.

The allowable range of device numbers for these commands is from 8 to 31 . The normal device number for a single Commodore drive is 8 . The default drive is the last device used in the current session; if for some reason that number falls outside the range 8-31, it is reset to 8 , the normal device number for a Commodore disk drive.

Every DOS command can be used in two forms. If your drive is device 8 (the usual situation), simply enter the command, followed by whatever information is indicated in the explanation for that command. If you have more than one drive, you can access the second drive (which will have a different device number) by adding , $U$ and a device number to the end of the command. For instance, the normal syntax for the DIRECTORY command is to type DIRECTORY and press RETURN. However, you would use the command DIRECTORY,U9 to get a directory of the disk in device 9 . This optional syntax can be used with all DOS commands.

All of these commands open the disk drive command channel (channel 15) during execution and close it when they finish. Thus, you always must close the command channel (15) before using any of these DOS commands.

In direct mode (when you are not running a program) all DOS commands that would alter the contents of a disk require confirmation before the command is carried out; the computer prints ARE YOU SURE? and does not carry out the command unless you press $Y$ and then press RETURN. If you have more than one drive in your system (for instance, one which is device 8 and another which is device 9), it is strongly suggested that you include the device number wherever appropriate.

DIRECTORY. If you learn only one DOS command, this should be the one. DIRECTORY lists the directory of the current disk in the specified drive, without alter-
ing the program in memory. In other words, you no longer have to use the familiar LOAD " $\$ 0$ ", 8 command to view the directory.

COLLECT. This command recovers disk sectors which have been temporarily lost as a result of repeatedly scratching and resaving files. (This operation is also called validation.) You should perform an immediate COLLECT whenever you discover an unclosed (splat) file on a disk, which is signaled by an asterisk (*) next to the filename in the disk directory.

SCRATCH. This command erases the specified file or files from a disk. For instance, SCRATCH "TEST" removes the file TEST from the current disk. This command accepts variables in place of literal strings; for instance, both of these commands accomplish the same thing:

## SCRATCH "TEST"

## A\$ = TEST:SCRATCH AS

You can also use wild-card characters to scratch more than one file. For instance, SCRATCH "TEST"" deletes the files TESTFILE, TESTER, and any other file beginning with the characters TEST. The disk drive manual contains more information about DOS wild cards. Do not use SCRATCH on any disk that contains an unclosed (splat) file; use COLLECT (see above) on the disk immediately.

RENAME. The RENAME command changes the name of an existing file. For instance, this command renames the existing file OLDFILE with the mew name NEWFILE:

## RENAME "OLDFILE" TO "NEWFILE"

The contents of the file are not changed by RENAME.

COPY. This command creates a duplicate of an existing file on the same disk. The original file is left unchanged. For instance, this command creates a new copy of the existing file TEST, naming the new file COPYOFTEST:

## COPY "TEST" TO "COPYOFTEST"

DCLEAR. The DCLEAR command closes all open files and channels on the specified drive. The drive is reset to its power-on state, and the current disk is initialized. It's a good idea to enter this command every time you perform a
disk swap, to make sure the drive knows it's dealing with a different disk.

HEADER. This command formats a disk. Before using a new disk for the first time, you must format it to mark off storage zones for the drive to use. The HEADER command can take two forms. Use this syntax if you are formatting a disk that has never been used before:
HEADER "name", id
The name inside quotes must be no more than 16 characters in length. The disk ID can be any two characters; it is important that every disk have a unique ID. For instance, this command formats a new disk with the name WORKDISK, giving it WD as a disk ID:

## HEADER "WORKDISK",WD

If you are formatting a previously formatted disk (for instance, to erase its contents), you can omit the ID from the command. This command removes all the files from a previously formatted disk, giving it the name MYDISK:

## HEADER "MYDISK"

Of course, you can also use the first syntax on a previously formatted. Use care with HEADER, since it effectively destroys all information that a disk might have contained before.

VIEW. You can consider this command a bonus, since it doesn't appear in either BASIC 7.0 or BASIC 2.0. It allows you to view a program file without disturbing the program currently in memory. This is very useful when you need to refer to a second program quickly and do not wish to save and reload the program you are working on. This command, for instance, displays the contents of the program file named MYPROG:

## VIEW "MYPROG"

VIEW displays correctly all BASIC 2.0 keywords, as well as the BASIC 7.0 keywords that are added by PFkey 64. However, it does not recognize other BASIC 7.0 keywords that PFkey 64 does not support (BUMP is one example).

## Program Notes

PFkey 64 uses the memory areas from locations 40448-40959, 49152-53247, and 679-767. You

## PFkey 64 Quick Reference

This table lists the abbreviations for every PFkey 64 keyword. It also shows the mode in which a command or function can be used. The abbreviation PRG means that a command works only in program mode, while DIR means that it works only in direct mode (when you're not running a program). ALL means that it works in both program and direct mode. The token value indicates the one- or two-byte value used to represent the keyword internally within a program line.

| Command | Abbreviation | Mode | Token value |
| :--- | :--- | :--- | :--- |
| AUTO | A shift-U | DIR | \$DC (220) |
| BANK | B shift-A | ALL | \$FE 02 (254 02) |
| COLLECT | COL shift-E | ALL | \$F3 (243) |
| COPY | CO shift-P | ALL | \$F4 (244) |
| DCLEAR | DCL shift-E | ALL | \$FE 15 (254 21) |
| DEC | none | ALL | \$D1 (209) |
| DELETE | DE shift-L | DIR | \$F7 (247) |
| DIRECTORY | DI shift-R | ALL | \$EE (238) |
| ERR\$ | E shift-R | ALL | \$D3 (211) |
| HEADER | HE shift-A | ALL | \$F1 (241) |
| HELP | H shift-E | ALL | \$EA (234) |
| HEX\$ | H shift-E | ALL | \$D2 (210) |
| POINTER | PO shift-I | ALL | \$CE 0A (206 10) |
| RENAME | RE shift-N | ALL | \$F5 (245) |
| RENUMBER | REN shift-U | DIR | \$F8 (248) |
| RESUME | RES shift-U | PRG | \$D6 (214) |
| RREG | R shift-R | ALL | \$FE 09 (254 09) |
| SCRATCH | SC shift-R | ALL | \$F2 (242) |
| TRAP | T shift-R | PRG | \$D7 (215) |
| TROFF | TRO shift-F | ALL | \$D9 (217) |
| TRON | TR shift-O | ALL | \$D8 (208) |
| VIEW | VI shift-W | ALL | \$FE 06(254 06) |
| XOR | X shift-O | ALL | \$CE 08 (206 08) |

should not attempt to use other utilities or programs that make use of those memory areas. The first area is also used by the computer itself whenever you open a channel to the RS-232 device (a modem or serial printer). If you wish to use PFkey 64 with programs that open the RS-232 channel, install PFkey 64 first, and then load and run the program that accesses the RS-232 device. The program also creates four variable descriptors when it is installed. To help protect against crashes, PFkey 64 modifies the POKE command to produce an ILLEGAL QUANTITY error when you to change the contents of memory areas used by this program.

Those PFkey 64 keywords that are equivalent to BASIC 7.0 keywords are tokenized just like in BASIC 7.0. Thus, a Commodore 64 program that uses PFkey 64 statements like RREG or TRAP will also load and run properly on a Commodore 128. Likewise, a Commodore 128 program using these keywords will work, load, and run on a 64 with PFkey 64. A very significant exception is that the BANK statement performs a very different operation in PFkey 64 than it does in BASIC 7.0. You
should also be aware that PFkey 64 supports only a few of the added features of BASIC 7.0. Thus, it will not allow all 128 programs to be run on a 64-just those that use the BASIC 7.0 statements specifically supported by PFkey 64.

## PFkey 64

Please refer to the "MLX" article in this issue before entering the following program.
$\begin{array}{lllllllll}\mathrm{BF} & 49: 28 & 43 & 29 & 38 & 37 & 43 & 4 F & 4 D\end{array} \mathrm{FF}$ BF48:50 $55 \begin{array}{llllllll}54 & 45 & 21 & 15 & \text { Cl } & 63 & 68\end{array}$ BF50:CD 54 CF 59 C5 OF C2 3B FF BF58:CE 60 A5 Ol 48 2C 45 CD 5 A BF60:10 0678 2D 45 C0 $85 \quad$ D1 84 BF68:A 00 B1 14 A8 $68 \quad 85 \quad 61$ A2 BF70:58 4C A2 B3 A9 00 8548 5F BF78:85 47 26 FA AE 2028 AF 36 BF80:A9 0685 OD A5 $48 \quad 85 \quad 6212$ BF88:A5 47 4C 03 CE 4C 6E CB B6 BF90:20 9E B7 BA F0 21 C9 05 DC BF98:B6 F3 49 FF 3019 Aも E7 A5 BFAØ:B9 82 CF 99 FF 9D 88 D 069 BFA8:F7 78 AD OB B9 $00 \quad 039974$
 $\mathrm{BFB}: 8810 \mathrm{Fl}$ AD 1563 8D ED 4A BFCD:C3 AD 14 83 8D DF C3 AD 61 BFC8: 9002 8D F8 9E AD BF $1021 F$ BFD0:8D F7 9E AO 32 B9 24 9E 52 BFD8:99 F9 9E B8 10 F7 60 A0 C1 BFEg:44 B9 59 BF 99 00 C0 88 EE BFE8:10 F7 AO 02 B9 C4 9E 99 5A BFFE:DC CF 88 ID F7 AD 02 B9 E 4 BFF8:C7 9E 99 3A CF 88 10 F7 93 C00日: A4 $38 \quad 8 \mathrm{C} \quad 83 \mathrm{C} 4 \mathrm{CO}$ 9E 90 A2 C008:05 AD 9E $2084 \mathrm{C} 4 \quad 20 \mathrm{AB}$ 2A C010:C4 90 $66 \quad 2082 \quad$ C4 4C AD 3B C618:C4 A5 01 AA 29 FE 850181 CØ20:20 9E BF B6 01 A0 97 B9 2D C028:7B A5 9953 CF 88 DO F7 73

C030：A 05 B9 C9 A6 9903 CF 5B C038：88 10 F7 A5 01 AA 29 FE 5F $\begin{array}{lllllllll}\mathrm{C} 40: 85 & 61 & 20 & \mathrm{DF} & \mathrm{BF} & 86 & 61 & 78 & 59\end{array}$ C048：A9 4D 8D 8F 02 A9 C3 8D 68 C050：90 02 A9 D6 8D 14 Ø3 A9 A9 C058：C3 8D 15 O3 A9 60 8D 45 9F C060：C0 5B 60 2047 CD 2C 9995 C668：9E 1011 EE 99 9E 20 BD 93 C070：C4 90 O9 20 F8 C3 206013 C078：A6 4C A0 C4 AD 92 9E 1ס C5 C080：27 CD 8F 9E Fg 22 AD BF DF C888：9E $85 \quad 62 \mathrm{AD} 8 \mathrm{E}$ 9E $85 \quad 63 \quad 3 \mathrm{~F}$ C090： 20 6F CA A2 日も BD Ø0 6179 C098：F0 66 9D 77 02 E8 D0 F5 BA CØAD：A9 20 9D 77 02 28 E8 86 C6 B1 COA8： 20 6日 A5 86 7A 84 7B 86 D2
 COB8：AD 90 $06 \quad 20 \quad 79$ A5 4C El D4 COCD：A7 CE 99 9E 20 6B A9 C9 B2 CDCB：$\triangle 0$ FG 16 2C 92 9E 10 11 4 C CODO：A5 14 18 6D 90 9E 8D 8E AC CODB：9E A5 15 6D 91 9E 8D 8F 3E COED： 9 E 4C 9 F A4 20 BC C4 FD B0 COE8：12 20 6B A9 A5 15 8D 91 Bl C0F0：9E A5 14 FO OF 8D 90 9E 2B C0F8：A9 FF 2C A9 00 8D 92 9E 69 Cl0ן：8D 8F 9E 664 C 6E CB 20 DB Cl08：E1 FF FO 03 4C B1 A7 A5 E8 C110：91 10 FC A2 LE A4 3A C8 EA CII8：08 F6 65 A9 FF BD 9E 9E 29 C120：8A 3045 日E 9E 9E A8 2067 C128：A2 B3 A9 17 20 D3 9E 2846 C130：08 F6 1F AD Ol B9 39 06 43 C138：99 Cø 9E B9 3D $\quad 0 \quad 99$ C2 08 C140：9E 88 10 Fl AD C1 9E AC B4 C14B：C0 9E 20 91 B3 A9 102075 C150：D3 9E AE 9E 9E AD 9B 9E A6 C158：30 26 EG 1E FG OD EG IF 18 C160：90 06 20 6E Cl 4C 47 A4 日B C168：4C 8B E3 4C 32 A8 FO ©3 4 F C170：A2 日2 2C A2 GD BD CA 9E AO C178：85 22 BD CB $9 \mathrm{E} \quad 85 \quad 23 \quad 60 \quad 6 \mathrm{D}$ C180：28 F6 D7 AD BE 9E 85 7A 20 C188：AD BF 9E 85 7B AD BC 9E A9
 C198：A7 Cl A5 7A D0 02 C6 7B 54 C1A日：C6 7A A9 89 4C 34 C2 AD 5A ClA8：9B 9E 8D 9C 9E 49 FF 8D C4 C1BD：9B 9E 68 A8 68 A2 60 9A A9 C1B8： 48 98 48 60 A2 $1 F$ 6C 00 FF ClC0：03 20 A6 B3 2 C 9B 9 E 30 1B ClC8：F3 2C 9C 9E 10 EE C9 82 21 ClD ：D0 C5 A0 Bl B9 C0 9E 99 F9 ClD8：3B B9 C2 9E 99 7A OD AD ClEO：88 10 Fl 20 A7 Cl 2073 E4 C1E8： 00 20 F8 A8 4C B1 A7 20 B6 ClFO：9E AD $20 \quad 79$ OD C9 89 FO F5 ClF8：05 A9 A7 20 FF AE A5 61 C 7
 C208：79 日の B0 24 4C 9A Cl 2C 1F C210：9A 9E 1Ø 19 A 6 3A E8 ED FE C218：14 A9 5B 20 FF C4 CA 8A B2 C220：A6 $39 \begin{array}{llllllll}30 & 34 & \text { C5 } & 20 & C D & \text { BD } & 96\end{array}$ C228：A9 5D 20 FF C4 2073 日D 6B C236：C9 FE FO F9 BA 8E B6 C1 57 C238：AA C9 BA DO O3 20 FB CD 35 C240：A5 30 C5 2E D0 09 A5 2F 65 C24B：C5 2D D9 03 20 BA CE A9 B8 C250：0D 8D 96 9E 8D 98 9E 8D 8F C258：9D 9E A9 C1 48 A9 06 48 E2 C26日：8A 48 10 DC A2 07 DD DF CC C268：9E FO O5 CA 10 F8 $30 \quad 08 \quad 93$ C270：20 EE C2 FO 03 4C A3 C4 7E C278：68 A2 16 DD 38 CC FG 1A 6C C280：CA 10 F8 A2 03 DD 65 9E B1 C288：FD 05 CA 10 F8 30 D5 A2 57 C290：00 8E 9F 9 E 20 7C 00 4C C298：ED A7 BA 85 OF GA AA BD 5C C2AD：D4 CC 48 BD D5 CC 48 4C 67 C2AB：73 DO AA $207300 \quad 2013$ 2E C2BO：B1 90 1A EO 44 FO 19 EG 7D C2B8： 45 DO 08 C9 4C FO 1C C9 DA C2CO：52 FO $18 \quad 20 \quad 73 \quad 00 \quad 90$ FB 69 C2C8：20 13 B1 B0 F6 4 C 7C बб 46 C2DO：C9 53 DG EF 20 C3 C2 C9 88

C2D8：24 DO O3 20 C3 C2 C9 24 E7 C2ED：Fも EB C9 25 FO E7 C9 2848 C2E8：F0 E3 $68 \quad 68$ DG 2B AA A5 A1 $\begin{array}{llllllllll}C 2 F O: 7 A & 48 & \text { A5 } & 7 B & 48 & 8 A & D 0 & 63 & 43\end{array}$
 C300：24 日F 30 F4 C9 B2 FO 日E BB C308：C9 3A FO BA 20 13 Bl 90 03 C310：E7 2g AA C2 D0 E5 A9 90 日6 C318： 2 C A9 FF 85 ØB $68 \quad 85$ 7B F 8 C320：68 85 7A A5 ØB $60 \quad 08 \quad 20 \mathrm{FO}$ C328：A6 B3 28 FO 1A A5 39 8D 6B C330：BC 9E A5 40 BD BD 9E A5 BC C338：7A 8D BE 9E A5 7B 8D BF 18 C340：9E 20 FB AB A9 FF 2C A9 18 C348：00 8D 9B 9E 60 AD 8D 02 67 C350：C9 03 DO 03 4C 4F EB OA 49 C358：C9 日8 90 02 A9 06 AA BD 71 C360：79 EB 85 F5 BD 7A EB 85 E4 C368：F6 A4 CB C4 C5 FD 1D B1 38 C370：F5 C9 20 D0 68 AD 96 9E 39 C378：49 FF 8D 96 9E 2C 93 9E 2B $\mathrm{C} 380: 10$ 2D A2 0 B DD 1B 9E Fg B9 C388：06 CA DO FB 4C Eg EA BA B5 C390：A8 A9 00 18 7D FB 9E CA 30 C398：D0 F9 BD 94 9E 38 F9 FB C4 C3Aø：9E CD 94 9E FO E6 8D BF 65 C3AB：C3 8D 95 9E EE 93 9E 2035 C3B0：B7 C3 A2 FF 4C 26 EB A6 D2 C3B8：C6 EC $89 \quad 12 \mathrm{FO} 15$ Aの Ø0 4D C3C0：B9 01 9F 9D $77 \quad 02 \mathrm{E} 8 \mathrm{C8} 91$ C3C8：8C BF C3 CC 94 9E D0 E9 76 C3DE：CE 93 9E 86 C6 $60 \quad 2 \mathrm{C} 9384$ C3D8：9E $30 \quad 03 \quad 20 \quad$ B7 C3 4 C C $31 \quad \mathrm{B4}$ C3ED：EA 4C 94 C4 4C A3 C4 20 6A C3E8：BC C4 FO FB 20 6B A9 20 B7 C3FD：F8 C3 4C 6E C9 4C 6E CB 7E C3F8： 2013 A6 96 E4 AS 144861
 C408：A9 AB 20 FF AE 26 6B A9 CB

 C420：D4 A5 5F $85 \quad 22$ A5 6085 AF C428：23 20 13 А6 90 ВЗ Аの бб АС C430：B1 5F AA CB B1 5 F $85 \quad 60$ C2 C438：86 5F AD 日O B1 5 5F 9122 41 C440：E6 22 DO 02 E6 23 A． $6 \quad 6071$ C448：A4 5F C8 D0 01 E8 8660 3B C450：84 5F C4 2D DØ E4 E4 2E 71 C458：D0 EØ 4C AB C4 78 AO 日B EA C460：B9 EB 9E $99 \quad 00 \quad 03 \quad 88 \quad 10$ 5C C468：F7 AD F7 9E 8D BF 02 AD 9E C470：F8 9E BD 90 62 AD E0 C3 25 C478：8D 15 日3 AD DF C3 $8 \mathrm{BD} 14 \quad 86$ C480：B3 58 AD AD A2 1020 2D 42 C488：FE 4C 02 E4 A4 3A CB DG A3 C490：09 4C 79 OD A2 11 2C A2 35 C498：80 2C A2 22 2C A2 16 2C 28 C4AO：A2 1B 2C A2 日B 6C 08 03 3C C4A8： 20 33 A5 A4 23 A5 22 18 1A C4B0：69 02 90 01 C8 84 2E 85 CB C4B8：2D $84 \quad 30 \quad 85 \quad 2 \mathrm{~F}$ A5 2D A4 67 C4CO：2E $18 \quad 69$ 1C $90 \quad 61$ C8 C4 35
 C4D0：A9 FF 2C A9 80 8D 9A 9E 59 C4D8：60 AE 9E 9E EB FU 19 AD E6 C4ED：C0 9E AC Cl 9E 851484 DB C4E8：15 20 13 A6 90 日A A9 80152 C4FD：8D 97 9E 4C $63 \mathrm{CF} 68 \quad 6850$ C4F8：A9 60 8D 97 9E A9 6D 20 58 C506：34 C5 4C D2 FF C8 D0 0395 C508：4C 4E CF AD 97 9E FO 23 5E $\begin{array}{llllllllll}C 510: 10 & 1 D & \text { A6 } & 60 & 98 & 18 & 65 & 5 F & 15\end{array}$ C518：9061 E8 EC C3 9E DO 1365 C520：CD C2 9E 9ø ØE FO ØC A9 16 C528：12 4E 97 9E 20 D2 FF B1 2B C530：5F FO C3 6048 AD 95 9E E8 C538：38 65 C8 8D BF C3 AD 96 2A C540：9E 30 FB 85 C6 $68 \quad 60 \quad 29$ C 0 C548：7F A4 49 20 D2 FF 20134 F2 C550：C5 2C 98 9E 30 F0 4 C 30 D4 C558：CF 10 F0 C9 FF FO EC 24 4C C560：0F 30 E8 C9 CE FO O4 C9 45 C568：FE DØ ØD 2C $98 \quad 9 \mathrm{E} \quad 30 \quad 05 \mathrm{BO}$ C570：C8 B1 5F D日 03 20 CF FF FD C578：84 49 A2 19 DD 3A CC FO EO

C580：11 CA DO FB 38 E9 7F AA 04 C588：A9 Ag 85 23 A9 9E 8522 E8 C590：30 日8 A9 CC $85 \quad 23$ A9 5599 C598：85 22 AD FF CA FO 87 C8 74 C5A ：Bl 22 10 FB 30 F6 CB Bl EF C5A8：22 30 9C 20 D2 FF DO F6 16 C5B0：4C 6E CB 26 EB B7 A5 15 18 C5B8：AC 45 CD CD FC FD 10 C9 A5 C5C0：D0 B0 ØС C9 Cの B0 E9 C9 65 C5C8：Aの BØ B4 C5 38 BØ El C9 BF C5D0：02 DO 03 20 2B CC 4C 2740
 C5EO： 00 FO 1384 OB 20 FD AE D6 C5E8： 20 9E B7 8A A4 ØB 99 OC 5C C5FO：03 CB C0 04 DO EB 4 C 30 7B C5F8：E1 A8 24 OD 30 6B 20 A2 79 C600：B3 A5 DE 4C C2 A9 4C 9D 4A C608：C4 AD D0 84 6B Fg 99 A4 3B C610：0B CO 04 FD 1920 FD AE D6 C618： 20 BB BO $85 \quad 49$ B4 4A A4 9 C C620：0B B9 OC 03 E6 OB 20 F9 F0 C628：C5 $20 \quad 79$ 日0 DO E1 6020 BE C630：34 C5 20 El FF FD $11124 \quad 75$ C638：90 70 01 60 A9 $82 \quad 24$ 90 7E C640：F0 03 A9 04 2C A9 80 2C Bl C648：A9 IE 2C A9 $95 \quad 48 \quad 20$ DD B9 C650：C6 $68 \quad 10 \quad 03 \quad 68 \quad 68 \quad 60$ AA DD C658：6C DO D3 AO DO 2C AD OF 87 C660：A9 OF 85 B8 84 B9 A9 0223 C66B：85 BC A9 A7 85 BB 2079 6C C670：00 F0 OD 20 FD AE A9 $55 \quad 31$ C678： 20 FF AE 20 9E B7 B6 BA 89 C680：2C 9D 9E 10 03 20 FE C7 BE C688：20 2B CC A5 BA C9 $88 \quad 9082$ C690：04 C9 1F 90 02 A9 08 85 CB C698：BA 2C $98 \quad 9 \mathrm{E} \quad 1006 \quad 20 \mathrm{AD} 12$ C6AD：F5 20 FD C4 20 DD C6 2063 C6AB：CD FF A6 B8 20 C9 FF B0 CF C6B0：9A 20 CC FF A6 B8 4C C6 A4 C6B8：FE A2 D0 86 B7 A9 OF 85 5F C6C0：B8 85 B9 2088 C6 Ab 00 E5 C6C8： 20 CF FF 99 A7 02 2C 9D 2F C6D0：9E 10031020 D2 FF C8 24 60 C6D8：90 50 ED 84 B7 26 CC FF A0 C6E0：A5 BB 4C C3 FF A9 $53 \quad 20$ A2 C6E8：21 C8 85 B7 A6 3A EG FO 46 C6F0：03 4C 7E C7 CE 9D 9E 20 A9 C6F8：5E C6 20 FD C4 4C C6 C6 F6
 C708：BB AA 2079 ØD C9 2C DØ 8A C710：36 9D A7 92 A0 01 B1 7A 1E C718：C9 49 DØ 2B C8 20 FB A8 13 C720：A FF C8 E8 B1 7A 9D A7 92 C728：02 FD 0B C9 24 FD OB C9 57 C730：2C DO EF CO D2 FO BD 4C 4E C738：A3 C4 20 26 C8 AA A5 B8 26 C740：C9 02 DO F3 20 FB A8 8657 C748：B7 4C $7 \mathrm{~B} \quad \mathrm{C} 7$ A9 43 2C A9 0 FF C750：52 48 A2 13 A9 3D 9D A7 C5 C758：02 $20 \quad 24 \quad$ C8 85 B7 A9 A4 05 C76B：20 FF AE $68 \quad 20 \quad 21$ C8 C9 C768：13 FG 13 BD A7 02 99 A7 1C C770：82 C8 E8 E4 B7 D0 F4 B4 OE C778：B7 F0 03 CE 9D 9E 20 5E 73 C78日：C6 4C DD C6 A9 56 2C A9 57 C78B： $49 \quad 20 \quad 4 \mathrm{~A}$ C8 $\mathrm{E} 8 \quad 86$ B7 $\mathrm{DO} \quad$ 3C C790：ED A2 81 A9 24 8D A7 $82 \quad 23$ C798： 86 B7 20 5B C6 CE 98 9E 54 C7A日：A0 $03 \quad 84$ ØB 20 CF $\mathrm{FF} \quad 8548$ C7A8：14 20 2F C6 20 CF FF 8562 C7BG：15 20 2F C6 C6 OB DO EC 16 C7B8：A6 14 A5 $15 \quad 20 \mathrm{CD}$ BD A9 94 C7C0： $20 \quad 20 \quad 59$ C5 20 CF FF 85 B5 C7C8：0B $20 \quad 21$ CD $20 \quad 2 \mathrm{~F}$ C6 A5 D 7 C7D0：0B DØ EE 20 FD C4 A0 O2 40 C7D8：D0 C8 A2 FF 2024 C 855 FF $\mathrm{C} 7 \mathrm{E} 0: \mathrm{B} 7$ CE 98 9E 20 5B C6 2019 C7E8：CF FF AA 20 CF FF 20 2F A5 C7F0：C6 AD 07 B9 69 9E 20 D2 61 C7FB：FF 88 10 F7 30 D5 A6 3 3A 8 C C800：E8 DO 15 AO DC B9 71 9E AF C808： 20 D2 FF 88 10 F7 20 CF 57 C810：FF C9 59 FO 03 4C 97 C4 8B C818：60 A2 日8 2C A2 17 4C $15 \quad 65$ C820：Cl 20 4A C8 86 B8 20 日F $\quad$ D6

C828：CD F0 EE C9 11 BD ED A6 25 C836：B8 85 B8 AO 00 E8 Bl 22 C9 C838：9D A7 02 C8 C4 B8 DE F5 EF C840：98 18 69 G3 A8 E8 BA A2 22 C848：13 60 A2 60 9D A7 92 E8 48 C850：A9 30 9D A7 02 E8 A9 3A 32
 C860：8C C4 C8 Bl 2B F6 F5 88 2F C868：B9 57 9E $99 \mathrm{BC} 9 \mathrm{EC8} \mathrm{C}$ CC C870：06 90 F5 85 6B 8D 9B 9E A4 C878：8D 9E 9E 207900 D 08 C3 C880：20 79 صб F6 1C 20 FD AE 9B C888：20 6B A9 A5 6B AA OA AB 54 C898：A5 1499 BC 9E A5 159948 C898：BD 9E E8 86 6B E6 03 90 A8 C8AD：DF 2074 C 9 CB Bl 5F 8D AE CBA8：CØ 9E CB Bl 5F 8D Cl 9E C9 CBBE：A5 6218 C9 FA 90 03 4C B9 C8B8：B2 C9 2Ø BA C9 D0 F1 20 5B C8C6：D7 C9 90 8C 4C 5B C9 20 87 C8C8：A8 C4 4 C 94 C 420 FE C9 21 C8DO：B0 712013 A6 90 F0 A4 4A C8D8：14 A5 15 CD Cl 9E 90 ED F4 C8E0：D 05 CC Cの $9 \mathrm{E} 90 \mathrm{E6} 85$ 4C C8E8：25 84242057 CA 2 C 9E 91 C8FO：9E 30 29 C4 OB FO D6 9ø A9 CBF8：日E 98 E5 0B 1865 2D 85 5B C900：2D 90 CA E6 2E B0 C6 A5 7D
 C919：A5 2D E5 6B 85 2D B0 B5 27
 C920：20 80 СА АП Øø В9 90 Ø1 2F C928：F0 059145 C8 D6 F6 98 gC C930：18 6545 90 62 E6 468598 C938：7A A5 $46 \quad 85$ 7B 28 A8 C4 $\quad$ Ø6 C940：4C CD C8 2C 9E 9E 3013 2C C948：CE 9E 9E 20 BD C4 08 28 F1 C950：A8 C4 28 B0 03 4C BF C8 日B C958：4C Aø C4 $2074 \mathrm{C9}$ Aの 03 EB C960：A5 62915 F BB A5 6391 BA C968：5F 20 BA C9 D Fg 206092 C970：A6 4C 97 C4 AD C0 9E 85 DC C978：14 AD Cl 9E $85 \quad 15 \quad 281377$ C986：A6 A5 5F 48 A5 $6 \varnothing 48$ AD 2E C988： BC 9E 85148563 AD BD E6 C990：9E $851585 \quad 62 \quad 2013$ A6 36 C998：68 AA 68 E4 6090 日8 D 8 C
 C9A8：60 85 5F A0 01 Bl 5F F0 42 C9B0：BD 60 A9 FF 8D Cl 9E 4C 6D C9B8： 6 E CB A5 63 18 6D BE 9E F3 C9C0：85 63 A5 62 6D BF 9E $85 \mathrm{F7}$ C9C8：62 AD 01 Bl 5F 48 88 Bl CF C9D6：5F 85 5F $68 \quad 85 \quad 6060 \quad 2076$ C9D8：8E A6 A0 02 B1 7A D0 02 AC C9E0： 3860 C8 Bl 7A $85 \quad 39$ C8 $\quad 62$ C9E8： Bl 7A 85 3A 20 FB A8 A5 30 C9F0：7A B5 3D A5 7B 85 3E A9 3D C9F8：0® 85 ØE 207300207907 CA日日：00 20 21 CD FO D4 24 OF D CA日B：30 Fl C9 CB D 99207386 CA10：00 C9 A4 D9 02 A9 89 AD 24 CA18：04 D9 CE 9E F6 1588 10 E6 CA20：F8 C9 8A F0 OE C9 91 D0 90 CA28：02 85 6E C9 3A F0 C0 24 B9 CA $30:$ © 10 C8 207300 B6 C6 AF CA38：Aの FF C8 Bl 7A C9 30 90 9 E CA40：04 C9 3A 90 F5 84 日B A5 18 CA48：7A 8545 A5 7 BB 854620 lE CA50：79 06 20 6 B A9 18 66 20 EB CA58：74 C9 Dの Ø3 20 BA C9 Aの 05 CA60：03 Bl 5F AA 88 Bl 5F E4 29 CA68：25 D6 FI C5 24 D 0 ED 20 BF CA70：05 CE 20 DF BD AØ 00 B9 68 CA78：00 01 F0 03 C8 DO F8 6078 CABD：90 2298 E5 日B 85 ØВ АО 7D CAB8：00 Bl 2D A4 ØB 91 2D A6 1A CA90：2E A4 2D Dø Ø1 CA 8886 E3 CA98：2E 84 2D C4 45 D0 E8 E4 7C CAAQ：46 DO E4 60 8C B4 CA A5 A2 CAA8： $4585 \quad 22$ A5 $4685 \quad 23$ A4 14 CABO：ØB Bl 22 А 009122 А6 B7 CAB8：23 A4 22 C8 D6 O1 E8 86 BC CACD：23 $84 \quad 22$ C4 2D D0 E8 E4 FC CAC8：2E D® E4 60 FØ 03 4C 76 EE

CAD0：CB A9 008514 A9 9F 85 1B CAD8：4A A9 018549 E6 14 A5 2A CAED：14 AA 09 30 8D 52 9E AO E2 CAE8：06 B9 50 9E 20 D2 FF 88 B8 CAF0：D0 F7 BD FB 9E F6 508513 CAF8：15 Bl 4948 C9 22 Fb OA F5 CB60：29 7F C9 14 F0 64 C9 0D BE CB68：D0 2C A6 D4 F6 O3 A2 06 0E CB10：2C A2 02 BD 5D 9E C9 29 A4 CB18：F0 66 28 D2 FF E8 D6 F3 14 CB20：68 AA 9848 A9 0020 CD 89 CB28：BD 68 A8 2062 CB FO 17 OB CB30：88 $26 \begin{array}{llllllll} & 65 & \text { CB D } & \text { C3 A6 D4 } & 35\end{array}$ CB38：D6 6488205 F CB 682067 CB40：67 CB DØ B5 20 5F CB A6 Bø CB48：14 E0 08 FG OF BD F8 9E 32 CB50：18 65498549 90 62 E6 46 CB58：4A 4C DD CA A9 øD 2C A9 14 CB60：22 2C A9 29 2C A9 2B 20 5A CB68：D2 FF C8 C4 15 60 A2 0E 4C CB76：2C A2 17 4C 15 Cl 20 9E FC CB78：B7 8A F0 F2 C9 09 B6 EE 9E CB80：8D 52 9E A9 2C 20 ØC CD A9
 CB90：06 18 7D F8 9E 90 F7 9931 CB98：A7 02 CB CD 94 FD 21 AE 7 E CBAG：52 9E BD F8 9E $48 \quad 38$ E5 BC CBA8： 0 D 99 A7 $02 \mathrm{C8}$ A5 0 D 48 Cl CBBD： 38 FD F8 9E 99 A7 0268 C 4 CBB8：9D F8 9E 8A 48 C8 DG CC AD CBC0：48 1865 0D 99 A7 02 C8 38 CBC8：68 99 A7 $62 \quad 68$ AA 684817 CBDE：18 79 A7 6299 A7 0268 BF CBD8：85 ØB C5 бD F® 3 B 90 1D 32 CBEG：AE AB 02 AC AC 62 B9 01 A7 CBEB：9F 9D 01 9F CB E8 EC A7 3D
 CBF8：F8 9E 4C 71 CB AD A7 02 BB CC $00: 18$ 6D A9 02 B 0 EF AA AC 9D CC08：A7 02 CC AA 02 90 ØA B9 5A CC10：01 9F 9D 01 9F CA $88101 F$ CC18：FI AE AA 02 A 0 OD C4 10 D 67 CC20：Fも 09 B1 22 9D 01 9F E8 E5 CC28：C8 D0 F3 A9 00 8D 9F 9E 87 CC30：60 98 0 A 日2 0915 IE 24 5A CC38：8B 9E 97 EE EA F2 F5 2454 CC40：F9 1E 15 Fl F3 F8 D8 D9 2F CC48：D7 D6 F7 DC 09 F4 02 D1 42
 CC58：45 43 54 4F 52 D9 $48 \quad 45$ B4 CC60：4C DO 53435241544376 CC68：C8 $52454 E \quad 414 D$ C5 56 A9 CC70：49 45 D7 4 AB 45 D9 $51 \begin{array}{llll}55 & 39\end{array}$ CC78：49 D4 $44 \begin{array}{lllllll}43 & 4 C & 45 & 41 & \text { D2 } & 75\end{array}$ CC80：48 45414445 D2 $434 F 47$ CC88：4C 4C 4543 D4 $52454 \mathrm{E} \quad 01$ CC9日：55 4D 4245 D2 54524 F AD CC98：CE $\begin{array}{lllllllll}54 & 52 & 4 F & 46 & \text { C6 } & 54 & 52 & 36\end{array}$ CCA日：41 D $5245 \quad 53 \quad 554 \mathrm{C} 5 \mathrm{FD}$ CCAB：44 $45 \quad 4 \mathrm{C} 45 \quad 54 \begin{array}{llllll} & 41 & 55 & 25\end{array}$ CCBO：54 CF $525245 \mathrm{C7} 43$ 4F F6 CCB8：50 D9 42414 E CB 4445 BC СССб：C3 504 F 494 E 5445 D 2 EF CCC8：48 45 58 A4 4552 52 A4 E9 CCDO：58 4F D2 $\begin{aligned} & \text { Ø } 0 \text { C1 EE C5 D8 F2 }\end{aligned}$ CCDB：C5 B2 C7 90 C4 D8 C6 E4 FF CCEヒ：C7 4E C7 D9 CA CB C4 5C F3 CCEB：C7 86 C6 FF C7 83 C8 5E 1D CCFE：C4 CF C4 D2 C3 25 Cl C6 9D CCFB：C3 E6 C0 E3 C6 88 C7 4B B5
 CDE8：CD A8 CO O1 20 FF AE 20 5B CD16：9E AD 2月 A3 B6 85 日D 60 EA CD18：20 FF AE 20 8A AD 4C F7 37 CD20：B7 48 C9 90 FØ 日8 C9 22 40 CD28：D0 ø6 A5 日F 49 FF 85 ØF B7 CD30：68 60 4C 6E CB A6 15 D0 7C CD38：F9 A5 14 F0 F5 C9 1F 9071 CD40：0D FØ 06 O8 C9 22 D 10 EA 43 CD48：28 20 6E Cl DO OC GA AA 5F CD50：BD 26 A3 8522 BD 27 A3 1B
 CD60：FB C8 98 20 7D B4 AO FF 41 CD68：C8 B1 224829 7F 9162 6A CD70：68 16 F5 4C CA B4 A9 0448

CD78：20 7D B4 A9 0285 日B A0 91 CD8日：FF CB $84 \begin{array}{lllllll}\text { Cl } & \text { A5 } & 64 & 48 & 29 & 6 B\end{array}$ CD88：0F AA 68 4A 4A 4A 4A A8 Cø CD90：B9 7E 9E A4 419162 BD 99 CD98：7E 9E C8 91 62 A5 658547 CDAB：64 C6 0 B D DC 4 C CA $\mathrm{B4} \mathrm{FD}$ CDA8：A5 1448 A5 1548 A9 2C CB CDBD： 2018 CD 68451585628 E CDB8：68 4514 4C ©3 CE A9 28 EF CDC0：20 OC CD 48 20 F7 AE 6854 CDC8：DØ 0520 E9 BC F® 36 C9 90 CDD0：05 B0 15 A9 00 A0 FF 8560 CDD8：63 85 62 C8 B1 22 A2 日F CA CDE日：DD 7E 9E FG 66 CA 10 F8 62 CDE8：4C 6E CB A5 OD 2901 D 69 CDFO： $\mathrm{DB} \mathrm{B}_{2 A}$ GA OA OA OA 8563 7D CDF8：C6 ØD 10 DF BA 0563 C6 31 CEO日：0D D6 D6 8563 A2 9938 8A CE08：4C 49 BC $68682073 \quad 08$ E6 CE10：CA 30 AB A5 1448 A5 1511 CE18：48 8A OA F6 0748 A9 28 A1 CE 20：20 18 CD 68 AA BD 62 CD 32 CE28：85 56 BD 03 CD 85552055 CE3日：54 日® 688515688514 C 6 CE38：4C F7 AE A5 7A 48 A5 7B E5 CE40：48 2073 Ø0 C9 CE FO F9 DD CE48：A2 05 DD 4F CC FØ BC CA 97 CE50：10 F8 2C 9F 9E 30 2A C9 87 CE58：44 DE 2620 EE C2 FO 2198 CE60：20 B9 C6 A9 FF 8D 9F 9E 14 CE68：88 98 Ag 02 91 2D A9 A7 E0 CE70：85 7A A9 0285 7B 267998 CE78：00 20 F3 BC A9 69 20 D3 ED CE80：9E $68857 B 68857 A 4 C ~ 8 A$ CE88：86 AE A9 gб 8D 9F 9E 8D FF CE90：9C 9E BD 9B 9E 20 BD C4 45 CE98：84 $308432852 F B 5315 D$ CEAD：AD 1B B9 AD 9E 91 2D 88 B4 CEA8：10 F8 60 A6 FF E6 ØB A6 FA CEB0：7A CA E8 CB BD 00 Ø2 3812 CEB8：F9 55 CC FO F5 C9 80 D $\begin{array}{ll}\text { F9 }\end{array}$ CEC0：2A A5 9B 38 E9 4A A8 B9 45 CEC8：38 СС 85 ØВ АФ $0788 \quad 3079$ CED日： 15 D9 31 CC D8 F8 Cの 62 50 CED8：90 93 A9 FE 2C A9 CE E6 31 CEE0：71 A4 7199 FB 01 A9 ØØ 5 F CEE8：4C 9D CF B9 55 CC 3606 ED CEF0：C8 B9 55 CC 10 FA B9 56 0F
 CFO0：4C 9F CF 43 41 4 E 2754 Cl CF08：20 $5245 \quad 53554 D$ C5 44 D9 CF10：49 $524543 \quad 54204 \mathrm{D} 4 \mathrm{~F}$ D2 CF18：44 45 20 4F 4E 4C D9 8501 CF20：89 86 8A 878 BB 8C 64 8B CF28：05 05050404650544 EE CF30：49 D2 6D 3F 445324 gD 83 CF38：48 45 4C 50 OD $564945 \quad 75$ CF4日： $57 \quad 2252554 \mathrm{E}$ 0D 4 B 4536 CF48：59 0D 4C 495354 0D 51 4D CF50：55 49 54 ØD 2C $23 \begin{array}{lllllll}59 & 45 & 2 E\end{array}$
 CF60：22 2B $4348522428 \quad 2965$ CF68：93 94 95 9F OD 47 4E 49 日F CF70：57 $4549563 F 45 \quad 52 \quad 55$ A4 CF78：53 $20554 \mathrm{~F} 592045 \quad 5291$ CF80：41 $30 \begin{array}{llllllll}31 & 32 & 33 & 34 & 35 & 36 & 21\end{array}$ CF88：37 $38 \quad 394142434445$ F9
 CF98：0600 00600060600638 CFAD：00 FF 0644 D 300 A7 9274 CFAB： 000044538000 D0 00 OA
 CFBA：45 $52818000006000 \mathrm{C7}$
 CFC8：AB CE $2005 \mathrm{C5} 009 \mathrm{E}$ ØC BD CFDE：9E 89 8D A7 D6 D7 A4 2E DB CFDE：18 65 2D $9081 \mathrm{CB} A A 4 \mathrm{C} 59$ CFEE：D4 BB Bl 848587889644 CFEB：A1 A7 50 46 4B 455936 бA CFFO： $34206279204 A \quad 454691$ CFFB：46 2050415254434894

# Zookeeper For The Amiga 

Michael Barron

Data for object images is stored in individual files-which can quickly lead to an unmanageable directory. This utility provides a solution-programs not only initialize faster, but they are also easier to handle.

The object commands in Microsoft Amiga BASIC, which allow you to manipulate sprites, vsprites, and bobs, provide easy access to some of the Amiga's most powerful animation routines. However, you must store the data for each object image in its own, separate file. Thus, if your program uses six objects, you'll have to manage seven separate disk files (six object files, plus the program itself). Before long, your previously-neat disk directory can start looking like a zoo.
"Zookeeper" offers a neat solution to this problem by converting image definition files into DATA statements which can be part of the main program. The DATA lines are organized into meaningful sections with commentary, bringing order to the object zoo.

Defining objects under program control does make the program itself somewhat larger. But the advantages of this method definitely outweight the drawbacks. Only one file need be duplicated when exchanging the program with a friend, and a printed listing of the program shows everything needed
to make it run properly. The program also initializes faster, since it simply READs DATA statements already in memory, rather than seeking and loading separate files on disk. And, finally, it eliminates the problems that can occur when a program is not able to load the necessary object files.

## Using The Zookeeper

Type in Program 1 and save a copy. The Zookeeper can handle object definition files for both sprites and bobs, in the format produced by the object editor program on the Amiga BASIC Extras disk. Let's demonstrate how it works using an example image file from the Extras disk.

In the BASICDemos drawer of the Extras disk is an image definition file named ball. Copy that file onto the same disk (and directory, if applicable) where you saved the Zookeeper program.

Run Zookeeper and enter the appropriate filename at the prompt. The program then asks you to enter the maximum number of data elements for each DATA statement (eight is a good number). With this information, Zookeeper creates a text file consisting of commented DATA statements. The DATA lines contain the same information as the image definition file. This new file has the same filename as the one which you entered earlier, with the
filename extension .ZOO. Thus, it you are converting the image file named ball, the new file is named ball.ZOO.

When the .200 file has been created, the Zookeeper program gives you the option to delete the original image definition file. Do not delete anything at this point.

## Demonstration

After you have created the ball .ZOO file, type in Program 2. This program will show you how easy it is to use the new image format. After you type in all the lines listed in Program 2, enter this command in the BASIC Output window:

## MERGE "ball.zoo"

The effect of this command is to merge the DATA lines from the ball.ZOO file with Program 2, which is already in memory. The DATA lines appear at the end of the current program.

Before you run the combined program, look at the subroutine named InitPlayer, near the end of Program 2. That routine sets a variable named ByteCount, which is used to indicate how many items to read from the DATA statments. If you examine the comments at the beginning of the ball.ZOO data, you will see a comment indicating how many bytes this particular set of DATA lines contains.

Since we knew in advance that ball. $Z O O$ would create 106 bytes of
data, we were able to use that number in the statement from InitPlayer which sets ByteCount. For any other image, however, that value will be different. When using these routines to display your own objects, you will need to examine the comment at the beginning of the DATA lines and modify the statement in InitPlayer to match the number shown.

When you run the demonstration, notice how much faster the program begins. Not having to access the disk drive is a great advantage. Another advantage is easy accessibility to the image data itself. To see what we mean, find the twenty-second DATA number in the ball.ZOO data set, change that number from 24 to 48 , and then rerun the program.

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

## Program I: Zookeeper

[^5]Wide\& $=$ CVL(MIDS(ImageS, 13,4)) 4 Height\&= CVL(MIDS(ImageS,17,4)) Flags= CVI(MIDS(Image\$,21,2))4 BytesPerRow= 2*INT( (Wide\&+15)/16 ) 4
BytesPerplane= BytesPerRow*Heigh t\&
BytesInBitmap= BytesPerPlane*Dep the
IF Flags AND 1 THEN4
ObjectIsSprite= TRUE
ReqBytes $=$ HeaderBytes + BytesInBit map+CoLorMapBytes 4

## ELSE

ObjectIsSprite= FALSE 4
ReqBytes $=$ HeaderBytes+BytesInBit map4
END IF4
IF LEN (ImageŞ) $<>$ ReqBytes THEN PRINT FiLenameS;" is not compati ble with the Zookeeper." 4
NoErrors= FALSE 4
ELSE4
NoErrors= TRUE 4
END IF4
RETURN 4
4
CreateZooFiLe: 4
PRINT "Output file: ";FiLenames:
". ZOO"4
PRINT4
PRINT "Please wait..."4
PRINT4
OPEN FiLename\$+". ZOO" FOR OUTPUT AS 14
PRINT \# 1,4
PRINT \# 1, "ObjectData:" $¢$
IF ObjectIsSprite THEN
PRINT * 1, "' SPRITE Format"4
ELSE4
PRINT \# 1, "" BOB Format"
END IF4
PRINT \# 1, "' Total Bytes: ";Req
BYtes PRINT $\#$ 1, "' Bit planes: ":Dep
th\&4
PRINT \# 1, "' Pixels Wide: ";Wid e\&4
PRINT ( 1, ": Pixels Tall: "; Hei ght\&
CurrentByte= 14
Comment\$= "' Object Header"4
CALL FormatData (Comment\$, MIDS (Im ageS, CurrentByte, HeaderBytes), Ma xBytes,l)4
CurrentByte= CurrentByte+Header $B$ ytes4
FOR PLane=1 TO Depth\&
Comment $\$=$ " " BitPlane " + STRS(PL ane) 4
CALL FormatData(CommentS, MIDS (Im age\$, CurrentByte, BytesPerPlane). MaxBytes,1)4
CurrentByte= CurrentByte + BytesPe rPlanes
NEXT PLane
IF ObjectIsSprite THEN4
Comment\$="' Sprite Color Map"
CALL FormatData (Comments,MIDS (Im ages, CurrentByte, CoLorMapBytes). MaxBytes,1) 4
END IF\&
CLOSE 14
RETURN4
4
FiLeMaintenance:4
PRINT "Shall I delete ":FiLename \$:" (y/n)";
INPUT Responses4
IF UCASES(Response\$)= "Y" THEN4 KILL FiLename $\$ 4$
PRINT EiLenames;" deleted."\&
END IF4
PRINT4
RETURN

EndJob: 4
PRINT "Job complete: returning $t$ o AmigaBASIC." ${ }^{4}$
PRINT 4
RETURN 4
4
SuB FormatData(Notes, Dats, DatLim
it, FiLeNo) STATIC4
PRINT \# FiLeNo, Note\$4
NoBytes= LEN (Dat\$) 4
NoFuLLLines= INT(NoBytes/DatLimi t.) 4

CurrentByte $=14$
FOR LineOut= 1 TO NoFuLLLines
CALL PrintDataline (MIDS (Dat\$, Cur rentByte, DatLimit), FiLeNo) 4
CurrentByte= CurrentByte+DatLimi $t 4$
NEXT LineOut 4
IF CurrentBytes= NoBytes THEN 4
BytesLeft $=$ Nobytes-CurrentByte +1
4
CALL PrintDataline (MIDS(Dat\$, Cur rentByte, BytesLeft), FiLeNo) 4
END IF\&
END SUB 4
4
SUB PrintDataLine(Dat\$,FiLeNo) S TATIC
NoBytes= LEN(Dat\$) 4
PRINT * FiLeNO, USING " DATA
\#\#\#";ASC(MIDS (Dat\$,1,1));
FOR ELement $=2$ TO NoBytes 4
PRINT 共 FiLeNo, USING ", \#\#\#":A SC(MIDS (DatS, ELement, 1)T;4
NEXT ELement
PRINT \# FiLeNo,4
END SUB4

## Program 2: Demonstration

${ }^{4}$ Zookeeper demonstration
' Copyright 1987 COMPUTEI Public ations, Inc.4

- All rights reserved 4

PRINT"Copyright 1987": PRINT"Comp utel Publications, Inc."\&
PRINT"A11 Rights Reserved.":FOR
$X=1$ TO 2000:NEXT X 4
CLS4
MainLine:4
GOSUB HouseKeeping4
gosub Initplayer
WHILE INKEYS=""4
IF MOUSE ( $\sigma$ ) $<>$ © THEN 4
OBJECT.X 1, MOUSE(1) 4
OBJECT.Y 1, MOUSE $(2) 4$
END IF4
WEND 4
END 4
4
Housekeeping:4
DEFINT a-z4
WINDOW 1,"Ball Demo", $(0,136)-(45$ 0.186),154

PRINT "Manipulate object with mo use."4
PRINT "Hit any key to exit."4 RETURN 4
4
InitPLayer:4
ByteCount $=1064$
Images= ""4
FOR Loop= 1 TO ByteCount
READ ImageData4
Image $\$=$ ImageS+CHRS (ImageData) 4 NEXT Loop
OBJECT.SHAPE 1, Image\$4
OBJECT.ON 4
RETURN \&
4

# Sprite Designer 

André Corbin

This full-featured sprite editor from a Canadian reader lets you design Commodore 64 sprite shapes quickly and conveniently. The program works with either disk or tape.

Nearly every Commodore 64 programmer uses sprites at one time or another. They're the movable graphics shapes that add so much to arcade games and other programs. If you have plenty of time, you can draw the sprites on graph paper, calculate the numbers that make up each sprite, type those numbers into a program, and hope that you didn't make any mistakes along the way. But "Sprite Designer" offers a much faster and easier alternative, allowing you to design sprites directly on the screen, with convenient keyboard controls. You can save a group of sprite shapes to disk or tape and reload them for future use, or you can create a series of BASIC DATA statements containing the sprite data. The program supports both single-color and multicolor sprites and it allows you to work on a group of eight sprites at a time.

## Typing it In

Sprite Designer is written in machine language, so you must type it in with the "MLX" machine language entry program published elsewhere in this issue. Read the MLX instructions carefully before you begin. When you run MLX, you'll be asked for a starting address and an ending address for the data you'll be entering. Here are the values to use for Sprite Designer:
$\begin{array}{ll}\text { Starting address: } & \text { 84D0 } \\ \text { Ending address: } & 9 E 47\end{array}$
After you've saved a copy of the program, load it with LOAD
"PROGRAM", 8,1 for disk or LOAD "PROGRAM", 1,1 for tape (replace PROGRAM with the name you used when saving the program). To start the program, type SYS 34000 and press RETURN.

Sprite Designer uses the memory in locations 8192-16383 to store sprite shape data. This work area can hold 16 groups of 8 sprites, allowing you to have a total of 128 sprite shapes in memory at one time.

## Main Menu

When you start Sprite Designer, it displays a main menu containing the following choices:

1. INITIALIZE
2. EDIT
3. ANIMATE
4. SAVE
5. LOAD
6. BASIC DATA
7. MONOCHROME
8. MULTICOLORED
9. QUIT

To choose a menu option, simply press the number key next to that option. For instance, the Edit option lets you design a sprite. To choose that option, you press the 2 key. Let's look at the menu options in order.

## 1. Initialize

Sprite Designer always begins by asking you if you want to initialize, or clear out, the entire sprite workspace. Since this action erases all sprite data in memory, the program asks you to confirm before it continues. If you press Y to answer yes, every dot in all of the sprite shapes is turned on. You can choose this option at any time from the main menu.

## 2. Edit

Option 2 (Edit) moves you to the sprite-editing screen, which is divided into three areas. In the lower

"Sprite Designer" is a comprehensive utility for designing sprite shapes for use in games and animation. This photo depicts the main editing screen.
right corner are two numbers that show the sprite series you are working on, as well as the individual sprite you are designing. Each series contains eight sprites, and the series are numbered $0-15$, corresponding to their respective positions in memory. Within a series, each of the eight sprites is given a number 0-7.

In the upper right portion of the screen you will see the shapes of all eight sprites in the current series. As you design a sprite, the changes immediately appear in this area.

The left portion of the screen is the editing area, where you actually design the sprite shape. This area is $24 \times 21$ spaces in size, with each screen space corresponding to a dot in the sprite shape.

## Editing Functions

Once you have reached the editing screen, you need to remember only one command: The plus key ( + ) displays an entire screen of instructions for editing. To return from the help screen to the editing screen, press any key. The asterisk (*) returns you from the editing screen to the main menu.

When you enter the editing
screen, the editing area contains the shape of sprite 0 within the current series. The function keys $\mathrm{f} 3-\mathrm{f} 6$ allow you to select any series and any individual sprite within a series. Press $f 3$ to go to the next series, or $f 4$ (SHIFT-f3) to go back to the previous series. The $f 5 \mathrm{key}$ advances to the next sprite in the series, while $f 6$ moves to the previous sprite. If you have designed a series of shapes for animation, you can hold down f 3 or f 4 to move through the entire series quickly.

A reverse-video cursor indicates your position in the editing area. To move the cursor around, press the cursor keys just as you would normally. The size of the cursor depends on whether you are working on a single color or multicolor sprite. For a single-color sprite, the cursor is a square one space in size; for a multicolor sprite, it is a rectangle two spaces in size, containing a number in the range $0-3$.

You can turn on every dot in the current sprite shape by pressing CLR. For a single-color sprite, the space bar lets you turn individual dots on and off inside the editing area. You can erase a dot by pressing the space bar and turn a dot on by pressing SHIFT-SPACE (hold down SHIFT and press the space bar).

For a multicolor sprite, a dot can have any of four different colors, including the background color (see "Multicolor," below). Use the numbers $0-3$ or the letter keys $Z, X$, $C$, and $V$ to color a dot with the desired color.

You also can change the position of the sprite shape within the editing frame, shifting everything one dot to the right, left, up, or down. This is done by holding down the Commodore key and pressing $W, Q, R$, or $E$, respectively.

It is possible to flip a sprite shape horizontally or vertically, by pressing Commodore-I or Commo-dore-K, respectively.

The f1 key allows you to copy a shape from one sprite to any other shape in memory. First, use function keys $\mathrm{f} 3-\mathrm{f} 6$ to put the shape you want to copy into the editing area. Press f 1 to copy the shape; then use f 3 -f6 to select the shape you want to copy to. Press f 1 a second time, and the shape is copied instantly.

The f2 key inverts every dot in
the current sprite shape. Use $£ 7$ and f8 to change the sprite's color.
3. Animate

Option 3 (Animate) lets you cycle through all the sprite shapes in ascending order, beginning with series 0 , sprite 0 . When you choose this option, Sprite Designer prompts you to enter a delay interval which controls the speed of the animation. The smaller the delay interval, the faster the animation. Press SHIFT-SPACE to stop the animation and return to the main menu. You can also use keys f3-f6 to cycle forward or backward through the sprite shapes, as explained in the preceding section.

## 4. Save

Sprite Designer allows you to save an entire set of sprite shapes to disk or tape. Enter a filename when prompted; then press D or T to indicate disk or tape, respectively. To cancel the operation, press RETURN when prompted to choose disk or tape. If a disk error occurs, Sprite Designer prints the appropriate error message at the bottom of the screen.

## 5. Load

This option allows you to reload a set of sprite shapes from disk or tape. Follow the onscreen prompts as explained in the preceding section.

## 6. Add DATA Lines

Option 6 (BASIC DATA) lets you save sprite shapes in the form of BASIC DATA statements. This is done by adding DATA lines to an existing BASIC program. Activate Sprite Designer and load your existing sprite shapes or design new ones. Once the sprite shapes are in memory, exit Sprite Designer and type NEW. Then load the BASIC program to which you wish to add the sprites. Don't worry that the program will disturb the sprite shapes: Sprite Designer automatically copied them into a safe place (the RAM under BASIC ROM) when you exited the program.

When the BASIC program loads, do not run it. Instead, type SYS 34000 to reactivate Sprite Designer. Do not initialize the sprite shapes at this stage, or load any shapes from disk or tape. Instead, choose option 6. The program prompts you to enter the series of
sprites that you wish to save. When that is done, you also are given the opportunity to include REMarks along with the DATA lines.

After you answer those questions, the program prompts you to enter a filename and indicate whether to use disk or tape, as in options 4 and 5. At this point, Sprite Designer adds the DATA lines to the program in memory and saves the new program. If you wish to cancel the operation, press RETURN at the filename prompt without typing anything.

After the save is complete, exit Sprite Designer and type NEW (to reset BASIC's internal pointers). In order to work properiy, the BASIC program to which you add the DATA lines must not exceed 24 disk blocks ( 6144 bytes) in length.

## 7. Monochrome

Each series of eight sprites can be either monochrome (single color) or multicolor. You cannot mix monochrome and multicolor sprites in the same series. When you choose option 7, a 16 -color board appears on the screen. To choose a color, press the letter key matching that color. That color will be used for all eight sprites in the designated series.

## 8. Multicolor

Option 8 allows you to choose colors for a series of multicolor sprites. When you choose this option, a 16color board appears as described in the previous section. Since a multicolor sprite can have four colors, the program asks you to select four colors, numbered $0-3$. When you're drawing in multicolor mode, the cursor contains a number to indicate which color you are drawing in. To switch to a different color, press a number in the range $0-3$. A small color board to the right of the drawing area shows you the current drawing colors.

## 0. Quit

When you exit Sprite Designer, the program copies all the sprite shapes in the workspace into the "hidden" RAM underlying the BASIC ROM chip. This is done to make it easy for you to alternate between using your own BASIC programs and Sprite Designer. You can load and use a BASIC program after using Sprite Designer, then reload and
activate Sprite Designer again．If you choose not to initialize the work area，Sprite Designer copies the previously stored sprite shapes back into its workspace．This elimi－ nates the need to reload the sprites from disk or tape every time you switch between a BASIC program and Sprite Designer．

## Sprite Designer

Please refer to the＂MLX＂article elsewhere in this issue before entering the following program．
B4D日：4C 3585299588 C9 3692 84D8：90 F9 C9 39 B6 F5 8D 21 ØF 84E0：85 A9 03 20 6B 8738 E9 4D 84E8： 30 AA AA 238585 FD F5 84Fg：E8 BD 238585 FE 6 C FD 99 B4F8： 0120 Fg 854 C D3 8426 5B 8500：E4 FF FG FB 60 60 A5 FB A5 8508：18 6D $058585 \mathrm{FB} 9002 \mathrm{B2}$ 8510：E6 FC 60 00 A5 FD 18 6D 9C 8518：13 8585 FD 90 F4 E6 FE C3 8520：60 20060794 E3 9394 C3 8528：8B CE 97 BF 98 6D 98 3E 85 8530：9B C7 958896 A9 EF 8D FE 8538：28 03 A9 Cl 8D 18 g3 A9 E5 8546：8E 20 D2 FF A9 98 20 D2 75 8548：FF AD 86 02 8D FE 9F AD 65 8550：20 D6 BD FD 9F AD 21 DC F7 855日：BD FC 9F AD 8A 02 8D FF AF 8560：9F A9 01 8D 86 62 8D 2016 8568：D D A9 15 8D 18 D $20 \mathrm{FD} \mathrm{F6}$ 8570：85 A9 Ø0 85 F9 85 FA 8D 6A 8578：23 9F 20 90 FF A9 33 8D A4 8580：21 85 20 68 8E A9 ØD 85 C 2 8588：F7 85 F8 A9 30 8D 79 9F F4 8590：8D 7A 9F A9 808 DC 8A 92 Eg 8598：A9 31 8D 21 85 A9 63 28 81 B5A日：6B 87 4C E3 932844 E5 96 85A8：A9 04 BD 5B 86 A9 4285 D5 85日0：22 A9 78 8D 06 04 A9 6E EF 85B8：8D 27 04 A9 7D 8D E7 0768 85C0：A9 6D BD Cb 67 A2 25 A9 70 85C8：43 9D Ø1 Ø4 9D 51 64 9D 15 85D0：Cl 67 CA 10 F4 20758874 85D8：A9 6B 8D 50 04 A9 73 8D 85 85ED：77 04 A5 2285 Ø2 A9 06 Ø7 85E8：20 6B 87 A5 02852260 F4 B5F0：26 48 86 A9 6B 8D 306681 85F8：A9 72 8D 62 64 A9 7D 8D 9C 8600：42 06 A2 10 A9 43 9D 31 CB 8608：06 CA 10 FA A2 0A AD 12 ØD 8610：A9 $78 \quad 20 \quad 58 \quad 86$ A9 014 C C2 8618：6B 87 A9 FF 8D 15 Dø 2074 8620：A5 85 A9 72 BD 69 D4 A9 81 8628：71 BD D9 $97 \quad 2687$ 88 A9 D6 8630：6B 8D E9 06 A9 73 8D F7 22 8638：06 A2 ØC A9 43 9D EA Ø6 79 8640：CA 10 FA A9 62 4C 6B 8750 8648：A9 Øø BD 15 D 0 8D 21 D 0 FC 8650：A9 61 8D 86 02 4C A5 85 9E 8658：85 FB A9 FF 85 FC A9 28 F7 8660：8D 05 85 A5 2291 FB 20 EF 8668：06 85 CA 10 F6 A5 226027
 8678：44 $45 \quad 5349 \quad 474 E \quad 45 \quad 5248$ 8680：00 31 2E 20494 E 4954 0C 8688：49 41 4C 49 5A 45 OD 1D C7 8690：1D 32 2E 2045444954 A2 8698：0D 1D 1D 33 2E 20414 E 6D 86A0：49 4D 415445 gD 1D 1D C8 86A8：34 2E 2053415645 OD 8F 86BE：1D 1D 35 2E $284 \mathrm{C} 4 \mathrm{~F} 41 \quad 2 \mathrm{~F}$ 86B8：44 6D 1D 1D 36 2E 20448 F 86C0：41 $5441 \quad 2042415349$ B4 86C8：43 6D 1D 1D 37 2E 20 4D 30 86D $0: 4 \mathrm{~F} 4 \mathrm{E} 4 \mathrm{~F} 4348524 \mathrm{~F} 4 \mathrm{D} \mathrm{AE}$ 86D8：45 0D 1D 1D 38 2E 2g 4D 49

86E6：55 4C $5449434 F 4 C 4 F \quad$ AA 86EB：52 4544 日D 1D 1D 36 2E B5 86F0：20 51554954 DD 0D 1D AF 86F8：1D $414354494 F 4 E 20$ D6 8700：00 3020202020311116 8708：11 11 11 9D 9D 9D 9D 9D 1C 8710：9D 3220202020331179 8718：11 1111 9D 9D 9D 9D 9D 2C 8720：9D 34202020203511 0E 8728：11 11 11 9D 9D 9D 9D 9D 3C 8730：9D 36202020203711 A2 8738：11 1111 9D 9D 9D 9D 9D 4C 8740：9D 9D 534552494553 D9 8748：3A 11 9D 9D 9D 9D 9D 9D 82 8750：9D 535052495445 3A 92 8758：11 11 9D 9D 9D 9D 9D 9D FD 8760：9D 2B 20 C3 C3 204845 BD 8768：4C 50 gø ØA ©A A8 A2 63 8D 8770：B9 878748 C8 CA 10 F8 3E 8778：68 A8 68 AA 18 20 FO FF C 0 8780：68 AB 68 4C 1E AB 0670 CF 8788：86 01 日C 81 86 日3 02 01 F9 8790：87 03 1D 2185 0D 8981 CD 8798：91 16 1C 618716 1C CF 2C 87A0：93 10 02 1F 960718 2A DA 87AB：96 07 1F 14960518 A7 8A 87B0：94 10 0213951202 A4 1D 87B8：97 10 02 4D 98 10 02 FF B5 87C0：9E 1402 E4 91 0C 19 1C BD 87C8：92 øC $19 \begin{array}{lllllll}19 & 98 & 12 & 02 & 86 & 64\end{array}$ 87D0：87 1402 F9 $9310 \quad 027 \mathrm{~F}$ E8 87D8：95 6713 A6 9515 02 4A 90 87E0：96 $1502 \mathrm{BC} 991402 \mathrm{B6} 61$ 87E8：88 6402 AF 89 ØE 027879 87F0：8A 1117859 A 1092 2D 日B 87F8：9B 1092 A9 D8 8D 5B 86 EE 880ø：A5 22 8D 00 D8 8D 27 D8 42 88ø8：8D E7 DB BD C 0 DB A2 25 øE 8810：9D 01 D8 9D 51 D8 9D C1 10 8818：DB CA 10 F4 207588 8D 90 8820：50 D8 8D 77 D8 A2 1F 9D E5 8828：2C D8 CA 10 FA 8 CD 69 D8 99 8830：8D D9 DB 208788 8D E9 5F 8838：DA 8D F7 DA A2 OC 9D EA 32 8840：DA CA 10 FA 8D 95 D8 8D 25 8848：9A D8 8D 35 D9 8D 3A D9 35 8850：8D D5 D9 8D DA D9 8D 7580 8858：DA 8D 7A DA A2 09 9D 14 BF 8860：DB CA 10 FA A2 08 9D 3C 70 8868：DB CA 10 FA A2 $089 \mathrm{D} \mathrm{BC} \mathrm{C8}$ 8870：DB CA 10 FA 60 A2 16 AD 2 E 8878：00 A9 2820 58 86 A2 1633 8880：A0 27 A9 28 4C 5886 A2 D6 8888：14 A0 19 A9 78 4C 5886 B5 8890：12 2б 92 9D øб А9 90 Аด 47 8898：88 18 20 1E AB A9 EC 85 3D 88AO：A2 20 E4 FF DO OF A5 A2 58 B8A8：D 67 AD $9 \varnothing 8849808 D$ D6 88Bø：90 88 4C 958860 IF 4457 88B8：49 53 50 4C 41434520 D3 88C0：54 $4845 \quad 204355 \quad 525320$ 88C8：4F $52 \quad 20 \quad 20 \quad 9 \mathrm{E} 43525316$ 88D0：52 20 1C 4B 455953 6D 8E 88D8：©D 1D 1D 1F 4D 4F 4449 C6 88EØ：46 59 2ø 20 20 4D 4F 4E 94 88E8：4F 43 48 52 4F 4D 45 20 FA 88F0：20 9E $53 \quad 5041434511$ DB 88F8：9D 9D 9D 9D 9D 534849 El 8900：46 54 2D 53 50 41434579 8908：0D 1D 1D 1D 1D 1D 1D 1D 13 8910：1D 1D 1F 4D 554 C 5449 7F 8918：43 4F 4C $4 \mathrm{FF} 524544 \quad 206 \mathrm{~F}$ 8920：20 9E 302020203120 F6 8928：20 $20 \quad 32 \quad 202020331194$ 8930：9D 9D 9D 9D 9D 9D 9D 9D 43 8938：9D 9D 9D 9D 9D 9D 1C 28 D2 8940：9E 5A 1C 2920289 E 5886 8948：1C 292628 9E 43 1C 29 9D 8950：20 28 9E 56 1C 29 0D 0D 63 8958：1D 1D 1F 4D 4F 56452078 8960：41 524 F 554 E 442053 FE 8968：43 $5245454 \mathrm{E} \quad 20 \quad 20 \quad 20 \quad 02$ 8970：9E 51 20 1C 4 C 45465445 8978：20 20 9E $45 \quad 20$ 1C $424 F 11$

8980：54 54 4F 4D 0D 1D 1D 1F C7 8988：43 4F 4D 4D 4F 44 4F 52 0C 8990：45 20 4B $45 \quad 5920414 \mathrm{E} 28$ 8998：44 2E 2E 2020 9E 57 20 6B 89Aワ：1C $5249474854209 E 66$ 89A8：52 20 1C $544 F 50$ 日ø IF 90 89B6：53 59 4D 4D 45545259 BB 8988：20 2ø 202020202020 CB 89C0：20 20282020 9E 4B 2024 89C8：1C 484 F 5249 5A 4 F 4 E AB 89D0：54 41 4C 0D 1D 1D 1F 4397 89D8：4F 4D 4D 4F 444 F 5245 CE 89Eの：20 4B 455920414 E 44 FB 89E8：2E 2E 2020 9E 49 20 1C 1B 89Fb：56 4552544943414 C 36 89F8：0D ØD 1D 1D 9E 463120 DB 8A9日：05 C3 C3 2の 1C 43 4F 50 DF 8A08：59 6D 1D 1D 9E 46322015 8A10：05 c3 C3 20 1C 524556 1E 8A18：45 525345 gD 1D 1D 9E D8 8A20：46 332805 C3 C3 20 1C 03 8A28：53 $455249455328 \quad 28$ F6 8A30：9E 4634 IC 29 0D 1D ID 43 BA38：9E $46 \quad 35 \quad 2605$ C3 C3 20 B5 8A40：1C 53505249544520 AD 8A48：28 9E 4636 1C 29 0D 1D 02 BA50：1D 9E 46372065 C3 C3 38 8A58：20 1C 53505249544599 8A60：27 53 GD 1D ID 1D 1D 1D 06 8A68：1D 1D 1D 43 4F 4C 4F 52 C7 8A70：20 28 9E 4638 1C 29 90 5C 8A78：9E 43 4C 522005 C3 2019 8A8b：1C 44454 C 4554451139 8A88：9D 9D 9D 9D 9D 9D 53 50 BB 8A90：52 4954451111 9D 9D A5 8A98：9D 9D 9D 9D 9D 9D 9D 9D AD 8AAD：9D 9D 9E 2A 2005 C3 C3 C2 8AAB：20 1C 4D 454 E 551111 CD 8ABも：11 9D 9D 9D 9D 9D 9D 9D 7F 8AB8：9D $65 \quad 53 \quad 5452494 B 4521$ 8ACD：20 $41204 \mathrm{~B} 45 \quad 59$ 2E 2E 99 8AC8：2E 60204886 A9 6B 8D BC 8ADE：CB 04 8D 90 05 8D 08 06 7A 8AD8：8D 80 ø6 A9 73 BD EF 94 E5 8AE0：8D B7 05 8D 2F 06 8D A7 78 8AE8：06 A9 71 8D D4 07 A9 43 CB 8AFE：A2 25 9D C9 04 9D 9105 AF 8AF8：9D 69 Ø6 9D 81 Ø6 CA 1083 8B00：F1 A9 72 8D 9406 A9 06 B7 8Bも8：8D 5B 86 A2 66 Aø 14 A9 3 C 8B10：42 $85 \quad 22$ A9 AB $2058 \quad 86$ 85 8B18：A9 $18 \quad 206$ 6B 87 A9 1920 F9 8B20：6B 87 A9 1A 20 6B 87 A9 0D 8B28：00 85 C6 A5 C6 FU FC A9 71 8B30：00 85 C 64 C 948 B 3031 AA 8B38： 32 33 5 5A $58 \quad 43 \quad 56 \quad 20$ A0 5 A 8B40：11 91 1D 9D 8687 88 8A AF 8B48：8B 8C $89 \quad 85$ AB B3 B2 B1 15 8B50：A1 A2 93 2B 2A EB 8B EB 0A 8B58：8B EB 8B EB 8B 1F 8C 2476 8B60：8C 298 C 2 E 8C Cl 8B Cl C0 8B68：8B 49 8C 52 8C 5B 8C 6C A5 8B70：8C 80 8C 8F 8C 9B 8C 86 EA 8B78：8C 95 8C A3 8C AE 8C C2 Ø2 8B80：8C C8 8C F3 8C 2B 8D 5A 67 8B88：8D 87 8D 69 8E 38 8E CA C7 8B90：8A 47 8E 06 2б 1A 862027 8B98：4D 8E 20 FF 84 8D 93 8B 0B 8BA0：AD 1E A2 00 DD 36 8B FØ B3 8BA8：97 E8 8818 F7 4C 9A 8B 41 8BBO：8A GA AA BD 55 8B 85 FD A2 8BB8：E8 BD 55 8B 85 FE 6 C FD 16 8BC0：00 AD 1C D F （03 4C 9A 9A 8BC8：8B AD $938 B C 920 \mathrm{D} \varnothing 65 \mathrm{Bl}$ 8BD0：A9 20 4C D7 BB A9 5l 85 F6 8BD8：B5 $20 \quad 929020 \mathrm{F9} 982058$ 8BE6：49 $91 \quad 20 \quad 72$ 90 $2020 \quad 90 \quad 02$ 8BE8：4C 9A 8B AD 1C DE D6 03 El 8BFG：4C 9A 8B AD 93 8B 29 ØF 4D 8BF8：C9 62 D 0 Ø8 A6 FA BD 27 D3 8C00：D0 4C 08 8C AA BD $249 F 92$ 8C08：85 B6 $20 \quad 9299 \mathrm{AD} 93$ 8B AC 8C10：20 36 8C 267290 AD 93 LF 8C18：8B $20 \quad 37$ 8C 4C E2 8B A9 5D


93F0：4C F9 842021 9E 4C F9 65 93F8：84 $51 \begin{array}{llllllll}55 & 49 & 54 & 20 & 28 & 59 & C 2\end{array}$ 9400：2F 4E 29 20 3F 20 Øø A9 9F 9408：13 20 6B 87 20 3C 94 F0 B4 9410：DF 2034 9E AD FF 9F 8D DB 9418：8A 02 AD FE 9F GD 86 g2 EE 9420：AD FD 9F 8D 20 D 0 AD FC 99 9428：9F BD 21 D0 A9 9320 D2 64 9430：FF A9 ED 8D 2803 A9 4742 9438：8D 18 Ø3 øø 209588 c9 C0 9440：59 DØ Ø3 A9 FF 60 C9 4E A8 9448：D6 F2 A9 D0 60 A9 00 85 FA 9450：FB A9 20 85 FC A9 80 8D 5B 9458：05 85 A2 1F A0 00 A9 FF 04 9460：91 FB 88 D 0 FB 20068561 9468：20 0685 CA 10 EE A9 Ø1 11 9476：A2 7F 9D 7C 9F CA 10 FA 89 9478：A2 07 9D 27 D6 CA 10 FA A7 9480：A2 3F 9D 28 9F CA 10 FA 44 9488：A9 ØØ A2 6F 9D 68 9F CA 64 9490：10 FA A9 $0085 \mathrm{F9} 85 \mathrm{FACF}$ 9498：A9 33 8D 21852068 8E 33 94AD：A9 日D 85 F7 85 F8 604124 94A8：20 05122020202092 BB 94B0：05 20 20202045209 C 5D 94B8：12 20 20 20 20 $20205 \quad 206 \mathrm{E}$ 94C0：20 $28 \quad 204920811220$ E5 $94 \mathrm{CB}: 2020209205 \quad 20202040$ 94D0：20 4D $20 \quad 9812202020$ 5C 94D8：20 9205 GD 1D 1D 42 20 2A 94E0：90 $1220202020 \quad 92 \quad 0588$ 94E8：20 2020204620 le 1231 94F0：20 $202020 \quad 9205 \quad 202041$ 94FB：20 204 AA 2095122020 DA $\begin{array}{lllllllll}9500: 20 & 20 & 92 & 05 & 20 & 20 & 20 & 20 & c 7\end{array}$ 9508：4E $20 \quad 99 \quad 12 \quad 20 \quad 2020 \quad 2098$ 9510：92 05 घ0 43201 C 1220 AF 9518：20 $2020 \quad 9205 \quad 20202091$ 9520：20 47 20 1F 1220202094 9528：28 $92 \quad 65 \quad 2 \varnothing \quad 28 \quad 20 \quad 2 \varnothing$ 4B 77 9530：20 $9612 \quad 2020202092$ A9 9538：65 20 20 20 20 4 F 20 9A 9D 9540：12 $2012020 \quad 20 \quad 92 \quad 05$ 日D E4 9548：1D 1D $44 \quad 28$ 9F 12262079 9550：20 $209205 \quad 2020202018$ 9558：48 20 9Е 1228202028186 9560：92 $05 \quad 202020 \quad 204 \mathrm{Cl} 2056$ 9568：97 12 28 $28 \quad 2020929595$ 9570：20 $202020 \quad 50209 B 1206$ 9578：20 $202020 \quad 92 \quad 05$ 日6 53 BD 9580：50 52 49 $5445 \begin{array}{lllll}53 & 29 & \text { C3 } & 52\end{array}$ 9588：C3 28 26 $36 \begin{array}{lllllll}31 & 32 & 33 & 34 & 35 & \text { B2 }\end{array}$ 9590：36 37 11 9D 9D 9D 9D 9D DC 9598：9D 9D 9D $12 \quad 20 \quad 2020 \quad 20$ B0
 95AB：59 50

 $95 \mathrm{CO}: 4 \mathrm{~F} \quad 20 \quad 45$ 95C8：61 97 A9 15 20 6B $87 \quad 20$ EE 95D0：6B 97 A9 1420 6B 8728 EB 95D8：64 8F B9 7C 9F 9D 5E D9 23 95E6：88 CA 10 F6 2® FF B4 C9 48 95E8：日3 F6 26 C9 41 90 F5 C9 35 95FO：51 B6 Fl 38 E9 412096 DD 95FG：97 85 22 20 64 8F A5 2266 9600：99 7C 9F 88 CA 10 F9 A9 C9 9608：0日 A6 F9 9D 68 9F 4C C7 1A 9610：95 4C F9 $84 \quad 5345 \quad 524940$
 9620：11 9D 3111 9D 3211 9D E9 9628：33 0012 20 20 11 9D 9D 51 9630：20 D1 11 9D 9D D1 201163 9638：9D 9D D1 D1 92 日0 12 20 CB 9640：20 20209200122092 CD 9648：00 80 9650：41 $28 \quad 4 \mathrm{C} 45 \quad 545445 \quad 52$ D4 9658：20 4F 52 20 9F 524554 DA 9660：55 52 4E 9E 2C ØD 1D 1D 6D 9668：9F $53 \quad 544 \mathrm{~F} 50$ 9E 2054 4B 9670：4F 20454 E 44 2C 28 9F 8D 9678：44 45 4C 9E 2054 4F 20 9D


9688：20 6197 A9 0720 6B 87 C2 9690：A9 $18206 \mathrm{~B} \quad 87$ A9 $16 \quad 20 \quad 7 \mathrm{E}$ 9698：6B 8720 6B 97205897 9D 96AD：A2 03 B9 28 9F 9D 24 9F F4 96A8：88 CA 10 F6 A2 03 8E 49 C5 96BD：96 BD 24 9F 208797 AE 14 96B8：49 96 CA 10 F1 A9 11 8D 50 96C0：86 62 AD 499618693014 96C8：8D 4696 Aø 18204 C 979 C 96D0：A9 45 AØ 96 2Ø 1E AB 2092 96D8：FF 84 C9 14 D 014 4C F9 C6 96E0：84 C9 日D FØ 23 C9 93 DG 8A 96E8：03 4C 26 97 C9 41 90 E7 45 96F6：C9 51 B6 E3 38 E9 4120 B7 96F8：96 97 AE 49 96 9D 24 9F D4 97ø0：20 8797 A9 01 8D 86 ø2 FB 9708：Аब 18 20 4C 97 A9 46 А曰 E6 9710：96 20 1E AB EE 4996 AD 88 9718：49 96 C9 04 Dø 05 A9 00 F8 9720：8D 49 96 4C C2 96205809 9728：97 A2 03 BD 24 9F 9928 03 9730：9F 88 CA 10 F6 20 648 F 3C 9738：AD 26 9F 99 7C 9F 88 CA 93 9740：10 F6 A9 FF A6 F9 9D 68 2B 9748：9F 4C F9 84 AD 49 96 18 B9 9750：69 67 AA 18 20 F0 FF 60 FI 9758：A5 F9 日A EA 1869 D3 AB CF 9760：60 A9 日A 20 6B 87 A9 日B 45 9768：4C 6B 87 A2 60 A5 F9 C9 08 9770：0A 90 64 E8 E9 ØA 1869 E8 9778：30 8D 1D 96 8A 6930 8D 18 9780：1C 96 A9 09 4C 6B 87 8D D5 9788：86 02 Aด 1A 284 C 97 A9 3 C 9799：3E Аб 96 4C 1E AB C9 61 D2
 97A0：02 A9 $0160494 \mathrm{E} 54 \quad 45$ D2 97A8：52 56414 C 28494 E 2066 97B0：36 $3654 \quad 48$ gD 1D 1D 4 F 7C 97B8：46 205345434 F 4 E 44 AA 97CO：20 $28 \quad 31 \quad 20544 \mathrm{~F} \quad 20 \quad 3284$ 97C8：35 35 29 3A 20 00 A5 F9 EE 97DD： 48 A5 FA 48 A5 F8 48 A9 BC 97D8：9C 20 6B B7 2060 A5 A2 6C 97E0：06 BD $9002 \mathrm{C9} 20 \mathrm{FO} 0454$ 97E8：E8 4C El 97 Eの 64 Bg E7 B5 97FD：A9 908 7A A9 9285 7B 29 97FB：20 79 日6 20 6B A9 A5 15 FA 9800：D0 D5 A5 14 F6 3B C6 14 1B 9808：A9 FF 4514851420 IA CE 9810：86 A9 0085 F9 85 FA 2043 9818：4D 8E A5 1485 A2 20 9F 28 9820：FF 8A C9 A0 F6 1B C9 20 DE 9828：D® 日A A9 日も 85 C6 20 FF O1 9830：84 4C 1A 98 A5 A2 D $\operatorname{DE}$ E6 C3 9838：20 04 8F 26 Bl 8F 4C 1A EC 9840：98 6885 FB 6885 FA 68 CF 9848：85 F9 4C F9 844649 4C FF 9850：45 4E 41 4D 45 3A 20 ø0 日8 9858：54 41 50 45 20 4F 522065 986日： $44 \begin{array}{llllllll}49 & 53 & 4 \mathrm{~B} & 20 & 28 & 54 & 2 \mathrm{~F} & 9 \mathrm{E}\end{array}$ 9868：44 29 3A 20 ø0 26 1D 99 A3 9870：AD g® 20 BA FF A2 ø0 A8 CC 9878：20 A9 ED 8D 28 g3 A5 2D 80 9880：48 A5 2E 48 A9 0020 D5 EC 9888：FF $68 \quad 85$ 2E $68 \quad 85$ 2D A9 C4 9890：EF 8D 280320 9B 99 C9 BE 9898：14 Bø D2 A2 7F BD $0040 \mathrm{B7}$ 98AD：9D 7C 9F CA 10 F7 A2 3F 45 98A8：BD 8040 9D 28 9F CA 1020 98B0：F7 A2 OF BD CO 40 9D 68 EE 98B8：9F CA 10 F7 4C F9 84 A2 E3 98C0：7F BD 7C 9F 9D 90 40 CA E2 98C8：10 F7 A2 $3 F$ BD 28 9F 9D B3 98D0：80 40 CA 10 F7 A2 बF BD D2 98D8：68 9F 9D C0 40 CA 10 F7 2B 98E0：20 1D 99 AØ FF 20 BAFF 9 C 98E8：A5 2B 48 A5 2C 48 A9 Øø F 98F0：85 2B A9 20 85 2C A2 D 0 D9 98F8：Aの 46 20 ØD 996885 LC 05 9960：68 85 2B 20 9B 99 C9 14 1B 9908：B6 D6 4C F9 84 A9 ED 8D A6 9910：28 03 A9 2B 20 D8 FF A9 DE 9918：EF 8D $2803 \quad 60$ A9 0 D 20 BF

9920：6B 872060 A5 A2 08 BD 6A 9928： 0 日 02 C 9 20 F0 04 E8 4C CC 9930：27 99 E0 60 D0 OF 686875 9938：AD 2185 C 936 D 06320 F 2 9940：21 9E 4C F9 84 8A A2 0068 9948：A8 ©2 20 BD FF A9 20 A2 B5 9950：23 9D FF 9E CA 10 FA A9 9C 9958：0E 20 6B 87 A9 11206 B BD $\begin{array}{llllllll}9960: 87 & 26 & 95 & 88 & \text { C9 } & 54 & \mathrm{FQ} & 07 \\ 23\end{array}$ 9968：C9 44 FD 03 4C 369985 D3 9970：02 20 D2 FF A5 02 C9 5424 9978：D® ØA A9 1220 6B 87 A9 54 9980：01 4C 8699 A9 088502 2C 9988：AA A9 $04 \quad 60 \quad 554 \mathrm{E} 4954 \mathrm{CC}$ 9990：20 4E 4F 5420524541 AC 9998：44 59 00 C9 05 DØ 08 A9 66 99A日：17 20 6B 87 A9 FF 60 A5 01 99A8：02 C9 08 F0 03 A9 9060 7E 99B0：A9 08 20 B4 FF A9 6F 20 AF 99B8：96 FF A9 008522 20 A5 07 99C0：FF C9 OD FO OF 8523 A5 91 99C8：22 AA A5 23 9D FF 9E E6 AF 99D0：22 4C BE 9920 AB FF A9 F2 99D8：0E 20 6B 87 A9 FF 85 7A D3 99E0：A9 9E $857 B \quad 207900 \quad 20 \mathrm{FF}$ 99E8：6B A9 A5 146064 6A 91 DB 99F8：20 $5345 \begin{array}{lllllll}92 & 49 & 45 & 53 & 20 & F C\end{array}$ 99F8：20 20 00 205350524910 9AD日：54 $4520 \quad 30$ 010 $2053502 F$ 9A08：52 $49 \quad 54 \quad 45 \quad 20 \quad 3100 \quad 2070$
 9A18： $00205350524954456 A$ 9A20：20 33 Øロ $2 \varnothing 53505249$ FD 9A28：54 $45 \quad 20 \quad 34 \quad 8020 \quad 53 \quad 5097$
 9A38：53 $50 \quad 5249 \begin{array}{llllll}54 & 45 & 20 & 36 & 38\end{array}$ 9A40：00 2053505249544592

 9A58：32 38 31 2C 35333238 B 0 9A60：35 2C 43 4F 4 C 4 F 52 $53 \quad 30$
 9A76：99 FB 99 65 9A 6F 9A 1954 9A7B：9A 23 9A 2D 9A 37 9A 4112 9A8B：9A 4B 9A 55 9A 9E 5459 CF 9A88：50 45 20 9F 2A 9E 285495 9A90：4F $20.53 \quad 45 \quad 4 \mathrm{C} 45 \quad 43 \quad 5486$ 9A98：05 20 20 20 30 $302020 \quad 101$ 9AAD：20 $30 \quad 3120202030322 E$ 9AA8：20 $2020 \quad 30 \quad 33$ OD 1D 1D 22 9ABD：9E $5345 \quad 524945 \quad 53 \quad 20$ FD 9AB8：4F 52 20 9 F 52455455 CD 9ACD：52 4E 9E 2C 6520203662
 9ADO：20 $30 \quad 36 \quad 20 \quad 2020 \quad 30 \quad 37 \quad 64$ 9AD8：0D 1D 1D 9F 53544 F 5054 9AED：20 9E 544 F 204255494 B
 9AFQ：20 $30 \quad 38 \quad 20 \quad 20 \quad 20 \quad 30 \quad 3966$ 9AF8：20 20 20 $2811302020 \quad 20 \mathrm{BF}$ 9B0日： 3131 0D 1D 1D 9F 4445 C 4 9Ba8：4C 20 9E 544 F 28434149 9B10：4E $43 \quad 45 \quad 4 \mathrm{C}$ ह5 $2028 \quad 20$ B5 9B18：20 $20 \quad 20 \quad 31 \quad 32 \quad 20 \quad 20 \quad 20 \mathrm{FQ}$ 9820：31 $33 \begin{array}{llllllll} & 20 & 20 & 20 & 31 & 34 & 20 & 11\end{array}$ 9828：20 2031350052454012 9B30：41 $524 \mathrm{4B} 53 \quad 28 \quad 28 \quad 592 \mathrm{~F}$ BE 9B38：4E $29 \quad 28$ 3F 20 日も A9 $1 B 48$ 9B40：26 6B 87 A9 60856985 5C 9B48：6A 85 6B A9 0185 6C A0 B5 9850：00 A9 0385 6D A2 94 A9 52 9B58：51 99 94 669848 8A 48 D4 9B6ø：20 FF 8485 6E 68 AA 6863 9B68：A8 A5 6E C9 14 D 03 4C FD 9B70：F9 84 C9 ØD Dø 034 C AØ 9B 9B78：9B C9 03 Dø ø3 4C BD 9B BD 9B88：C9 2A D6 D8 B9 95064948 9B88：80 99 95 Ø6 B9 96 Ø6 49 F6 9B90：80 99 96 66 A5 6A 45 6C 6F 9B98：85 6A A5 6945 6B 8569 C4 9BAD：06 6C 26 6B A9 20999407 9BA8： 66 C8 C8 C8 C8 C8 CA D® 8A 9BBD：A6 $98 \quad 18 \quad 6914$ A8 C6 $6 \mathrm{C} \quad 39$

9BB8：16 9B 4C 4B 9B A9 日б C5 66 9BCD：69 D0 67 C5 6A D0 03 4C 07 9BC8：F9 $84 \quad 20$ Fg 85 A9 1C 20 5C 9BD0：6B $87 \quad 20 \quad 3 \mathrm{C} 94 \quad 85 \quad 70$ A4 A7 9BD8：2E A5 2D $18 \quad 69$ FE 85 FD 68 9BE0：85 65 BO O1 $88 \quad 84$ FE 8433 9BE8： $66 \quad 20 \quad 34 \quad 9 \mathrm{E}$ A9 $30 \quad 85 \quad 63 \quad 48$ 9BFO：A9 F2 8564 A9 2C 8D F8 C2 9BF8：9E A9 00 85 6D $46 \quad 6966 \mathrm{FF}$ 9C00：6A B0 OB E6 6D A5 6D C9 11 9C08：10 D0 F2 4C B8 9C A2 06 1E 9C10：A5 6D C9 0A 9004 E8 38 EF 9Cl8：E9 0A 09 30 8D F9 99 8A FE 9C20：09 30 8D F8 99 A5 6D 6A 73 9C28： 0 A 日A 69 80 2010 90 A5 26 9C30：FC 18698085 FC A5 70 FE 9C38：D0 $06 \quad 20 \quad 39$ 9D 4C 4A 9C 42 9C40：A9 $008562 \quad 20 \quad 06 \quad 9 \mathrm{D}$ 20 99 9C48：ØA 9D 2063 9E A9 61 8D 4D 9C50：05 85 A9 $2085 \quad 29$ A9 10 D8 9C58：85 2A A2 $85 \quad 20 \quad 72$ 9D 20 A9 9C60：06 9D A9 7C 85 FB A9 9F 10 9C68：85 FC A5 6D GA OA DA 8D 49 9C70：05 85 20 日6 85 A0 97 B1 60 9C78：FB 29 ØF 91 FB 8810 F7 0F 9C80：A9 Ø1 8D $0585 \quad 85 \quad 29$ A9 0F 9C88： $08 \quad 85$ 2A A2 $85 \quad 20 \quad 72$ 9D Cl 9C90： $20 \quad 06$ 9D A9 28 B5 FB A9 A2 9C98：9F 85 FC A5 6D OA OA 8D 32 9CAD：05 $85 \quad 20 \quad 06 \quad 85$ A9 01 8D 84 9CA8： $05 \quad 85 \quad 85 \quad 29$ A9 $94 \quad 85 \quad 2 A \quad 9 B$ 9CBD：A2 $65 \quad 20 \quad 72$ 9D 4C 03 9C 68 9CB8：A9 90 A8 91 FD C8 91 FD 29 9CC日：A9 02 8D $13 \begin{array}{lllllll}13 & 20 & 14 & 85 & 8 C\end{array}$ 9CC8：A5 FD 85 2D A5 FE 85 2E 3A 9CDD： 20 12 $9 \mathrm{EE} 20 \mathrm{FO} 85 \quad 20$ 1D $\quad 6 \mathrm{~F}$ 9CDB：99 AD FF 20 BA FF A6 FD 2A 9CED：A4 FE 20 OD 99 20 9B 99 1F 9CEB：C9 14 BO EA 2021 9E 4C DF 9CED：F9 84 A5 64 8D 03 日2 A5 65 9CF8： 63 8D $82 \quad 02 \quad 18 \quad 69$ 日1 $85 \quad 95$ 9D00：63 90 02 E6 $64 \quad 60$ A5 70 20 9D08：F0 2F 20 F2 9C A9 BF 8D F2 9D10：04 62 A4 62 B9 6F 9A 8D D6 9D18：26 9D C8 B9 6F 9A 8D 27 AA 9D20：9D A2 05 AO OD B9 FF FF 64 9D28：Fも 08 9D $00 \quad 02$ E8 C8 $4 \mathrm{C} \quad 23$ 9D30：25 9D 20 43 9D E6 62 E6 Dl 9D38：62 20 F2 9C A9 83 8D O4 4F 9D40：02 60 CA A9 00 9D 00 02 01 9D48：86 61 E8 $8 \mathrm{BA} 18 \quad 65 \quad 65 \quad 85 \quad 8 \mathrm{~B}$ 9D50：65 90 02 E6 66 A5 65 8D 33 9D58： 06 Ø2 A5 66 8D 01 02 A4 48 9D60：61 B9 ØD 0291 FD $88 \quad 1080$ 9D68：FB A5 6585 FD A5 668567 9D70：FE $60 \quad 86 \quad 61$ A 0060 AD 10 9D78：9D 206685 C6 2A D0 F2 17 9D80：20 42 9D C6 29 FD 18 A5 5F 9D88：29 29 03 D0 06 20 06 9D 6A 9D90：4C 96 9D 2039 9D A9 10 FO 9D98：85 2A A2 05 4C 72 9D 60 8D 9DAØ：A2 Oठ A9 30 8D F5 9E 8D 74 9DAB：F6 9E 8D F7 9E Bl FB DD C9 9DBD：ED 99 90 6A 38 FD ED 99 2B 9DB8：FE F5 9E 4C AF 9D E8 EØ 30 9DC0： 03 D0 EC A6 61 B1 FB C9 4D 9DC8： 64 B0 06 C8 C9 日A B0 0188 9DD0：C8 B9 F5 9E 9D 90 02 E8 61 9DD8：C8 C 064 D6 F4 60 A9 日0 B2 9DEØ：8D EB 9D 8D EE 9D AØ 20 B9 9DE8：A2 60 AD FF FF 8D FF FF 61 9DFB：EE EB 9D EE EE 9D CA DD 95 9DFB：Fl EE EC 9D EE EF 9D 88 5B 9ED0：DØ E6 60 AD 日E DC 29 FE 7B 9E08：BD BE DC A5 O1 29 FE 85 B5 9E10：日1 60 A5 01 0901850103 9E18：AD 0E DC 09 g1 8D ØE DC 13 9E20：60 20 03 9E A9 AD 8D EC B7 9E28：9D A9 20 8D EF 9D 20 DE 90 9E30：9D 4C 12 9E A9 20 8D EC 51 9E38：9D A9 Ag 8D EF 9D 4C DE 69


# Disk Expander For Apple II 

Boris Troyanovsky

Everyone can use more disk space． This program allows you to format DOS 3.3 disks with an extra track of space，giving you 16 more disk sectors for storage．

Here is a utility that gives you extra storage space on any DOS 3.3 disk． After formatting a disk with this program，you have 16 extra disk sectors for storing programs and other files．Type in the program and save it to disk．

When you run the program，it waits for you to press a key．Insert a blank disk into slot 6 ，drive 1 （this is the built－in drive on Apple IIc com－ puters）．Press any key to begin． When the drive stops spinning，the disk has been formatted with 16 extra sectors．Now you can save a HELLO program on the disk or use it as you would a normal DOS 3.3 disk．The FID program on the DOS 3．3 System Master disk can be used to verify that the disk really does contain the extra space．

## Disk Expander for Apple II

For instructions on entering this program， please refer to＂COMPUIEl＇s Guide to Typing In Programs＂elsewhere in this issue．
 1月 26 TEXT ：HOME ：HTAB 17：PRI NT＂D．M．E．S．＂：VTAB 1：FOR
$x=1$ TO 16：HTA日 $X:$ PRIN $T$＂－n；：NEXT X：FOR $x=25$ TO 40；HTAB X：PRINT＂－＂； ：NEXT X
日F 30 VTAB 13：PRINT＂INSERT DIS K INTO SLOT 6，DRIVE in：$^{\prime \prime}$ PR INT＂AND PRESS ANY KEY＂：$G$ ET A
9640 PRINT

39 60 POKE 48894，PEEK（48894）＋ 1
8970 PRINT D＊；＂INIT HELLO，D1，S6 ＂：PRINT Ds；＂DELETE HELLO＂
3C BD PDKE 48894，PEEK（48894）－ 1
$2 A 9 \varnothing S S=6: S E=0: B U=B 192: O P$ ＝1：TR＝17：GOSUB 136
I日 100 POKE 8192 ＋196，255：POKE日192＋197；255：POKE 日19 $2+52,36$
F6 110 SS $=0: S E=0: B U=8192: 0$ $P=2: T R=17:$ GUSUB 136
AD 120 GDTO 20
56 130 REM＊＊
B5 140 FOR SA $=5 S$ TO SE
F7 150 POKE 788，TR：POKE 789，SA： POKE 796，OP
C7 $168 \mathrm{HB}=$ INT（BU／256）：LB $=$ BU－（HB 256）
bE 179 POKE 792，LB：POKE 793，HB
27180 CALL 768：BU $=\mathrm{BU}+256: \mathrm{N}$ EXT SA
23 196 RETURN
37206 FOR I＝ 76 TO 822：READ A：POKE I，A：NEXT I：RETU RN
98 210 DATA $169,3,160,16,32,217$ ， $3,96,0,0,6$
IC 220 DATA $0,0,0,0,0,1,96,1,0,1$ 7，15
C2 230 DATA $48,3,0,32,6,0,1, \theta, 25$ 4，96，1
240 DATA $0, \varnothing, \sigma, \sigma, \sigma, \sigma, \varnothing, \varnothing, \sigma, \varnothing$ ， 0
IC 250 DATA $0,0,6,0,0,1,239,216$,

# 1571 Utility Package 

Dick Smit

Among other exciting features, the Commodore 1571 disk drive has the ability to perform high-speed burst mode operations and can read MFM (non-Commodore) disks for CP/M mode. The four programs included with this article let you copy MFMformat disks, read and alter the information on an MFM disk, and access all of the 1571's special features from BASIC. A Commodore 128 with 1571 disk drive and 80 -column monitor is required.

The Commodore 1571 is the most versatile disk drive ever offered by Commodore. It can operate as a 1541 drive, giving you access to the huge library of existing Commodore 64 software. With a Commodore 128 in 128 mode, it can also transfer data in burst mode at much higher speeds than a 1541 disk drive. Commodore disks use a recording system known as GCR (Group Code Recording), but $\mathrm{CP} / \mathrm{M}$ disks for many other computers use a different system known as MFM (Modified Frequency Modulation). Since the 128 can operate as a CP/M computer, the 1571 provides the ability to read and write MFM-format disks. $\mathrm{CP} / \mathrm{M}$ is one of the most widely used microcomputer operating systems, and vast amounts of public domain $\mathrm{CP} / \mathrm{M}$ software are available on MFM disks. The IBM PC and compatible computers also use MFM disks.

The 1571's special capabilities are impressive, but using them from BASIC is not always so easy. Some of the most useful 1571 routines aren't designed for use with

## Command Descriptions

There are 14 individual routines included in Program 3. Five of these serve as subroutines for the other nine user-callable subroutines. These five subroutines (SENDCMD, SPOUT, SPIN, CLKLO, and CLKHI) are not meant to be called directly from BASIC with SYS.

The following descriptions provide all the information needed to use these routines. The Call address specifies the entry point of the routine; to activate the routine, SYS to this address. The Table address shows the location of that command's data storage area. The Format section of each description details the function of each byte in the command's storage area. Note that some bits are common to all commands; they are detailed only in the description of the first command, Read Sector.

## READ SECTOR

Purpose: Reads a sector from the currently logged disk and stores the data in the computer's memory
Call address: \$30F8 (12536)
Table address: $\$ 3800-\$ 3806$ (7 bytes)
Format: \$3802: Control byte
bit 7 transfer data ( $1=$ no transfer)
bit 6 error ignore flag ( $1=$ ignore error)
bit 5 buffer transfer ( $1=$ transfer buffer)
bit 4 side select (MFM only- $0=$ front, $1=$ back)
bits 1-3 burst command ( 000 for Read Sector)
bit 0 drive select (keep at 0 for all commands)
\$3803: Track to be read ( $0-35$ for GCR or 0-39 for MFM)
$\$ 3804$ : Sector to be read (range of valid values depends on format and mode)
$\$ 3805$ : Number of sectors (must be more than zero)
\$3806: Next track (optional, normally unused)
Explanation: This routine reads a sector from the disk into the memory. Before this routine is called, the correct values should be placed in the instruction table by POKEing into locations $\$ 3802-\$ 3806$. You must also specify the addresses where the data read from disk is to be stored. Computing the length of this area is not difficult for GCR, since a GCR block always contains exactly 256 bytes. For MFM, however, the block length may vary from 128-1024 bytes. Make sure that the difference between the starting and ending addresses matches the number of bytes you expect the sector to contain. Store the low byte of the starting address in location $\$ F B$ and the high byte in location $\$ \mathrm{FC}$. Similarly, locations $\$$ FD- $\$$ FE must contain the low and high bytes of the ending address. You can calculate the low and high bytes of an address A with the statements $\mathrm{HI}=\mathrm{INT}(\mathrm{A} / 256)$ and $\mathrm{LO}=\mathrm{A} \cdot \mathrm{HI}^{*} 256$, where HI is the high byte and LO is the low byte.
Example: None.

BASIC, and cannot be called directly with a SYS command. And the 1571 user's manual offers little information on how to use special features such as burst mode.

This article includes four programs which make the 1571's power easily accessible to BASIC programmers. Program 1 lets you copy MFM-format disks. Program 2 is a comprehensive "disk doctor" that permits you to read and alter any data found on an MFM disk. Program 3 is a machine language utility which makes it possible to access all burst mode routines with BASIC SYS commands. Program 4 is a machine language display routine used by Program 2.

Type in and save all four programs (be sure you have copies of all four on the the same disk). Programs 1 and 2 are ordinary BASIC programs. (To generate the \{BELL\} character in Program 1, hold down the CONTROL key and type a G.) Programs 3 and 4 are written in machine language and must be typed in with the Commodore 128 version of "MLX," the machine language entry program listed elsewhere in this issue. Be sure to read the MLX instructions carefully before you begin. Here are the addresses required to enter Programs 3 and 4 with MLX:
Program 3: BURST
Starting address: $\quad 3000$
Ending address: 323F
Program 4: SCREEN
Starting address: 3400
Ending address: 349F
You must save Programs 3 and 4 with the filenames BURST and SCREEN, respectively. It's important to use these filenames because Programs 1 and 2 use them when attempting to load the programs from disk. Again, it's also important that you save Programs 3 and 4 on the same disk with Programs 1 and 2.

## MFM Disk Copier

Program 1 makes copies of MFMformat disks, including both $\mathrm{CP} / \mathrm{M}$ and IBM PC disks. It will not copy GCR-format Commodore disks, nor can it be used to duplicate copyprotected MFM-format disks. (Note that the master system disk for Commodore $128 \mathrm{CP} / \mathrm{M}$ isn't in true

## WRITE SECTOR

Purpose: Write a sector from memory to the currently logged disk
Call address: $\$ 3153$ (12627) in bank 12-15
Table address: \$3807-\$380D (7 bytes)
Format: \$3809: Control byte
bits 4-7 same as Read Sector
bits 1-3 command ( 001 for write)
bit $0 \quad$ same as Read Sector
\$380A-\$380D: same as Read Sector
Explanation: The format of this command is almost identical to that of Read Sector. The only difference is that it writes a block to the current disk.
Example: This program writes the contents of locations $\$ 4000-\$ 40 \mathrm{FF}$ to track 20, sector 3 in GCR format.

```
10 B=DEC("3800"):POKE251,0:POKE253,0:POKE252,64:PORE254,65
20 POKE B+3,20:POKE B+4,3:POKE B+5,2
3® OPEN15,8,15:BANK 15:SYS DEC("3153"):END
```


## INQUIRE DISK

Purpose: Log the disk in the drive
Call address: \$30E8 (12520) in bank 12-15
Table address: $\$ 380 \mathrm{E}-\$ 3810$ ( 3 bytes)
Format: \$3810: Control byte
$\begin{array}{ll}\text { bits 5-7 } & \text { not used (can be any value) } \\ \text { bit 4 } & \text { same as Read Sector } \\ \text { bits 1-3 } & \text { command (010 for Inquire Disk) } \\ \text { bit } 0 & \text { same as Read Sector }\end{array}$
Explanation: This command logs a disk for use. Disks must be logged in before they are used. Information pertaining to the disk is returned in the status byte. The status byte indicates the disk's format (MFM or GCR), the number of bytes in each sector, and the drive's error status. If you wish to determine the format of the disk, use the command Query Disk Format, which returns more information.
Example: This line logs the disk and prints the status and format on the screen.
10 OPEN15,8,15:BANK 15:SYS DEC("30E8"):PRINT PEEK(250):END

## FORMAT MFM

Purpose: Format an MFM disk
Call address: \$30EE (12526)
Table address: \$3811-\$381B (11 bytes)
Format: \$3813: Control byte
bit 7 partial format ( $1=$ partial)
bit 6 index mark written ( $1=$ written)
bit 5 double side select ( $1=$ format double side)
bit 4 side select (valid if bit $5=0$ )
bits 1-3 command ( 011 for MFM)
bit 0 same as Read Sector
\$3814: Control byte
bit 7 must be a 1
bit 6 must be a 0
bits 0-5 specify the logical starting sector
$\$ 3815$ : Interleave byte (normally 0)
\$3816: Sector size ( $0=128$ bytes, $1=256,2=512,3=1024$ )
\$3817: Last track ( 0 to 39 , used for partial format)
\$3818: Number of sectors per track (standard is 26 for 128 -byte sectors, 16 for 256 -byte sectors, 9 for 512 -byte sectors, and 5 for 1024-byte sectors.)
\$3819: Logical starting track (normally 0)
\$381A: Starting track offset (normally 0)
$\$ 381 \mathrm{~B}$ : Fill byte (value which to fill all sectors; normal value is \$E5)
Explanation: This command formats an MFM disk, which allows great flexibility. You may control the size of the sectors, the number of sectors

MFM format, and cannot be copied with this program.) When you run the program, it checks to see whether the burst utility routine (Program 3) is in memory, and loads it from disk if it is not. Follow the prompts on the screen and swap disks when indicated. The program automatically detects the format of the source disk and creates the same format on the destination disk. An 80 -column monitor is required because the program uses the 128's FAST mode.

## MFM Disk Utility

Program 2, "MFM Disk Utility," offers a number of useful features for manipulating the information on MFM disks. Note that it requires an 80 -column display, since a 40 column screen doesn't have enough room to display the contents of an entire 1024-byte MFM disk sector. When you run the program, it loads both the BURST and SCREEN routines (Programs 3 and 4) from disk, if they aren't already in memory. Line 4 of the program is optional: Its only purpose is to make sure that the drive's read/ write head is within the range of a GCR disk (tracks 1-35) before the main program begins.

The program has the standard features found in most disk utilities. With this program, you can examine the contents of any sector on an MFM-format disk, and change the data as desired. The program is selfprompting, so you won't need extensive instructions to use it. Simply respond to the prompts displayed on the screen. Here is a list of the program's functions:

[^6]You should always perform a log in operation when you insert a new disk in the drive. After logging in a new disk, you should use the New block option to select the first block before using the + or - keys to change blocks. The program dis-
per track, and the number of tracks per disk. You need not precede this command with an Inquire Disk or Query Disk Format command.
Example: The following will format an MFM disk with ten 512-byte sectors per track on both sides.
10 OPEN $15,8,15: \operatorname{B=DEC}$ ("3800"): POKE B+19,102: POKE B+22, 2
20 POKE B+2ø,128: POKE B+24,10:BANK 15:SYS DEC("30EE"):END

## FORMAT GCR

Purpose: Format a GCR disk
Call address: \$30E4 (12516) in bank 12-15
Table address: $\$ 381 \mathrm{C}-\$ 3821$ ( 6 bytes)
Format: $\$ 381 \mathrm{E}$ : Control byte (must be $\$ 06$ )
$\$ 381 \mathrm{~F}$ : Control byte (must be $\$ 00$ )
$\$ 3820-\$ 3821$ : ID characters (can be any value)
Explanation: Formats a disk in Commodore GCR (Group Code Recording) format. This command operates the same as a normal format but does not write a directory to the disk.
Example: Format a GCR disk with an ID of GC
10 OPEN 15, 8, 15:B=DEC("3800"): POKE B+32, 71:POKE B+33,67
20 POKE B+30,6:POKE B+31, $9: B A N K ~ 15: S Y S ~ D E C(" 36 E 4 "): E N D$

## SECTOR INTERLEAVE

Purpose: Read or change the sector interleave factor used for multisector burst read and write
Call address: $\$ 30 \mathrm{C} 4$ (12484) in bank 12-15
Table address: \$3822-\$3825 (4 bytes)
Format: \$3824: Control byte
bit 7 interleave read or write ( $0=$ write interleave, $1=$ read interleave)
bits 1-4 select command ( 0100 for sector interleave)
bit 0 same as Read Sector
$\$ 3825$ Interleave (interleave to be written to the drive; $\$ 00$ is normal)
Explanation: Reads or sets the interleave byte stored in the drive used for multisector reads or writes. The interleave byte is usually set to zero.
Example: Read and display the sector interleave.
10 OPEN 15,8,15:BANK 15:B=DEC("3800"): POKE B+36,136
20 SYS DEC("30C4"):SI=PEEK(250):PRINT SI:END

## QUERY DISK FORMAT

Purpose: Determine the disk format on the specified track
Call address: $\$ 3099$ (12441) in bank 12-15
Table address: $\$ 3826-\$ 3829$ (4 bytes)
Format: $\$ 3828$ Control byte:

$$
\begin{array}{ll}
\text { bit } 7 & \text { step head flag }(0=\text { track } 0) \\
\text { bit } 4 & \text { same as Read Sector } \\
\text { bits 1-3 } & \text { select command (101 for Query Disk Format) } \\
\text { bit } 0 & \text { same as Read Sector } \\
\$ 3829 \text { Track offset (if bit } 7 \text { of } \$ 3828 \text { is set to } 1)
\end{array}
$$

Explanation: Determines the format of any track on the disk. This command also logs in the disk so that it can be used. The status byte in \$FA (250) is updated to indicate any errors, the sector size of the disk ( 128,256 , 512, or 1024), and the disk's format (MFM or GCR). For an MFM disk, the routine returns additional information about the format in locations $\$ 3700-\$ 3704$ (14080-14084). Location $\$ 3700$ holds the number of sectors on the track; $\$ 3701$ holds the logical track number on the track; and $\$ 3702$ holds the minimum logical sector number (the sector with the lowest value address). Location $\$ 3703$ holds the maximum logical sector number (the sector with the highest value address); $\$ 3704$ holds the $\mathrm{CP} / \mathrm{M}$ hard interleave found on the track. This data can be useful in finding the format of nonstandard MFM disks.

Example: Determine the format of track 10.
plays information about the format of the currently logged disk. The double side select operation lets you access the alternate side of a dou-ble-sided disk. You can't access the back side of an MFM disk by simply flipping it over, since that maneuver prevents the drive from finding the disk's index hole.

## Burst Mode Utility

In addition to its use with Programs 1 and 2, Program 3 provides full access to the 1571's extra featuresincluding burst mode commandsfor anyone wishing to write diskoriented programs. Although the program itself is written in machine language, you need not be a machine language expert to use it. All of the disk-handling routines can be accessed from BASIC with a SYS command. Of course, the routines can also be accessed from machine language if you wish.

Program 3 occupies memory locations 12288-12860 (\$3000$\$ 323 \mathrm{C}$ ). Each burst utility command is activated by SYSing to a different location. For instance, the SYS address for the Query Disk Format routine is $\$ 3099$ (12441). To execute this routine, you can perform either SYS 12441 or SYS DEC("3099").

Program 3 also uses a small command table which begins at location $\$ 3800$ (14336). This table contains the actual commands which are sent to the drive to perform disk operations. To create the command table from BASIC, include the following lines in your program (this routine may be renumbered as needed):

1000 RESTORE: FOR I=DEC("3800")
TO DEC(" $\left.3800^{\prime \prime}\right)+16$ * 3-1
1010 READ AS: POKE I, DEC(AS): NE XT I:RETURN
1020 DATA 55,30,00,00,01,02,01 $, 55,30,02,00,01,02,01,55,30$
1030 DATA $04,55,30,06,81,00,02$ $, 27,0 \mathrm{~A}, 00,00, \mathrm{E} 5,55,30,06,00$
1040 DATA $58,58,55,30,08,00,55$
$, 30,0 \mathrm{~A}, 00,55,30,8 \mathrm{C}, 00,00,00$
You can also generate the command table by calling the GEN TABLE routine contained in Program 3 (see below).

Many of the special disk commands require that you pass some information to the drive along with the command itself. For example, when you wish to read the contents

10 OPEN 15,8,15:BANK 15:B=DEC("3800"):POKE B+41,10
20 POKE B+40,138:SYS DEC("3099"): END

## INQUIRE STATUS

Purpose: Read or write the status byte in the drive
Call address: $\$ 3075$ (12405) in bank 12-15
Table address: \$382A-\$382D (4 bytes)
Format: $\$ 382 \mathrm{C}$ (14380) Control byte
bits 6-7 $00=$ write new status
$01=\log$ in disk
$10=$ read status
$11=$ has disk been changed? (\$FA contains \$0B if
changed)
bits 1-4 burst command (110 for Inquire Status)
bit 0 same as Read Sector
$\$ 382 \mathrm{D}$ (14381) New status (status sent to the drive if $\$ 382 \mathrm{C}$ bit 7 is 0 )
Explanation: Reads or writes the status in the drive. The command can also be used to detect whether the disk has been swapped, and if it has, to $\log$ it in.
Example: Read and display the status from the drive.
10 OPEN 15,8,15:BANK 15:B=DEC("3800"):POKE B+44,140
20 SYS DEC("3675"):PRINT PEEK(250):END

## SENDCMD

Purpose: Send a command to the disk drive
Call address: \$304A (12362) in bank 12-15
Table address: none
Format: none
Explanation: Sends a command to the disk drive. The Y and X registers must contain the high and low byte, respectively, of the address for the character string which comprises the command. The A register must contain the length of the command. This subroutine is called by all the burst utility commands. For the subroutine to function properly, the disk command channel must be open to logical file 15 (OPEN $15,8,15$ ).
Example: Send a Query Disk Format command.
10 OPEN 15,8,15:BANK 15:SYS DEC("304A"),4,38,56:END

## SPIN

Purpose: Prepares the serial bus for fast serial input
Call address: $\$ 3025$ (12325) in banks where the I/O block is visible (for example, bank 15)
Table address: none
Format: none
Explanation: For standard (slow) data transfers, the 128's serial bus is bidirectional-data is free to flow either in or out. However, the bus has extra circuitry to enforce the direction of data flow for fast (burst mode) transfers. This subroutine, intended for use by other burst utility routines, sets up the serial bus for fast input.

Example: Prepares bus for fast input.
10 sYs DEC("3625"):END

## SPOUT

Purpose: Prepares the serial bus for fast serial output
Call address: $\$ 3000$ (12288) in banks where the I/O block is visible (for example, bank 15)
Table address: none
Format: none
Explanation: See the explanation above for the SPIN routine. This routine sets up the serial bus for fast output.
Example: Prepares bus for fast output.
10 SYS DEC("3006"): END
of a sector，you must tell the drive which sector to read．The command table contains a storage area for each command．Before you activate a command with SYS，you must POKE the data needed by that com－ mand into the corresponding stor－ age area for that command．The descriptions at the end of this article contain all the details you need to call the 14 routines provided by Program 3.

To see how this works，let＇s call the Read Sector routine．The description for this routine indi－ cates that its storage area is at loca－ tions $\$ 3802-\$ 3086$ ．In addition to placing information in that area， you must indicate the starting and ending addresses of the memory area where you wish to store the data from the disk sector．The ad－ dresses are stored in locations \＄FB－\＄FC and \＄FD－FE，respective－ ly，using standard low－byte／high－ byte format．The following program segment calls Read Sector to read the contents of track 10，sector 1 into memory at $\$ 4000$（it assumes you are reading a GCR disk）．
10 B＝DEC（＂ 3800 ＂）：POKE251， $0:$ POK E253， $0:$ POKE252，64：POKE254，6 5
20 POKE $\mathrm{B}+3,10:$ POKE $\mathrm{B}+4,1:$ POKE $B+5,2$
30 OPEN15，8，15：BANK 15：SYS DEC （＂30F8＂）：END

## Program 1：MFM Disk Copier

For Instructions on entering this program． please reter to＂COMPUTEI＇s Guide to Typing In Programs＂elsewhere in this issue．

QF 1 REM COPYRIGHT 1987 COMPUT E！PUBLICATIONS，INC． \｛2 SPACES\}ALL RIGHTS RESE RVED．
PF 2 PRINT＂\｛CLR］COPYRIGHT 1987 ＂：PRINT＂COMPUTE！PUBLICAT IONS，INC．＂：PRINT＂ALL RIG HTS RESERVED．＂：FORX＝1TOIの 00：NEXT
CJ 10 OPEN15，8，15
FB 20 FAST
MQ 30 BANK15
KK 40 PRINT＂\｛CLR\}\{4 TAB]MFM DI SK COPIER＂
FB 45 IFPEEK（DEC（＂ $3800^{\circ}$ ））$=85 \mathrm{TH}$ ENGOTO60
DX 50 BLOAD＂BURST＂
XF 60 SYSDEC（＂3200＂）
PX $78 \mathrm{~S} \$="\{B E L L\}\{C L R\}$ INSERT SO URCE DISK＂
XB 80 D $\$="\{B E L L\}$ INSERT DESTINA TION DISK ${ }^{13}$
KG 90 ES＝＂\｛BELL\}\{CLR\}ERRORS: "
QF 100 PRINT：PRINT＂\｛BELL\}INSER T SOURCE DISK＂
MR 110 GETAS：IFAS＜＜CHRS（13）THE NGOTOIIØ
FK 115 POKEDEC（＂ 3828 ＂）， $26: S Y S D$

## CLKLO

Purpose：Set the serial bus clock line to a low state
Call Address：$\$ 3038$（12344）in banks where the I／O block is visible（for example，bank 15）
Table address：none
Format：none
Explanation：Sets the serial bus clock line output to a low state（ 0 volts）． This subroutine is intended for use by other burst utility routines．
Example：Bus clock line output set to a low state．
16 sys DEC（＂3638＂）：END

## CLKHI

Purpose：Set the serial bus clock line to a high state
Call address：$\$ 3041$（12353）in banks where the I／O block is visible（for example，bank 15
Table address：none
Format：none
Explanation：Sets the serial bus clock line output to a high state（ +5 volts）．This subroutine is intended for use by other burst utility routines．
Example：Bus clock line output set to a high state．
10 sys DEc（＂3041＂）：END
GEN TABLE
Purpose：Generates the command table at $\$ 3800$ required for the other BURST subroutines
Call address：$\$ 3200$（12800）in banks with block 0 RAM
Table address：none
Format：none
Explanation：Creates the command table at $\$ 3800$ ．The table can also be generated using the BASIC program shown above．
Example：Generates the command table at $\$ 3800$ ．
16 sys DEC（＂3200＂）：END

EC（＂3099＂）：A＝PEEK（250）： A＝AAND15：IFA＜2THENBS＝1： ELSEBS＝0
PX 116 POKE DEC（＂3828＂）， 10
SM 120 SYSDEC（＂3999＂）：SB＝PEEK（ 250）： $\mathrm{SI}=\varnothing$
RC 130 TD＝SBAND128
KM 140 IFSB＝0THENPRINT：PRINT＂I DONT COPY GCR DISKS＂：C LOSE15：RUN
MK 150 PRINT＂MFM FORMAT＂
MJ 160 BL＝SBAND48
RA 170 IFBL $=0$ THENP $1=0: B Y=128$
BR 180 IFBL $=16$ THENPI $=1: B Y=256$
MF 190 IFBL $=32$ THENPI $=2: B Y=512$
PH 200 IFBL＝48THENPI＝3：BY＝1624
QE 205 P2＝PEEK（DEC（＂37日0＂））
HX 210 B＝DEC（＂3800＂）
BX 220 POKEB＋22，P1：POKEB＋24，P2
CK 230 PRINTBY＂BYTE SECTORS＂P2 ＂SECTORS PER TRACK＂
AF 270 PRINT：PRINTD\＄
QK 280 GETAS：IFAS《＞CHR\＄（13）THE NGOTO280
EF 290 PRINT：PRINT＂\｛3 BELL\}FOR MATTING．．．＂
EC 294 SL＝DEC（＂3900＂）：SA＝252：E A＝254：POKE251，0：POKE253 ，$\varnothing:$ IFBS $=1$ THENPOKEDEC（＂3 813＂），38：POKEDEC（＂3813＂ ）．PEEK（DEC（＂3813＂））OR64
RE 300 SYSDEC（＂30EE＂）：CLOSE15： OPEN15，8，15
DP 310 FORD＝00TO39STEPINT（144／ P2／BY＊256）

```
HM 320 PRINT：PRINTS \(\$\)
QE 330 GETAS：IFAS＜＞CHRS（13）THE
NGOTO 330 ：ELSESYSDEC（＂30 99＂）
KS 335 TL＝INT（144／P2／BY＊256）－1
CX 340 SL＝DEC（＂ 3900 ＂）：DL＝SL
QG 350 FORT＝ØTOTL
KB 360 FORS＝1TOP2
AD 370 GOSUB3000：POKESA，HI：POK ESA－1，LO：SL＝SL＋BY：GOSUB 3000 ：POKEEA，HI ：POKEEA－1 ，LO
```

AE $38 \emptyset$ POKEB＋3，T＋D：POKEB $+4, \mathrm{~S}: \mathrm{P}$
OKEB $+5,2:$ POKEB $+6, T+D+1$
GB 390 PRINTSI＂（LEFT\}R: "T+D"
\｛LEFT\}\{2 SPACES\}"S"
\｛LEFT］\｛2 SPACES\}\{UP\}"
QX 400 SYSDEC（＂30F8＂）
MH 410 IFT＋D 3 3ANDS +1 ＞P2THENGO TO420：ELSENEXT：NEXT
DC 420 PRINT：PRINTDS
AP 425 TL＝INT（144／P2／BY＊256）－1
DQ 430 GETAS：IFAS＜＞CHRS（13）THE NGOTO430：ELSESYSDEC（＂30 99＂）
PQ 449 FORT＝0TOTL
GE 450 FORS＝1TOP2
MS 460 GOSUB3G10：POKESA，HI ：POK ESA－1，LO：DL＝DL＋BY：GOSUB 3Ø10：POKEEA，HI：POKEEA－1 ，LO
FJ 470 POKEB $+10, T+D:$ POKEB $+11, S$ ：POKEB＋12， $0:$ POKEB＋13，T＋ D＋1
RH 480 PRINTSI＂\｛LEFT\}W: "T+D"
\｛LEFT］\｛2 SPACES\}"S" \｛LEFT\}\{2 SPACES\}\{UP\}"
CS 490 BANK15：SYSDEC（＂3153＂）： B ANK15
FH 500 IFT＋D＞38ANDS＋1＞P2THENGO TO565：ELSENEXT：NEXT：NEX $T$
XR 505 IFBS $=1$ ANDSI $=\emptyset$ THENGOTO 52 0
DR 510 PRINT＂$\{C L R$ \} (3 BELL) COPY COMPLETE．．．＂：SLEEP4：RU N
ES 520 POKEDEC（＂3802＂），16：POKE DEC（＂3809＂），18：POKEDEC（ ＂3828＂）， 26
HC $530 \mathrm{SL}=\mathrm{DEC}(" 3908$＂）： $\mathrm{SA}=252: \mathrm{E}$ A＝254：POKE251，0：POKE253 ， $6: S I=1$
RE 540 GOTO310
SJ 3000 HI＝INT（SL／256）：LO＝SL－H I＊256：RETURN
JJ $3010 \mathrm{HI}=\mathrm{INT}(\mathrm{DL} / 256): \mathrm{LO}=\mathrm{DL}-\mathrm{H}$ I＊256：RETURN

## Program 2：MFM Disk Utility

For instructions on entering thls program． please refer to＂COMPUTEI＇s Guide to Typing In Programs＂elsewhere in this issue．
QF 1 REM COPYRIGHT 1987 COMPUT E！PUBLICATIONS，INC．
\｛3 SPACES\}ALL RIGHTS RESE RVED．
PF 2 PRINT＂［CLR］COPYRIGHT 1987 ＂：PRINT＂COMPUTE」 PUBLICAT IONS，INC．＂：PRINT＂ALL RIG HTS RESERVED．＂：FORX＝1TOI Ø0：NEXT
DQ 3 BANK15
QE 4 DCLEAR：AS＝DS
AM 5 PRINTCHRS（14）
AK 6 RZS＝CHRS（19）：FOR J＝1 TO 1 4：RZS＝RZ\＄＋CHRS（17）：NEXT
SA 10 FAST
XJ 20 OPEN15，8，15
HF 36 PRINT＂\｛CLR\}(15 DOWN\}[L]O G IN NEW DISK＂
XD 40 PRINT＂［N］EW BLOCK＂
HR 50 PRINT＂$[\bar{R}]$ EWRITE BLOCK＂
BB 60 PRINT＂$[$－$]$ NEXT BLOCK＂
DP 76 PRINT＂［－］PREVIOUS BLOCK＂
GK 80 PRINT＂［ + NEXT TRACK＂
KX 90 PRINT＂［－］PREVIOUS TRACK＂
EG løø PRINT＂［C］HANGE BYTE UND ER CURSOR＂
KH 116 PRINT＂［T］EXT MODE＂
RA 115 PRINT＂［D］OUBLE SIDE SEL ЕСТ $\left\{\mathrm{HOME}^{\text {T }}{ }^{\prime \prime}\right.$
PS 120 PRINT＂$\{$ HOME］［15 DOWN］ \｛40 RIGHT\}DISK INFO: ［2 SPACES $\} \overline{M F M} / \mathrm{GCR}: "$
PB 136 PRINT＂$\{52$ RIGHT\}BYTES $P$ ER BLOCK：＂
JF 140 PRINTT＂\｛52 RIGHT\}BLOCKS \｛SPACE\}PER TRACK:"
DR 145 IFPEEK（DEC（＂3800＂））$=85$ T HENGOTOI7б
JD 150 BLOAD＂BURST＂
HB 160 BLOAD＂SCREEN＂
SC 170 POKE14302，Ø0：POKE14303， 45
JM 180 SYS13433：SYS13418
HB $190 \mathrm{~B}=\mathrm{DEC}(" 3800 \mathrm{Cl}): \mathrm{SA}=252: \mathrm{EN}$ ＝254：CP＝Ø：SI＝1：CS＝Ø
DJ 195 SYSDEC（＂3200＂）
EQ 200 POKE251，0：POKE253，0：POK E252，44：POKE254，46：POKE B＋2，0：POKEB＋9， 2
MA 210 GOSUB 1420
AF 211 GETBS：IFB\＄＝＂＂THENGOTO21 1

BG 220 IFB\＄く＞＂L＂THEN3B0
ED 230 SYSDEC（＂3899＂）：SYS13433
DS $240 \mathrm{SU}=\mathrm{PEEK}(250)$
 ＂$\{$ RIGHT］＂：NEXT
MC 260 PRINT＂［HOME］\｛14 DOWN］＂
RS 270 PRINTAS；：PU＝SUAND128
XR 280 IFPU＝128THENP $\$="$ MFM＂：E LSEPS＝＂GCR＂：SU＝16
XS 290 PRINTPS
MQ 306 PRINTAS：
BK 310 AU＝SUAND48：POKE14302，0
FB 320 IFAU $=\varnothing$ THENBY $=128:$ POKE14 362，80：POKE14303，44
MJ 330 IFAU＝16THENBY＝256：POKE1 4303，45
AM 340 IFAU＝48THENBY＝1024：POKE 14303，48
JE 350 IFAU $=32$ THENBY＝512：POKE1 4303，46
GH 351 BL＝PEEK（DEC（＂3700＂））
RB 352 IFPU＜＞128THENBL＝20：T＝1： $\mathrm{S}=-1$
KF 355 PRINT＂\｛5 SPACES］＂：PRINT AS：＂ 5 SPACES $\}$＂
PR 356 PRINT＂$(2$ UP $]$＂；AS；
PQ 360 PRINTBY：PRINTAS：BL
MK 370 GOTO210
ES 380 IFBS＜＜＂N＂THENGOTO50ø
JG 398 PRINT＂${ }^{\text {（HOME］}} 19$ DOWN）＂；
AD 400 $A S=" 1: F O R F=1 T O 40: A \$=A \$+$ ＂\｛RIGHT\}": NEXT
PA 410 PRINTAS＂TRACK＂；：INPUTT ： PRINTAS＂BLOCK＂；：INPUTS
CK 42 PRINT＂$\left\{2^{-U P}\right.$ U＂AS＂ \｛17 SPACES\}": PRINTAS" ［20 SPACES\}"
MD 430 POKEB＋3，T：POKEB＋4，S：SYS 13433 ：POKESA， 42
AP 431 PRINT＂\｛HOME\} (22 DOWN\}"; LEFTS（AS，40）：＂TRACK ［5 SPACES］［5 LEFTT］＂；
XD 432 PRINTLEFTS（AS，40）；＂BLOC K $\{5$ SPACES $\}$（ 5 LEFT $\}^{\pi / S}$
EA 433 PRINTLEFTS（AS，40）：＂SIDE

CC 435 POKEEN－1， $0:$ POKESA－1， $0: P$ OKESA， 44
PE 440 IFBY＝12BTHENPOKEEN，44：P OKEEN－1，80
MA 450 IFBY $=256$ THENPOKEEN， 45
XH 460 IFBY＝512THENPOKEEN，46
CG 470 IFBY＝1024THENPOKEEN， 48
XB 480 SYSDEC（＂3EF8＂）

SB 490 GOTO210
RH 500 IFBSく＞＂＋＂THENGOTO58б
CH 51．IFSI＝1THENS＝S＋1：GOTO515
BE 5ll CS＝CS＋1：CS＝CSANDI：AV＝16 ＊CS：POKEB＋2，AV：POKEB＋9， $\mathrm{AV}+2$
EG 512 IFCS＝THENS＝S＋1
MP 515 IFPU＝ØTHENGOTO55
RB 520 IFS＞BLTHENT＝T＋1：S＝1
MK 530 IFT＞39THENT＝Ø
DF 540 GOTO430
BP 550 IFS＞20THENT＝T＋1：S＝ø
MS 560 IFT＞35THENT $=1$
XJ 570 GOTO43ø
GX 580 IFBS＜＞＂－＂THENGOTO670
BH 59ø IFSI＝1THENS＝S－1：GOTO60ø
DX 591 CS＝CS－1：CS＝CSAND1：AV＝16 ＊CS：POKEB＋2，AV：POKEB＋9， AV＋2
PX 592 IFCS $=1$ THENS $=S-1$
SX 600 IFPU＝ØTHENGOTO646
CF 610 IFS＜1THENT＝T－1：S＝BL
PK $62 \varnothing$ IFT＜ØTHENT＝39
MP 630 GOTO43g
MD $64 \varnothing$ IFS $<$ ©THENT $=T-1: S=2 \emptyset$
XJ 650 IFT＜1THENT＝35

GR 660 GOTO430
JB 670 IFB\＄く＞＂$\pm$＂THENGOTO 740
HA $680 \mathrm{~T}=\mathrm{T}+1$
FC 696 IFPU＝ØTHENGOTO720
DE $7 \varnothing \varnothing$ IFT＞39THENT $=\emptyset$
CB 710 GOTO430
XE 720 IFT＞35THENT＝1
MA 730 GOTO43ø
SQ 740 IFBS＜＞＂二＂THENGOTOB1 $\sigma$
AF $750 \mathrm{~T}=\mathrm{T}-1$
XR 760 IFPU＝øTHENGOTO 790
KH 770 IFT＜ETHENT $=39$
GE 780 GOTO430
KB 790 IFT＜1THENT $=35$
PE 800 GOTO430
AE 810 IFBSく＞＂R＂THENGOTO936
PC 820 PRINT＂（HOME ］（19 DOWN\} "L EFTS（AS，40）：＂ㅍRE YOU SU RE？＂；
SE $83 \varnothing$ GETBS：IFBS＝＂＂THENGOTO83 $\theta$
AA 835 PRINT＂$\{17$ LEFT $\}$ ［20 SPACES］＂
DX 840 IFB\＄く＞＂Y＂THENGOTO210
PA 850 POKE251，6：POKE253，0：POK ESA， 44
PP 860 IFAU $=0$ THENPOKEEN， 44 ：POK EEN－1， $8 \varnothing$
CP $87 \emptyset$ IFAU＝16THENPOKEEN， 45
SE $88 \emptyset$ IFAU $=32$ THENPOKEEN， 46
XO 890 IFAU $=48$ THENPOKEEN， 48
DK $9 \varnothing 0$ POKEB＋1ø，T：POKEB＋11，S
EK 91ø SYSDEC（＂3153＂）
GM 920 GOTO21ø
PP 930 IFBSく＞＂ （DOWN\}"THENGOTO9 60
MM $940 \mathrm{R}=\mathrm{INT}(\mathrm{C} / 80): I F C+80>B Y-1$ THENGOTO210
QE 950 PRINT＂$\{$ DOWN $\} ":: C=C+80: G$ OTO210
XM 960 IFB\＄く＞＂\｛UP\}"THENGOTO990
EP $970 \mathrm{R}=\mathrm{INT}(\mathrm{C} / 80): I F R=0$ THENGO T0210
HD 980 PRINT＂\｛UP\}";:C=C-80:GOT 0210
AA 999 IFBSく＞＂\｛RIGHT\}"THENGOTO 1020
BE 1000 IFC＝BY－1THENGOTO210
 GOT0210
XA 1020 IFBS＜＜＂$\{$ LEFT\}"THENGOTO 1650
AR 1030 IFC＝ 0 THENGOTO210
GR $104 \varnothing$ PRINT＂\｛LEFT\}": $: C=C-1: G$ 0 OTO210
GG 1050 IFBSく＞＂\｛HOME\}"THENGOTO 1078
EK 1060 PRINT＂\｛HOME\}";:C=Ø:GOT 0210
DQ 1070 IFB\＄＜＞＂C＂THENGOTOI160
 LEFTS（AS，4g）＂NEW VALUE ＂；：INPUTNV
PS 1090 PRINTLEFTS（AS，40）＂\｛UP\} ［10 SPACES\}"
BE lløø POKE11264＋C，NV：R＝INT（C （80）： $0=C-R^{*} 8 \varnothing: M=I N T(O /$ 8）$: L=0-M * B$
RQ 1110 PRINT＂$\{$ HOME］＂：：IFR＝ØTH ENGOTOI130
SP 1120 FORF＝1TOR：PRINT＂（DOWN\} ＂：：NEXT
KS 1130 IFM $=9$ THENGOTOI150
MX 1140 FORF＝1TOM：PRINTCHRS（9） ：：NEXT
EX 1150 IFL＝ØTHENGOTO1000：ELSE FORF＝1TOL：PRINT＂
［RIGHT］＂；：NEXT：GOTOL日 $\square$
XK 1160 IFBS＜＜＂T＂THENGOTO1350
BX 1170 PRINT＂$\{$ HOME $](19$ DOWN \}"

LEFTS（AS，40）＂RETURN TO EXIT＂；
AP $1180 \mathrm{R}=\mathrm{INT}(\mathrm{C} / 80): 0=\mathrm{C}-\mathrm{R}^{\star} 80: \mathrm{M}$ ＝INT（O／8）：L＝O－M＊8
GB 1190 PRINT＂$[\mathrm{HOME}$ ］＂：$: I F R=0 T H$ ENGOTOL21б
BH 120ן FORF＝1TOR：PRINT＂［DOWN］ ＂：：NEXT
BD 1210 IFM＝0THENGOTO1230
GC 122Ø FORF＝1TOM：PRINTCHRS（9） ；：NEXT
JQ 1236 IFL＝0THENGOTO1240：ELSE FORF＝1TOL：PRINT＂
\｛RIGHT\}": : NEXT
MX 1240 GETBS：IFB\＄＝＂＂THENGOTO1 240
$\mathrm{XP} 1250 \mathrm{~A}=\mathrm{ASC}(\mathrm{B} \$$ ）：IFA＝13THENGO TO1270：ELSEPOKE11264＋C ，A：IFC＝BY－1 THENPRINT＂ ［HOME］＂：：C＝0：GOTOL240
XB $1260 \mathrm{C}=\mathrm{C}+1$ ：PRINT＂\｛RIGHT\}": GOTO124D
RX 1270 PRINT＂$\{$ HOME $\}$ \｛19 DOWN \}" LEFTS（AS．40）＂
（16 SPACES ${ }^{\prime \prime}$＂
SF $1280 \mathrm{R}=\operatorname{INT}(\mathrm{C} / 80): 0=\mathrm{C}-\mathrm{R} * 80: \mathrm{M}$ $=\operatorname{INT}(0 / 8): L=0-M^{*} 8$
JK 1290 PRINT＂\｛HOME\}": : IFR=øTH ENGOTOL316
PS 1300 FORF＝1TOR：PRINT＂\｛DOWN \} ＂；：NEXT
JP 1310 IFM＝ØTHENGOTO1330
RJ 1320 FORF＝ITOM：PRINTCHRS（9） ；：NEXT
AE 1330 IFL＝0THENGOTO1340：ELSE FORE＝1TOL：PRINT＂ \｛RIGHT\}": : NEXT
JX 1340 GOTO210
FQ 1350 IFBS《＞＂D＂THENGOTO210
KS 1360 IFSITHENGOTOI 380
AH 1370 SI＝1：P\＄＝＂DOUBLE SIDE O FF＂：GOTO1 $\overline{3} 90$
RK 1380 SI＝0：P\＄＝＂DOUBLE SIDE O N＂
ES 1390 PRINT＂$\{$ HOME $\} 20$ DOWN \}" LEFT\＄（A\＄，40）P\＄；
SK 14ØØ SLEEP1
OJ 1410 PRINT＂$\{20$ LEFT $\}$ ［22 SPACES ${ }^{\prime \prime}$ ：：GOTO210
DG 1420 PRINT RZ\＄：：RETURN

## Program 3：BURST

Please refer to the＂MLX＂article elsewhere in this issue before entering the following program．
3000：AD 05 D5 09 08 8D 05 D5 1A 3008：A9 7F 8D DD DC A9 90 8D BA 3010：ø5 DC A9 03 BD 64 DC AD 73 3018： 0 E DC 29800955 8D OE AA 3020：DC 2C OD DC 60 AD DE DC 1C 3028：29 80 09 88 8D 9E DC AD EA 3030：05 D5 29 F7 8D 05 D5 60 B9 3038：AD 00 DD $99108 D 00$ DD 50 3040：60 AD OD DD 29 EF 8D D0 3E
 3050：A8 A9 06 85 FA AD 1C 0A 98 3058：29 BF 8D 1C 日A A2 6F 20 C9 3060：C9 FF A2 00 BD 26382011 3068：A8 FF E8 88 DO F6 20 CC 32 3070：FF 2C 1C 日A 60 A2 2A A0 82 $\begin{array}{llllllllll}3078: 38 & \text { A9 } & 04 & 20 & 4 A & 30 & 20 & 25 & 5 A\end{array}$ 3080： 30 2C OD DC $20 \quad 38$ 30 A9 5 F 3088： 08 2C ØD DC FO FB AD GC 46 3090：DC 85 FA AA 2041 30 8A BB 3098：60 A2 26 AD 38 A9 04 26 31 30AD：4A 3020 DF 3185 FA 29 F 2 30A8：80 1018 A5 FA $29 \quad 15$ C9 18 30BD：82 $90 \quad 08$ A9 0685 FB A9 8 B 30B8：05 85 FD A9 37 85 FC 85 A6 30CD：FE DO 3 E 60 A2 22 Aб 38 B9

30C8：AD $24 \quad 38 \quad 29$ 80 D0 05 A9 9D 30D0：04 4C D6 30 A9 Ø3 20 4A 08 30D8： $30 \mathrm{AD} 24 \quad 38 \quad 29 \quad 86 \mathrm{FO} \quad 03 \mathrm{~F} 4$ 30ED： $20 \quad 75$ 30 60 A2 1C AD 38 B9 30E8：A9 $\quad 66 \quad 20$ 4A $30 \quad 60$ A2 11 A1 30Fも：A6 38 A9 日A 20 4A 30 6も 7Ø 30F8：A2 ดロ Aも 3B A9 07 20 4A 36 3100：30 78 2C OD DC AD 日® DD 6A 3108：49 10 8D 00 DD A9 08 2C 96 3110：0D DC FO FB AD 00 DD 4980 3118：10 8D 00 DD AD OC DC 85 AD 3120：FA 29 日F C9 02 Bg 2A Ag 90 3128：00 A9 08 2C OD DC FG FB 72 3130：AD 60 DD $49168 D 60$ DD 4E 3138：AD ØC DC 91 FB E6 FB D 0 6D 3140：02 E6 FC A5 FD C5 FB DQ 27 3148：E0 A5 FE C5 FC DO DA 58 F9 3150：60 58 60 A2 97 A0 38 A9 84 3158： 06 20 4A 30 4C A1 31 8D EA 3160：EF 37 A 0 Øठ 20 日月 30 AD AB 3168： 06 DD CD $0 \varnothing$ DD D日 F8 4D 6D 3170：EF 372940 FO Fl AD EF 5C 3178：37 49 48 8D EF 37 BI FB 65 3180：8D OC DC A9 0B 2C OD DC CA 3188：F0 FB E6 FB D 02 E6 FC 58 3190：A5 FE C5 FC DD Dl A5 FD 25 3198：C5 FB DQ CB 4C AC 315883 31A0：60 78 A9 3E 8D 00 FF A9 80 31A8：40 4C 5F 31 A9 Ø0 8D 日0 A5 31BD：FF 20 C6 31 EE 20 DØ AD 4E 31B8：0A 38 8D EF 37 AD GB 38 9D 31Cb：8D EE 37 4C 9 F 31 $2025 \quad 78$ 31C8：30 2C ØD DC 20 38 30 A9 A9 31D ： 08 2C DD DC FD FB AD EC 90 31D8：DC 85 FA $20413060 \quad 2018$ 31E0：25 30 2C OD DC $20 \quad 38 \quad 3040$ 31E8：A9 08 2C DD DC FO FB AD C8 31F0：0C DC 60 EA AD 00 DD 49 BD $31 F 8: 10$ 8D DD DD AD OC DC 60 5C 3200：A2 2F BD DC 32 9D 00 38 3A 3298：CA 10 F7 $60 \quad 55 \quad 30$ OD DO 46 3210：01 Ø2 Ø1 55 30 02 $0 \varnothing$ 日1 75 3218：02 $0155 \begin{array}{lllllll}36 & 04 & 55 & 30 & 06 & 47\end{array}$ 3220：81 00 01 27 10 DO DO E5 3E 3228：55 30 Ø6 3230：08 日0 55 30 DA D0 55 30 71


## Program 4：SCREEN

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

3400：A2 1220 DA CD 8D D日 37 6D 3408：A2 $13 \quad 20$ DA CD 8D D1 37 B7 3410：A2 OA 20 DA CD 8D D2 37 7F 3418：A9 日ロ A2 1220 CC CD E8 83 3420：20 CC CD A2 7F A9 00 2072 3428：CC CD A9 2C 8D 3634 A9 B9 3430：00 8D 3534 AD 06 2E 20 CF 3438：CA CD EE 3534 DØ 13 EE 84 3440：36 34 AD 3534 CD DE 37 A7 3448：D $\quad$ EA AD 3634 CD DF 37 BC 3450：D 0 E2 AD DO 37 A2 1220625 3458：CC CD E8 AD D1 37 20 CC 日B 3460：CD A9 60 EA A2 6A 20 CC 1F 3468：CD 4C 65 FA 78 A9 34 8D 87 3470：15 03 A9 8D 8D 14 日3 58 4D 3478：60 A2 日0 A9 20 9D 60 2F FA 3480：9D 00 2C 9D ø0 2D 9D Ø0 67 3488：2E E8 DO F1 60 CE CF 3790 349Ø：F0 03 4C 65 FA A9 05 8D 28 3498：CF 37 4C $0034 \quad 00$ 00 00 E1
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# Medium-Resolution Autorun For Atari ST 

Brian McCorkle

This compact program allows you to rull Atari ST programs from the AUTO folder in medium resolution.

The AUTO folder on the Atari ST is a handy device. When you turn on the ST, the computer looks on the disk in drive A: for a folder (subdirectory) named AUTO. If AUTO exists, the ST automatically runs every program it finds in that folder. One of the most common uses of the AUTO folder is to run programs that allow you to set the time and date or that set up a RAMdisk in the computer's memory.

The AUTO folder has some significant limitations, however. First, because the ST runs programs from AUTO before it installs the GEM graphics interface, you cannot autorun any GEM program. (A GEM program is one such as First Word, which uses the ST's mouse, windows; menus, and icons. All GEM programs end with the filename extension .PRG, but it also is possible for a non-GEM program to have that extension. Files that end with .TOS or .TTP are never GEM programs.)

Secondly, if you have a color monitor, the ST always autoruns programs in the low-resolution ( $320 \times 200$ ) screen. This screen has only 40 columns for text, which is inconvenient for applications such as word processing.
"Medium-Resolution Autorun" allows you to autorun programs in medium resolution, with a full 80column screen. Boot ST BASIC, type in the program from the listing, save a copy, and then run it. The BASIC program creates an executable program file named MEDRES.PRG. (Because the BASIC program creates a file named MEDRES.PRG, be sure that you do not use that name for the BASIC program itself.) An internal checksum is used to detect typing errors. If the program signals an error, check all of your typing carefully, especially the DATA lines.

## Inside the AUTO Folder

Once you have created MEDRES.PRG, select the disk on which it is to be used. If the disk does not already have an AUTO folder, create one now with the New Folder option from the desktop. (Click twice on the disk icon to open its directory window, then move the pointer to the File menu and select New Folder. When the dialog box appears, type AUTO and press Return.)

It is very important that MEDRES.PRG be the first program placed in the AUTO folder. This is necessary because the order in

## AUTO Folder Example


which files are run from AUTO is determined by their times of creation. The program with the earliest time and date runs first; the next earliest program runs second, and so on.

Thus, if you have just created the AUTO folder, be sure to copy MEDRES.PRG to that folder before putting any other programs there. If AUTO already exists, you should remove everything else from the folder, copy MEDRES.PRG to the folder, and then return the other programs to AUTO. The act of copying a file to a new place gives it a new time and date.

Although the ST's internal clock keeps time with an accuracy of two seconds, the time-stamping of files is accurate only to within one minute. To be absolutely certain that the AUTO folder will work correctly, you should allow at least two minutes to elapse between the time that you place each file in AUTO. This ensures that the ST will have no difficulty deciding the correct order in which to run the programs.

The figure illustrates an example AUTO folder. In this case we have copied MEDRES.PRG into the folder first, followed by SETTIME.PRG, a short program that lets you set the time and date. Notice the difference in creation times between the two files. This AUTO folder will work correctly because MEDRES.PRG has an earlier time and date than SETTIME.PRG.

Once you have set up the disk, press the reset button to try it out. The disk drive spins as MEDRES.PRG loads and executes, then the other program or programs in AUTO will load and run. If you do not get the expected results, reread the instructions carefully and make sure you have set up the AUTO folder as indicated.

## Simple Yet Effective

Written in assembly language to save space, MEDRES.PRG is extremely simple, consisting of only five calls to system routines. If you are a beginning assembly language programmer, or think you might be interested in learning assembly language, this is a good example to study. A complete source code listing appears at the end of this article.

At the beginning of the source code are three equate (equ) state-

## Source Code Listing <br> * <br> * MEDRES.PRG for Atari ST. <br> * Boot in medium resolution from the AUTO folder. * <br> - Copyright 1987 COMPUTE! Publications, Inc. <br> * All rights reserved

| GEMDOS | equ 1 |
| :--- | :--- |
| BIOS | equ 13 |
| XBIOS | equ 14 |
| .text |  |

* See whether we're running on a monochrome system

| move.w | \#4,-(sp) | * Getrez, XBIOS function 4 |
| :--- | :--- | :--- |
| trap | \#XBIOS | * Perform XBIOS trap |
| addq.1 | \#2,sp | * Clean up stack |
| cmpi.w | \#2,d0 | * 2 2 high resolution |
| beq | skip | * Don't run on a mono system |

- Shift to medium resolution

| move.w | $\# 1,-(\mathrm{sp})$ | * $1=$ medium resolution |
| :--- | :--- | :--- |
| move. | $\#-1,-(\mathrm{sp})$ | * Retain same physical screen base |
| move.l | $\#-1,-(\mathrm{sp})$ | * Retain same logical screen base |
| move.w | $\# 5$, -(sp) | * Setscreen, XBIOS function 5 |
| trap. | \#XBIOS | * Perform XBIOS trap |
| add.l | $\# 12, \mathrm{sp}$ | * Clean up stack |



* Set text color to black (otherwise, it ends up yellow)

| move.w | \#0,-(sp) | * Black color |
| :--- | :--- | :--- |
| move.w | $\# 3$, -(sp) | : Color \#3 |
| move.w | \#7,-(sp) | : Setcolor, XBIOS function 7 |
| trap | \#XBIOS | - XBIOS trap |
| addq. 1 | \#6,sp | * Clean up stack |

skip:

* Terminate program and release our memory to the system
clr. 1 -(sp) Term, GEMDOS function 0
trap \#GEMDOS * Perform GEMDOS trap
.end
ments which define constant values that appear later in the program. By giving these numbers meaningful names, we make the program easier to understand.

The program begins by checking to see whether you are using a monochrome monitor. This is a convenience which allows you to use the same disks on either color or monochrome systems. When the ST is using a monochrome monitor, it will reboot the system whenever you attempt to change to a different screen resolution. Thus, if it detects that you have a monochrome system, the program terminates without changing anything.

All of the GEMDOS and XBIOS calls in this program follow the same general pattern. First, you must push onto the microproces-
sor's stack whatever information the system routine needs to work. (The expression $s p$ stands for the stack pointer, which is actually processor register A7.) Second, you push the number, or opcode, of the routine you wish to execute. Third, you execute a trap instruction to invoke the system routine. Different categories of routines use different trap numbers. Finally, after returning from the routine, you must clean up the stack by adding as many bytes as you previously pushed onto it.

When a system routine returns information to you, that information usually appears in the microprocessor registers D0 and A0. Thus, after executing the first system routine, we look at the number contained in register D0. The
cmpi.w instruction checks whether the value in D 0 is equal to 2 , which stands for a monochrome (highresolution) monitor.

The second system call shifts the computer into medium resolution. The first value pushed onto the stack is 1 , which stands for medium resolution. This routine also allows you to change the physical base or logical base of the display screen. Since we don't want to change the screen, we push the value -1 for each of these parameters.

The third system call controls the cursor. The first value pushed on the stack makes the cursor flash and the second makes it visible.

The fourth system call sets the text color to black. If this were not done, the computer would use the low-resolution palette and color assignments, which would create yellow text on white background.

The final system call terminates the program. While there are other ways to terminate ST programs, this is the simplest and probably the most common. All the memory which our program used is released to the system, which takes back control of the computer.

## Medium Resolution Autorun

 For ST| 100 | rem "MEDRES.PRG" filemaker |
| :---: | :---: |
| 110 | rem Copyright 1987 COMPUTE Publications. Inc. |
| 120 | rem All rights reserved. |
| 130 | data 60, 1A, $0 \varnothing, 0 \varnothing, 0 \varnothing, 4 E$ |
| 140 | data $\varnothing \square, 00,00,00, \theta 0,00$ |
| 156 | data $90,00,00,00,06,00$ |
| 163 | data $00, \varnothing 0,00,0 \varnothing, \varnothing 0, \varnothing 0$ |
| 170 | data 00,00,00, 00, 3F, 3C |
| 180 | data $00.64,4 \mathrm{E}, 4 \mathrm{E}, 54,8 \mathrm{~F}$ |
| 190 | data 6C, 40, 00, $02,67,3 \mathrm{C}$ |
| 200 | data 3F,3C,00, 01, 2F, 3C |
| 219 | data FF, FF, FF, FF, 2F, 3C |
| 220 | data FF, FF, FF, FF, 3F, 3C |
| 259 | data $08,65,4 \mathrm{~A}, 4 \mathrm{E}, \mathrm{DF}, \mathrm{FC}$ |
| 240 | data $0 \varnothing, 00.00,0 \mathrm{C}, 3 \mathrm{~S}, 3 \mathrm{C}$ |
| 250 | data $00,28,3 \mathrm{~F}, 3 \mathrm{C}, 06,01$ |
| 260 | data 3F, 3C, $00,15,4 \mathrm{C}, 4 \mathrm{~S}$ |
| 270 | data 5C, 8F, 3F, 3C, 00, 20 |
| 280 | data 3F, 3C, $06,63,3 F, 3 C$ |
| 290 | data $60,97,4 \mathrm{E}, 4 \mathrm{E}, 5 \mathrm{~S}, 8 \mathrm{~F}$ |
| 380 | data 42, 7 , $4 E, 41,06,00$ |
| 316 | ```close:open "R",1,"\MEDRES. PRG",6``` |
| 320 | fleld \#1, 6 as $\times$ \$ |
| 330 | for $j=1$ to 18 |
| 340 | y $\$=01$ : for $k=1$ to 6 |
| 356 | $\begin{aligned} & \text { read z\$:byt=val }(" \& H "+z \$): y \\ & \$=y \$+c h r s(b y t) \end{aligned}$ |
| 360 | $c=c+1: c h k=c h k+c+b y t: n e x t$ |
| 379 | ```1set*x$=y$:r=r+1:put 1,r:n ex:t``` |
| 380 | close:if chk=11954 then en d |
| 396 | print "Typing error in DAT A":kill "\MEDRES.PRG" |

# Text File Splitter For Atari 

Frank P. Walters

This Atari utility is especially useful for telecommunications buffs who download long text files to disk. It splits any text file-including those created by SpeedScript-into shorter files for more convenient use.

Have you ever captured a long text file with a modem, and then tried to edit it in your word processor-only to find it was too long to fit in memory? "Text File Splitter" splits a long text file into shorter ones for editing. Type in and save the program.

When you run the program, it asks you for a source filename. This is the name of the long file you wish to split. If you don't specify a drive, the program defaults to drive D1:. You must also tell the program the density of the source disk. Singledensity disks contain 128 bytes per sector, while double-density disks contain about twice that much. This allows the program to estimate the file size, based on the number of disk sectors in its directory entry.

You then choose the number of new files to create, entering a number from 2-5, depending on the size of the original file. Finally, the program asks that you enter the destination disk drive number (1-4).

## Single Drive Use

This program can be used with just one disk drive, but you must be sure that the destination disk has enough free space to contain the
new files you are creating. The program does not close the channel for the file it is reading between saves, so absolutely no disk-swapping is permitted. If you are splitting an exceptionally long file on a single drive, you may need to use a DÓS 2.5 enhanced-density disk or a true double-density disk to contain all the data.

If you have a 130XE computer and a single drive, you can copy the source file into the RAMdisk, deleting the DUP.SYS and MEM.SAV files, if necessary. Format a new disk to use as the destination, then run the program and specify drive D8: for the source file and D1: for the destination.

The maximum length of each split file is limited to the buffer size displayed at the top of your screen. Other information appears while the task is in progress.

## Ready To Edit

The program saves the new files with the same filename as the original, but with extensions $. Z Z 1, . Z Z 2$, and so on, in numerical order. When the process is complete, you can load the new files in a word processor for editing, or do whatever you like. If for any reason you want to reassemble the original file, go to DOS and use the copy (C) function with the append (/A) option. (The copy-with-append function starts each appended file on a new sector, so the reassembled file
may use more sectors than the orig－ inal．You can eliminate the extra sectors by copying the reassembled file to another disk．）

Since the original file is split at arbitrary points，there is no guaran－ tee that any of the smaller files will end with a RETURN character． Thus，if you print a split file without editing，the last portion of text may not be printed unless you force the printer to print an extra RETURN． This can be cured by adding a RE－ TURN at the end of the file when editing．Some editing is normally needed，anyway，since the split files probably will end in the middle of a word or sentence．（You can print the entire file without losing data if you copy the unedited split files from disk to printer with the com－ mand D：＊．ZZ？，P：．）

## Text File Splitter

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

OC 5 REM COPYRIGHT 19 CO7 COMP UTE！PUBLICATIONS，INC． （3 SPACES）ALL RIBHTS RE SERVED．
FF 1 R READ Nb，N1，N2，N3，N4，N1 5，N12日，N155，N255，Q：GOT － 260
IL 20 TRAP 25＠：CLDSE N2：OPE N N2，N4＋N2，NB，F\＆iINPU T N2：A $\quad$ CLQSE N2
LC 30 IF AB（N2，N2）＜＞＂$\quad$ THEN ？：？＂File not found＂ ：GOTD 320
त1 46 GEC＝VAL（A（N15，LEN（As） ）） $10=\mathrm{Na}$
A 50 ？ 1 ？＂singlo（Enhanced ）or Double density？＂；
PD 6 GET WN1，K：IF Kく＞6日 AND Kく＞83 THEN 6 ©
KL 70 DEN＝N12日－N3IIF K＝6日 TH EN DEN－N255－N2
AK B 7 CHR（K）：BLOCK円INT（SE C異DEN／N255＋1）：？？$A$
HB 9® IF BLOCKくN4 THEN POP： POP GOTD 600
 M／N255 THEN Ab＝＂${ }^{3}$ ：IF BLOCK／N3＞MEM／N2S5 TH EN As＝＂ ＞MEM／N25S THEN AS＝＂EN＂
IC 115 B BLOCK／（ABC（A $)-176$ ）$+\boldsymbol{m}$ －5）＞MEM／N255 THEN 62■
FO 220 IF BLロCK／B＜N4 THEN B＝ B－N1：EOTO 120
 A＊THEN B\＆＝A
 ＂＂BLOCKS long．＂：？＂ら Plit into how menn fid
 ＂：
B 150 EET WN1，K：IF KくASC（A！ ）－N12B OR K＞ASC（B＊）－N 128 THEN 156
ND 16 FOR I＝NE TO N4：FIL（I） ＝N末：NEXT I
经 175 ？CHR（K）INUM＝K－48：FO

R I＝NG TO NUM－N2：FIL $I)=I N T((B L O C K / N U M)+$ ． 999）：NEXT I
M18 180 FOR I＝N® TO NUM－N2：FI L．（NUM－N1）＝FIL（NUM－N1） ＋FIL（I）：NEXT I：FIL（NU $M-N 1)=B L O C K-F I L(N U M-N$ 1）
腹 190 RETURN
ED 268 FOR J＝N1 TO FIL（I－N1）
 $A$（N2）$=A$
KR 220 TRAP 240 ：XID N4＋NS，\＃N 2，N4，No，A
 T JaRETURN
HC 24 POP ： 8 （LEN（BE）＋N1）$=A$ －ARETURN
 －＂PPEEK（195）：TRAP 40 ODf：CLR IEND
01266 DIM A（N255），F象（N15）． FN（N15），M\＄（N4＋N1），FI L（4）：MEM＝INT（FRE（NE）／ N255）${ }^{\text {（N255：}}$ IF FRE（0）－ MEMく 106 THEN MEM＝MEM－ N255
If 276 DIM B\％（MEM）：M8＝3TR\＄（M EM）：FOR I＝N1 TD LEN（M ©）：J＝ASC（M＊（I，I））：JmJ $+N 12 \mathrm{~B}$ ： M （I，I）$=$ CHR（J） ：NEXT I
H2日も GRAPHICS NO：POKE 710， N128
炏 296 ？（4 spaces forcumant CTEKT FILE SPLITTEE
（4 SpacEs）＂：？＂COPHFi GLT 1967 CCMPMtE！PUE H．Inc：＂
 LE Lexserved．
（7 Spacies）＂
CH 295 ？＂（5 SPACES）BUFIEE： ご；M ；＂BYTES＂
A 30 CLOSE WNI；OPEN WN1，N4

Kp 31 ？ 3 ？＂Enter filename of text file to （8 SPACES\}to be mplit into several filim．＂
H⿰ 320 TRAP 32g：？？＂flies ＂：IINPUT FN ＂＂THEN $?$＂CUP\}RUIE!〔3 DELETE\}": GOTO 59\%
JO 35 IF LEN（FN©）＜N3 THEN 3 76
㫙 34 IF $F N$（N1，N2）＝＂D：＂TH EN FN：$=F N$（N3）：GOTO 3 78
 D FN＊（N3，N3）＜＞＂：＂THE N 379
L6 365［F FN（NJ，N3）＝01＂THE


－ 38 DRV＝VAL（F（N2，N2））
PF 390 ？17＂Insert disk wit h＂ifé＂into＂i？wdis $k$ drive ${ }^{4}$ ；DRV；＂and $p$ ren m RETURE＂
W45月 GET WNI，K：IF Kく＞N155 THEN 4 显
收 418 ？
小 428 IF $Q$ THEN EOSUB 26：？ ＂cups＂
边430 ？？？mave files c a crime म（K－4D）＂
FI 445 EET \＃1，KIIF Kく49 OR K $>52$ THEN $44 \%$
FH 45e FN＝F ： 5 FNs（N2，N2）mCHR （K）$\quad$ ？CHR（K）
CN4b＊？？＂Insert SAVE diE $k$ in drive ；K－4日i？к and prese retidet＂；

IH 475 GET $1, K I I F K<>N 155 T$ HEN 470
IG 486 ？？：TRAP 250：CLOSE WN2：OPEN WNZ，N4，ND，F ：Bi＝n＂：FOR I＝NI TO NU M
明490 ？＂Reading＂ifti＂－＂ ；FIL（I－N1）；＂BLOCKS＂： GOSUB 20
WK 506 IF ImNUM THEN ？＂CIEa「1ng nulla＂；
CF 510 IF I＝NUM THEN IF B（L EN（B（））＝＂C，\}"THEN B
 －GOTO 516
AK 520 IF I＝NUM THEN ？
IL 530 FDR M＝N4 TO LEN（FN ）： IF FN $(M, M)=" \cdot{ }^{\prime}$ THEN FNE（M＋1）$={ }^{\prime \prime} Z Z^{\prime \prime}: F N$（ $M+3$ ）＝STR（I）：POP IOOTO 5 $5 \%$
ca 54 5 NEXT M\＆FN（LEN（FN\＆）＋N 1）＝＂．Z2＂：FN（LEN（FN＊） ＋NI）＝STR（I）
F0 550 ？＂Baving＂；FN：＂－ ＂I INT（（LEN（Be）／DEN）＋ ．999）：＂SECTORg＂
10565 TRAP 250：CLOSE UNJ：OP EN WNS，N4कN2，NB，FN
 \％＝＂＂
Fi 380 ？$?$ ？（BELL）DOUEE \｛BELL\}\{3 BPACES\}Hit [E ETMRE to quit＂i日＝N1： QTO 310
0059 CLOBE W1：CLOBE N2：C
 LR E END
 an 1820＂：＂BYTEG．Th 1：program will only split＂i？＂files groat er than 1 ©2\％BYTES．＂
0061 BOTO 59日
 too long to Eplit＂？ ＂ 5 ways with＂MEM：＂ byte buffer．＂：？Mod ify 1t to epilt nore than thatz＂
 1日も－12\％．．．etc．＂：BOTO $59{ }^{\circ}$
K0 64 DATA $\quad 1,2,2,3,4,15,12 日$ ，155，255．1

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

# Converter Graphics Conversion Utility For The Print Shop ${ }^{\text {TM }}$ 

Lee Swoboda

Now you can convert graphics from the popular Print Shop program for use in Apple hi-res mode, and vice versa. This utility performs both conversions.

One of the more popular Apple II programs in recent years is The Print Shop, which has sparked users' clubs of its own, workalike programs, and thousands of graphics pictures that can be included in Print Shop banners and cards. Unfortunately, Print Shop images aren't directly compatible with Apple II high-resolution graphics. You can't use them in hires screens, and vice versa. "Print Shop Converter" solves that problem, allowing you to convert easily between Print Shop pictures and Apple hi-res mode.

## Starting Out

This program is in two parts. The main program, written in BASIC, loads the second portion, a machine language file, from disk when it runs. Note that you must enter both programs using DOS 3.3. This is a limitation imposed by The Print Shop itself, which saves files only in DOS 3.3 format.

Type in and save Programs 1 and 2. If your computer is one that can't display lowercase graphics, you will have to type Program 1
entirely in uppercase.
Program 2 is machine language, so it must be entered with the Apple version of the "MLX" machine language entry program printed elsewhere in this issue. When you run MLX, you'll be asked for a starting address and an ending address for the data you'll be entering. Here are the values you need to enter for Program 2:
STARTING ADDRESS? $\mathbf{6 0 0 0}$ ENDING ADDRESS? 6C08

Note that you must save Program 2 with the filename CV. This is necessary because Program 1 attempts to load Program 2 from disk with that name. Make sure that both programs are saved on the same disk.

## Converting

When you run the Converter, it begins by loading the machine language portion (Program 2) from disk. After a brief delay, it displays a menu screen offering several choices. If you need instructions about using the program, select the option labeled Instructions. The computer prints out several screens of instructions, pausing at the end of each screen until you press a key.

Before converting a picture, you should understand the different format choices. In hi-res mode,
you can load and save pictures in normal hi-res format or in a special compressed form which makes a picture file smaller than usual. Print Shop mode allows you to load and save graphics in Print Shop format.

You must begin by indicating which conversion you wish to make. The program asks you two questions, once with the prompt CONVERT FROM? and again with the prompt CONVERT TO?. The choices are the same both times. If you are using hi-res graphics, don't worry about whether the picture is compressed; the program will detect compression and respond accordingly.

After asking what conversion you want to make, Converter asks you the name of the file you wish to convert. Enter the name of the source file which you want to convert to a different format. If you can't remember the filename, press RETURN without typing anything; the program prints a disk catalog and repeats the prompt.

At this point, the program loads the designated file, then does one of the following, depending on which conversion format you have chosen:

1. If you want to convert from Print Shop to hi-res format, Converter asks you what to name the new file.

Type the name and press RETURN． Converter then asks if you want to save it as a full－size（8192－byte）hi－ res picture or if you want to com－ press it．If you select a full－size picture，Converter saves hi－res page 1 intact so you can use it with other programs or graphics editors．If you elect to compress the picture，Con－ verter scans hi－res page 1 and squeezes the file to about half or two－thirds of its normal size．Com－ pression saves disk space，allowing you to store more pictures on a disk． （Note that you will need this pro－ gram to restore a compressed file to normal hi－res format．）
2．If you are converting from hi－res format to Print Shop format，the program first loads the picture，then draws an $88 \times 52$ window in the middle of the screen．This area will hold the Print Shop picture．You can move the window around using the arrow keys．（Apple II + owners can use CTRL－J and CTRL－K to move up and down，respectively．）At first， the window moves nine dots each time you press a cursor key．This allows you to move in coarse incre－ ments．The number keys at the top of the keyboard change the incre－ ment to the corresponding number of dots．If the graphics you want to save are on the lower part of the screen（hidden behind the four text lines），use the $F$ key to turn the full screen on and off as needed．When you have finished positioning the window，press RETURN to save the graphics contained in the window． 3．After you finish a conversion，or if you press the ESC key during a conversion，Converter returns you to the main menu．From there，you can quit the program by pressing 0 ．

## How It Works

The Print Shop graphics format dif－ fers from normal hi－res format in three respects．First，the graphics oc－ cupy only 572 bytes（ $88 \times 52$ dots） instead of the 8192 bytes taken up by a hi－res page．Second，the dots are arranged sequentially（with the second row following the first）rath－ er than in the reverse order of Apple hi－res．Third，Print Shop uses all eight bits in a byte rather than seven bits per byte as with hi－res．

One final caution：The graph－ ics sold by Brøderbund and other commercial software vendors are
protected under United States and international copyright laws．Mere－ ly converting graphics from one format to another does not destroy its copyright protection，so you should respect the copyright of the converted graphics just as you would the original．

## Program 1：Print Shop Converter

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

F1 10 REM PRINT SHOP（TM）
if 20 REM CONVERTER
SD 30 REM COPYRIGHT 1987
554 REM COMPUTE！PUBLICATIONS， INC．
6C 56 REM ALL RIGHTS RESERVED．
$6 E 60$ REM
CF 70 TEXT ：HOME ：HIMEM： 8191
的 $8 \varnothing$ FU\％$=0: X 0 \%=0: Y 6 \%=0: X 1$ $X=6: Y 1 \%=6 i V 0 \%=0$
6F 90 D $=$ CHR（ 13 ）+ CHRs（4）： Qs＝CHRs（34）
70100 IF PEEK（41868）＜＞ 113 T HEN PRINT＂Gorry！You mus t use DOS 3．3n：END
CC 110 POKE 1013，76：POKE 1014， 0 3 POKE 1515，96
12 126 POKE 768，164：POKE 769，16 8：POKE 770，104：POKE 771 ，166：POKE 772，223：POKE 773，154：POKE 774，72：POK E 775，152：PDKE 776，72：$P$ OKE 777，96
2\％ 130 PRINT D＂＂BLDAD CV＂
of 149 IF PEEK（ 64435 ）＜＞ 6 THE N FUX＝6：\％
29156 UTAB 10：HTAB 15：PRINT＂PR INT BHOP＂：HTAB 12：PRINT＂ C ONVERTER＂：PRINT： HTAB 13：PRINT＂COPYRIGHT 1987＂：VTAB 15：HTAB 7：PRIN T＂COMPUTE！PUBLICATIDNS．
INC．＂：FDR I＝ 1 TO 2000： NEXT I
2155 VTAB 17：HTAB 16：PRINT＂ All Rights Resurved＂：FDR $I=1$ TO 1686：NEXT I
AI $16 \%$ HOME ：HGR ：POKE 49234，8
98170 POKE 44596，234：POKE 4459 7，234：POKE 44598，234
92 180 REM
B4 196 REM Main Menu
83206 REM
AG 210 HDME ：HGR ：POKE 49235， 6
E8 226 HOME ：VTAB 21：PRINT＂C onvert fram．．．＂SPC（ 10）＂ E＝Quit＂
81 230 PRINT TAB（ 6）＂1＝HIRES p leture＂
is 246 PRINT TAB（ 6）＂2 $=$ Print 5 hop（tm）graphic＂
IC 250 PRINT TAB（ 6）＂3＝Instruc tione＂；VTAB 1：HTAB 1
41268 FDR I＝TO 1 STEP 0
88 $276 \mathrm{~KB}=$ PEEK（49152）：IF KB $>127$ THEN I＝ 1
63 208 NEXT Is POKE 4916日， 6
CA $290 \mathrm{FD}=\mathrm{KB}-176:$ IF $F \mathscr{}$ OR FG＞ 3 THEN 26も
83 $3 \varnothing \varnothing$ IF FD $=3$ THEN 1690
F4 310 IF $F O=\varnothing$ THEN TEXT ：HOM E：END
FG 320 VTAB 21：HTAB 1：PRINT＂ Convert to．．．＂；CALL－ 9 68

63 336 VTAB 24：HTAB 12 CALL－ 6Bi VTAB 1：HTAB 1
48340 FDR I＝TD 1 STEP
8 8 $356 \mathrm{~KB}=$ PEEK（49152）：IF KB $>127$ THEN I＝ 1
81 360 NEXT I：PDKE 49168，0
A9 370 IF KB－ 155 THEN 210
BD $386 \mathrm{Fi}_{1}=\mathrm{KB}-176$ ：IF F1＜ 1 OR FI＞ 2 THEN 340
is 390 ON Fg GOTO 430,520
6540 REM
AA 416 REM Load HIRES
时 420 REM
C6 436 GOSUB 1900
4月 446 ONERR 日OTO 430
［3 458 GOSUB 1660：PRINT D ${ }^{\text {n BLOA }}$ D＂FIb＂，AB4GES，D1＂：POKE 2 16， $8:$ CALL 76日
81463 FU\％＝0：IF PEEK（43616） +256 PEEK（43617）＜8\％ g THEN FU\％$=4$
IC $476 \%$
A5 480 GOTO 560
97490 REM
68506 REM Load Print Shop
88510 REM
C5 529 GOSUB 1060
39536 QNERR GOTO 526
11546 GOSUB 1666：PRINT D＊＂ELDA D＂FI象＂，A\＄5800，D1＂：POKE 2 16， 0 ：CALL 768
75550 FUX $=1:$ \＆
2A 566 ON F1 GOTD 696，776
94 576 REM
88 5B0 REM Save HIRES
98596 REM
is 660 GOSUB 986：HOME ：VTAB 21 3 PRINT＂Gave this as．．． ＂
19 610 PRINT TAB（6）＂1＝Full－si ze HIRES picture＂
FA 629 PRINT TAB（ 6）＂2＝Compres sed HIRES picture＂
19630 FOR I $=0$ TO 1 STEP 0
$89640 \mathrm{~KB}=$ PEEK（49152）：IF KB ＞ 127 THEN $1=1$
14 659 NEXT I ：POKE 4916日，0：VTA B 1
AA 660 IF KB $=155$ THEN 210
6D 670 F $=$ KB－176：IF FG＜1 OR FE $>2$ THEN 630
F7 680 FIs $=F I \$+$＂．PIC＂
12690 IF $\mathrm{FE}=1$ THEN PRINT Ds＂B GAVE＂FI象＂，A\＄2060，L\＄1FFF，D 1＂：BOSUB 1536：EOTD 216
75709 FU\％＝ $3: \&$
9E 710 L $=$ PEEK（1）－ 64
$11720 \mathrm{~L}=256$＋+2 PEEK 10 ）
 6，L＂L＂，D1＂：GOSUB 1530：E OTO 210
96740 REM
46 750 REM Save Print Shop
91766 REM
CF 770 FR $=5:$ GOSUB 1446
$84780 \times 0 \%=95: Y 6 \%=56: \times 1 \%=1$日3：Y1X＝102：FU\％＝5：\＆
$57790 \mathrm{~J}=9$
45 日G0 FOR $1=0$ TO 1 STEP 6
$44810 \mathrm{~KB}=$ PEEK（49152）：IF KB ＜ 128 THEN NEXT I
（1A 日20 POKE 49168，6：\＆：KB＝ KB － 32 （KB＞223）
1A 830 IF $K B=141$ THEN 930
FA 840 IF KB $=136$ THEN $X 8 \%=X g$ $\%$－Ji IF XEX＜THEN XD $\boldsymbol{x}=\boldsymbol{b}$
6C 850 IF KB $=138$ THEN Y $13 \%$－Yg $\%$＋Ji IF Y $\%$ \％ 139 THEN Yox＝ 139
AB 860 IF $K B=139$ THEN $Y G \%=Y \theta$
 $\%=0$

18870 IF KB $=149$ THEN $\mathrm{X} 0 \%=\mathrm{XD}$ $x+J 1$ IF $x$ © $>191$ THEN $\mathrm{XBX}=191$
Ab 880 X1\％＝X6\％＋88：YiK＝Yg\％ $+52$
128890 IF KB $=155$ THEN 210
EJ 900 IF KB＞ 176 AND KB＜ 186 THEN J＝KB－ 176
9 C 910 IF KB $=19 \mathrm{THEN} \mathrm{F}=4923$ $4+(F=49234):$ POKE $F$ ，$\quad$ ©
E2 920 \＆：NEXT I
66 930 GOSUB 989：FU\％－2：\＆
19940 FIs $=$ FIs＋＂．PS＂：PRINT D＊＂BSAVE＂FI\＄＂，A22528，L576 ，D1＂8 GOSUB 15368 воTO 21 $\sigma$
94959 REM
80969 REM SUBROUTINES
$5 E 970$ REM File name
91989 HOME ：UTAB 21：POKE 4923 5，0：PRINT＂What name sho uld 1 use to save this？＂
22996 G05UB 1090：G03UB 1550：R ETURN
$2 E 1008$ HOME ：VTAB 21：PRINT＂W hat graphic do you want to convert？＂
${ }^{13} 1010$ VTAB 24：PRINT＂Press ${ }^{\prime}$ R ETURN＇for a catalog of files＂
$3 F 1020$ BOSUB 1110
EB 1030 IF FI $\gg \mathrm{mm}$ THEN 1070
71 1040 TEXT ：HOME ：PRINT D $\$$＂C ATALOG，D1＂
981050 PRINT＂Press any key to continue．．．＂：CALL－ 7 56：HGR
621068 в0TO 1006
AC 1670 GOSUB 1540：RETURN
651080 REM Bet file name
021690 VTAB 23：PRINT＂CTRL－X＝E rase file name＂SPC（ 3 ）＂ EsC＝Main manu＂
611109 PRINT＂＜－or DELETE＝Dele te char RETURN＝Accept＂；
E2 1118 VTAB 22：HTAB 1：CALL－ 86日：FI＝＂＂
361120 FOR I $=\varnothing$ TO 1 STEP
76 1136 CALL－756：KB＝PEEK（49 152）：POKE 4916日， 0
CB $1149 \mathrm{~KB}=\mathrm{KB}-32$（ $\mathrm{KB}>96$ ）
$7 E 1158$ IF KB＝ 13 THEN RETURN
10 1166 IF KB $=27$ THEN 210
89 1170 IF KB $=24$ THEN 1119
181189 IF KB＜$>8$ AND KB＜＞ 9 5 AND PEEK（36）$=25$ THE N CALL－198：NEXT I
$5 F 1190$ IF KB＜＞ 8 AND KB＜ 32 THEN NEXT I
A9 12øб IF KB＜＞ 8 AND $\mathrm{KB}<>9$ 5 THEN FI $=$ FI + CHR （KB）：PRINT CHR＊（KB）；： NEXT I
81 1210 IF PEEK（36）$=6$ THEN CA LL－19B：NEXT I
191220 PRINT CHR＊（8）CHR（32） CHR（ ${ }^{(B)}$ ：
C4 1238 IF LEN（FI＊）$=1$ THEN FI －＝＂＂：NEXT I
931248 FI\＄＝LEFT（FIs，LEN（F 18）－1）：NEXT I
021259 REM Move window frame
781268 GOSUB 1440：\＆
401279 FOR K $=0$ TO 1 STEP $\varnothing$
5A $1289 \mathrm{~KB}=\mathrm{PEEK}$（49152）：IF KB ＜ 128 THEN NEXT K
D5 1290 POKE 49168， $9: 8 \mathrm{~K}$ ： $\mathrm{KB}=\mathrm{KB}$ -32 （KB＞223）
as 1306 IF KB＝ 141 THEN \＆：RET URN
041310 IF KB $=136$ OR KB $=139$ THEN YG\％－YGY－J（FR ＝1） Y Y1X $=\mathrm{Y} 1 \%$－J（F $R=2) s \times 0 \%=x \boxminus \%-J!$

FR＝3）：X1\％＝Xi\％－J （FR＝4）
1D 1320 IF KB＝ 149 DR KB $=138$ THEN Y $0 \%=Y$ Y\％$+J$（FR －1）：Y1\％＝Y $1 \%+J$（F $R=2): X 0 \%-X 0 \%+J$（ $F R=3): \times 1 \%=X 1 \%+J$（ $(F R=4)$
791330 IF KB＞ 176 AND KB＜ 186 THEN J＝KB－ 176
11 1340 IF X6\％＜ 35 THEN X6\％＝ 3 5
6 1350 1F $\times 1 \%>266$ THEN $\times 1 \%=$ 266
A4 1360 IF $Y 9 \%$＜$\varnothing$ THEN Y $9 \%=0$
IF 1370 IF $Y 1 \%>167$ THEN $Y 1 \%=$ 167
FB 1386 IF $X 0 \%>X 1 \%-2$ THEN $X 0$ $\%=X 1 \%-2$
CC 1390 IF $Y 6 \%>Y 1 \%-2$ THEN YD $\%=Y 1 \%-2$
01406 IF $X 1 \%<X 0 \%+1$ THEN $X 1$ $\%=X 6 \%+1$
AI 1410 IF Y1\％＜Y0\％＋ 1 THEN Y1 \％＝Yg\％＋ 1
751420 \＆：NEXT K
941430 REM Messages
CB 1446 HDME ：VTAB 21：PRINT＂A RROWS＝MOVE＂；ON FR EO TO 1450，1460，1470，1486， 1 490
4 1459 PRINT＂TOP＂；：BOTO 1490
的 1460 PRINT＂BOTTOM＂；：GOTO 1 496
E1 1470 PRINT＂LEFT＊；：GOTO 149 g
51 1480 PRINT＂RIGHT＂：
TC 1496 PRINT＂window frame＂
If 15g』 PRINT SPC（3）＂1－9＝Dist ance of frame moverment＂
81 1510 PRINT SPC（5）MF＝Turn $f$ ull screen ON／OFF＂
321520 PRINT＂RETURN＝Accept p anition＂；VTAB 1：RETUR N
3C 1536 HOME ：VTAB 21：PRINT＂9 aved as＂Gefltas：FDR I － 1 TD 200ø：NEXT I：RET URN
481548 A事＂＂Place the disk con taining＂＋Ot＋FI ${ }^{\text {c }}$＋ Q \＄：GDTO 1568
$5 E 1559$ A $=$＂Place the diEk you want to mave＂＋Q + F

731360 A $=A$ nd prese any key＂
121579 HOME ：VTAB 21：I $=40$
$161588 \mathrm{~J}=0$
CB 1596 Bs＝LEFTs（As，I－J）
181600 IF LEN（Bs）＝LEN（As） 0 R RIGHT（Bi，1）＝CHR（ 32）THEN 1620
C6 $1610 \mathrm{~J}=\mathrm{J}+1:$ GOTO 159\％
BC 1620 PRINT LEFT\＄（B＊，I－ 1 ）
$981630 \mathrm{~K}=$ LEN（A ）－LEN（B\＄）
Ab 1640 IF K $=6$ THEN CALL -198 ：CALL－198：CALL－ 756 ：RETURN
241650 A $=$ RIGHT $\left(A{ }^{(1)}, K\right):$ EOTD 1586
AE 1666 HOME ：VTAB 21：PRINT＂L oading＂ 0 \％FItGit RETURN
DC 1670 REM
C8 1686 REM Help
051690 TEXT ：I＝ 1
D4 1709 HDME ：INVERSE ：PRINT $S$ PC（ 15）＂CONVERTER＂SPC（ 15）：NORMAL ：VTAB 3：HT AB 1
911710 FOR J＝I TO I＋ 9
5E 1726 READ As：IF As＝＂END＂T HEN 1776
6D 1730 PRINT A $\$$ ：PRINT

0 1740 NEXT JsI $=+1+9$
c7 1750 VTAB 24：PRINT＂Press an y key to continue．．．＂s
If 1769 EET B象：PRINT ：GOTD 179 D
Cf 177ヵ UTAB 24：PRINT＂Preses an y key to continue．．．＂i
93 1789 GET B ：GロTD 216
941798 DATA＂Broderbund Softwar －＂Print Shop（tm）＂
67 1800 DATA＂program uses a spe cial format to stor：＂
451810 DATA＂graphic images．$C$ DNVERTER converts＂
is 1820 DATA＂graphics back and forth between＂
121836 DATA＂Apple＇s high resol ution（HIRES）sereen＂
DA 1840 DATA＂and Print Shop＇s f ormat．You have＂
If 1850 DATA＂three choices of $f$ ormats you can＂
0f 1860 DATA＂convert to or from ：＂
F4 1870 DATA＂1）A normal Apple HIRES Ecreen，which＂
93 1880 DATA＂will let you store up to 17 images on＂
201890 DATA＂a disk．＂
4E 19øø DATA＂2）A special HIRE 3 format that＂
ig 1910 DATA＂appeary normal whe n you view it，but＂
431920 DATA＂is stored on disk in a＂compresered＂＂
5A 1930 DATA ${ }^{*}$ format that lats $y$ ou store up to 50＂
D4 1940 DATA＂images on a disk．＂
C9 1950 DATA＂3）The standard $P$ rint Shop image．
7A 1960 DATA＂CONVERTER lets you convert an＂
ES 1970 DATA＂image in any of th ese three formate to＂
361986 DATA＂any of the other $f$ ormats．Junt select＂
DB 1996 DATA＂the＇from＇and＂to format you desire＂
DA 2000 DATA＂from the menus and CONVERTER will do＂
F5 2010 DATA＂the work sautomati cally．＂
BD 2026 DATA＂The computer will add the following＂
BF 2936 DATA＂prefix or suffix t －the name you＂
812040 DATA＂choose：＂
11 2050 DATA＂Ffilename．PS＇for Print Shop images．＂
DE 2060 DATA＂＇filename．PIC＂for normal or＂
DF 2070 DATA＂compressed HIRES i mages．＂
D 2080 DATA＂END＂

## Program 2．CV

Please refer to the Apple＂MLX＂article in this issue before entering the following program．
6986：A5 D9 48 A5 7648 A5 BE 46 6『®日：48 AS B9 4日 A9 ש2 日S 76 EB 601\％：A9 FF 日5 D9 A9 BF 85 33 7E 6018：A9 06 B5 F3 4C IF 60 A9 E6 6028：BS B5 85 A9 7D AD 0 A2 9E 6028：1D 25 ED 68 A5 69 BD 16 E1 6030：7D A9 60 日D 51 7D AS 6A A6 6038：日D 62 7D A9 01 日D E3 7D 44 684\％：A9 61 E5 BA A9 AE MS 1D 6048：7D AC 02 7D 26 BF 6B 日E 70 605月： 53 7D BC 62 7D 1日 AD MA 4B 6650：7D 6D 92 7D 8D 14 7D AD BC 6868： 61 7D 6D 63 7D 日D 15 7D AB 6068： 18 AD 14 7D 69 ES 日D EE 7B

68701 7D AD 157069 日6 日D 6F $4 B$ 6978：7D AD ©E 7D 日D 86 66 AD F1
 69BE：日D 98 7D A9 Eg 日D 61 7D 16 6090：AE 6B 7D CA 1056 4C F7 2E 669日：69 4C CF 6ヵ CA 10 ©6 4C 日B 60AB： 69 61 4C CF 68 CA 106649 6円AB： $4 C$ 4C 63 4C CF 6\％CA 1879 60BD：©6 4C BE 64 4C CF 60 CA 72 6曰BE： 10 a6 4C E3 65 4C CF 6824 60CE：CA 10 66 4C 6966 4C CF 日D 6月CE：69 CA 10 03 4C Bi 6720 B6 60D®： 58 FC 2036 FB 2022 6B 74 6\％DE：CG DS AS Ag CD DS DJ D4 75 6日ED：Ag C2 CS Ag C9 CE Ag D2 ©S 6月EE：C1 CE C7 CS AS B® AD B7 GE 60F历： 062667 6B 4C D6 03 A9 AG
 6100：7D AD 017049496010 1D 610日：65 6B 3\％ $151016 \quad 68 \mathrm{C9}$ 1A 6110： 68 30 DE Dg 99 AD 08 7D 5A 6118：C9 90 96 95 Fg 63 4C $66 \mathrm{B4}$ $6120: 61$ AD 日g 7D BD 2E 41 AD GC 612B：61 7D ED 2F G1 AD 60 10 41 6130：日D 日E 7D A9 日 日F 7D 59 613日： 38 AD 08 7D E9 日g 日D 12 C6 6140：7D AD 61 7D E9 20 日D 1313 614日：7D AD 92 7D 日D 5961 AD BF 6158：63 7D 日D 5A 61 AD GE 7D A6 615日：日D 10 EE © 70 D 03 6D 616月1 EE ©1 7D 4C E1 61 4C CF 45 616B：6A A9 FF ED 6C 7D A9 57 A4 617®：日D 9D 7D A9 32 日D 18 7D FC 617日：A9 00 ED 19 7D A9 5F 日D 32
 618E： 09 日D 04 7D A9 08 日D 0574 6190：7D AD 65704849 O8 10 6D
 61AE：Eg 30 EE Dg 59 AD 14 7D C2 61AB：C9 6690105 FO 03 4C 49 A9 6180：63 A9 06 日D 0270 A9 96 C1 61BB：日D 03 7D AD 03 7D 484975 61CE：60 1065 6日 30151816 B4
 61D月：62 7D C9 97 90 65 FB 03 1B 61DE：4C 3E 63 A9 00 日D 0ッ 7D ©C G1E月1 A9 OD 日D 01 7D AD 11 7D 5C


 6206：F6 63 4C 1863 EE 日C 7D 75 620日：D6 63 EE GD 7D AD OC 7D DC 621．： 8 D 1A 62 AD 0 D 7D 日D 1B DD 621日： 62 AD 16 日D 10 7D A9 B3 6220：日6 0B 7D AD 64 7D C9 C3 622日：©6 D6 18 AD 05 7D C9 06 B3 6236：D6 11 AD 02 7D C9 64 D9 63 623E： $6 A$ AD 63 7D C9 68 D6 63 9日 6240：4C CF 6A A9 日8 日D 10 7D DE 6248：A9 60 日D 11 7D A9 日6 日D C4 6250：©6 7D A9 60 日D 67 7D AD DD 625B： 07 7D $4849 \quad 106056850$ 6260： $36151510 \quad 68$ C9 150630 626日：बE DG 69 AD 06 7D C9 97 25 6270：96 ש3 Fg 63 4C FC 62 A2 CA 62781 6026 Fg Fb 38 AD 10 7D E8 6289：E9 日1 日D 12 7D AD 11 7D BF 628日：E9 日月 日D 13 7D AD 9B 7D 5B
 629B：2C 101260 CD 13703626 62AD： 24 D6 GA AD 日A 7D CD 12 BB
 62B0：Fg FG 38 AD 0 A 7D ED 10 BF 62BE：7D ED 6A 7D AD EB 7D ED 3B 62C＠： 11 7D 日D 日B 7D 18 AD 16 日D 62CE：7D 6D 96 7D 日D 12 7D AD 9D 62DE：17 7D 6D 67 7D ED 13 7D 64 62DE：AD 18 7D AE 1270 AC 13 日日 62E6：7D 2611 F4 26 5A F4 AD DF 62E日： 11 7D 6A $6 E 11$ 7D $6 E 1029$ 62F6：7D EE 66 7D D6 03 EE 67 4ø 62FB：7D 4C 57 b2 1B AD 16 7D C1 6390： 69 日8 日D 16 7D AD 17 7D DE 6308： 69 日月 ED 17 7D EE 60 7D CB 6310：D6 03 EE $0_{1}$ 7D 4C ES 61 3B 631B：18 AD 18 $70 \quad 69 \quad 61$ 日D 18 E3

6320：7D AD 19 7D 69 日6 日D 19 日B 632日：7D A9 5F 日D 16 7D A9 60 DG 6338：日D 17 7D EE 62 7D DE 63 CC 633日：EE 03 7D 4C 日B 61 EE 04 F 6340：7D DO שS EE 05 7D 4C 9191 634B：61 4C CF 6A A9 FF 日D OC E7 6350：7D A9 57 日D 6D 7D 20 2D CF 635日：68 AD 18 7D 日D 60 7D AD AE 6360： 19 7D BD 01 7D AD 61 7D FG 6368：4日 4D 1D 7D 10 日5 $68 \quad 30$ 日7 6370： 17 10 12 6日 CD 1D 7D 36 9D 637B：$\sigma F D$ DA $A D$（ 70 CD 1C C4 6380：7D 90 65 FB 03 4C BB 64 FB 6388：A9 08 日D 02 7D A9 98 日D 16 6390： 63 7D AD 6370484900 BD 6398：10 $65 \quad 68$ 30 15101068 2A 63A6：C9 60 36 DE D6 69 AD 62 3B 6JAB：7D C9 6A 90 05 Fg ©3 4C 29 63B6：AD 64 EE 0C 7D D® 03 EE 2A 63B8：6D 7D A9 60 8D 6A 7D A9 D3 63C6：BD EB 7D A9 BD 日D 15 9E 6JCB：7D A9 6月 日D 11 7D A9 96 63 63DE：日D 04 7D A9 日g BD 05 7D 67 63DE：AD 85 7D 4849601005 5B 63Eも：6B 3015 10 10 6日 C9 0041 63E日：30 0E D® 09 AD 04 7D C9 3B 6JFD： 979695 FG 93 4C 9864 DD 63F日：A9 60 ES 8A A9 6日 AE 63 BB 6409：7D AC 027 D 20 BF 6B 日E 30 6408：OF 7D BC ©E 7D 1B AD DE DF 6416：7D 6D 04 7D BD EE 7D AD 9日 641B：9F 7D 6D 65 7D 日D 0F 7D 日3 6429：18 AD 16 7D 6D DE 7D 日D 27 6428：©E 7D AD 17 7D 6D 6F 7D BB 6430：8D EF 7D AD 80 7D AE EE 6F 643B：7D AC OF 7D 20 11 F4 B1 85 644छ： $26 \quad 253629$ 7F Fg 62 A9 6B 644B：61 日D 12 7D A9 00 BD 13 BA 6450：7D AD 11 7D BS 8A AD 19 FE 6459：7D AE 13 7D AC 12 7D 20 日E 6460：BF 6B 日E 99 7D BC 9 DB 7D F 6468：1B AD 6A 7D 6D 6B 7D 日D D5 6470：6A 7D AD 6B 7D 6D 69 7D 35 6478：BD 9B 7D AD 11 7D GA GE 56 64日g： 11 7D 6E 10 7D EE 64 7D 2D 64B8：D8 ©S EE 85 7D 4C DE 6J DA 6496：AD GC 7D 日D AQ 64 AD AD BA 6498：7D 8D A1 64 AD IA 7D 日D 1C 64A8：60 16 EE 62 7D DE 63 EE BF 64AE： 63 7D 4C 9263 EE 7D 59 64B8：DG 53 EE 61 7D 4C 6563 DB 64B8： $4 C$ CF 6 A A9 60 ES A9 43 64C0： 40 日5 61 A9 FE 8509 A9 8F
 64D6： 27 A9 78 日S 02 A9 20 ES 7B 64DB： 63 AS 62 3日 E9 28 85 62 4D 64E6：B6 62 CG 03 AS 62 日5 64 CF 64EB：AS 631869648565 AS 24 64F末： 0438 E9 日6 BS 04 Bض 62 AE 64FE：C6 65 A5 048506 A5 65 EF 6509： $18 \quad 69$ 26 日5 97 A5 97 38 A2 6508：E9 6485871890 20 A5 D2 651．： 67 C5 05 D6 F6 A5 04 C5 69 6518： 92 D6 D4 AS 95 C5 63 D6 23 6520：CE AS 02 D6 84 日B 10 A9 9A 6528：A9 日6 85 OC $18 \quad 90$ 2A B1 62 6530： 8624 ©B 36 24 CS ©B DE 84 653日： 26 A6 ©A ES FF Fg 1 A E6 EA 65401 OA EE E 64 BE EE C5 99 FB
 6550：D8 62 E6 61 85 98 18 90 FD 6558：B6 AA 4E 98 4日 BA A2 ©® 6D 6560：C5 69 DB 65 AC 6291 EA 6568：EB AS $0 \% 38$ E9 03 日5 06 FA 6570：日 62 C6 0124 10 3017 C1 6578：A5 MA C9 04 B0 06 AS 68.03 6588：CS 09 Dg 0B AD 9 AS 0994 658日： 91 GO CB AS GA 91 © 86 AC 659\％：6B AS 66 ES 61 1B D6 6567 6598： 69 06 B8 58 926963 85 F6 65A5： 969062 E6 91 A9 618574 65AB：BA 6日 AB 6日 24 DC 109636 65B6：4C CF 6A A9 8085 © 89 3D 65BB： 4085 © 1 A9 FE 85 AB A9 87 65CE： 68 日S IA AB 27 A9 78 85 日E 65CE： 02 A9 28 85 63 A5 823846

65D0：E9 2日 日S 02 Bo 02 C6 03 日 65DE：A5 02 日S 94 A5 031869 日A 65Eも： 04 日S ©5 A5 0439 E9 86 5F 65E日：B5 04 日月 62 C6 65 A5 6447 65F0：85 06 AS 05 1日 69208531 65FB： 97 A5 97 38 E9 84 日5 9786 6600：18 90 1C AS 07 C5 05 D6 05 6608：F6 A5 04 C5 02 D D4 AS 36 6610： 85 C5 03 DE CE AS 02 D8 20 6618：B4 B8 10 A9 4C CF 6 A 2498 6620：DA 3038 A2 0 A1 10085 3B 6628：©B C5 88 DO 21 Eb 00 DO 6F 6630： 02 E6 01 A1 06 日 09 E6 91 6638：D6 02 E6 01 A1 $0 \%$ 85 6640：DB E6 06 D 02 EG 91 A9 B9 664B：B6 B5 6A 1日 90 ©D AS $9 B$ 日 6650： 91 日6 E6 66 D6 02 E6 01 A1 6658： 1896 A日 A5 9891 g6 C6 36 6666： 69 DG A9 A9 06 E5 6 Fg AF 6668：9A 29 2D 68 AD 18 7D 日D 9D 6676： 62 7D AD 19 7D 日D 63 7D 日A 667B：AD 16 7D 日D 00 7D AD 1792 6680：7D 8D 61 7D AD 01 7D 48 1C 6688：4D 1B 7D 10 65 68 30 17 B4 6690：10 1268 CD 1B 7D 36 6F 12 6698：DO DA AD ©D 7 D CD 1A 7 D DA G6A6：90 65 Fg 03 4C B5 66 20 6B 66AE：E7 67 EE 09 7D D6 63 EE 45 66B0：61 7D 4C 84 66 EE 18 7D CB 66BB：DG 03 EE 197D AD 1A 7D 72 66C0：日D 00 7D AD 18 7D 日D $01 \mathrm{C9}$ 66C8：7D AD 18 7D 日D 62 7D AD B7 66DE： 19 7D 日D 63 7D AD 03 7D 91 66DB：4B 4D 1D 7D 10 05 68 30 2E 66E6： $171012 \quad 12 \mathrm{CB}$ CD 1D $7 \mathrm{D} \quad 3014$ 66EB：GF DO EA AD 02 7D CD 1C 4B 66FD：7D 90 05 Fg 03 4C 06 67 6D 66FB：20 E7 67 EE 02 7D D\％ 03 56 6700：EE 03 7D 4C DS 66 AD 1A 39 6768：7D DE 63 CE 1B 7D CE 1A 9D 6710：7D AD 1C 7D 日D 02 7D AD B1 6718：1D 7D 8D 03 7D AD 16 7D 03 6720：BD 08 7D AD 17 7D 日D 81 0B 672B：7D AD 61 7D 4B 4D 1B 7044 6730：10 $0568 \quad 3017101268$ DD 6738：CD 18 7D 30 OF DO OA AD E4 6740：ø6 7D CD 1A 7D 9605 FD F2 674B：63 4C 5A 6720 E7 67 EE CB 6756： 06 7D DE 63 EE 01 7D 4C 8B 6758： 2967 AD 1C 7D DC 03 CE 11 6766：1D 7D CE 1C 7D AD 16 7D 05 676日：BD 60 7D AD 17 7D 日D 01 53 6779：7D AD 1日 7D 8D 02 7D AD 61 6778： 19 7D 8D 03 7D AD 03 7D 3B
 67日B： 17 10 1268 CD 10 70 30 日D 6790：9F D9 6A AD 02 7D CD 1C F4 6798：7D 90 55 F0－63 4C AE 67 6B 67A6： 26 E7 67 EE 62 7D D6 63 FF 67AB：EE 63 7D 4C 7067 4C CF 16 67B6：6A A5 67 日S 06 A5 68 日5 日6 67BB：67 AO ©1 B1 66 D 63 4C 34 67C0：CF 6A Ag 04 BI D6 Fg 18 FD 67CB：C9 7F Bo 09 C9 6190 65 FC 67D91 38 E9 2391 66 CE DO EC 35 67DB：AD 05 B1 Eb AA CE B1 6670 67EG：B6 B6 日S 07 30 BN D2 AD 6D 67EA： 62 7D AE 日g 70 AC 017 D 9 C $\begin{array}{llllllllll}67 F 0_{1} & 20 & 11 & F 4 & B 1 & 26 & 25 & 30 & 29 & 10\end{array}$ 67FG：7F FG 62 A9 M1 BD $0 日$ 7D 6A 686』：A9 6® 日D 09 7D A2 02 2』 7E 686日：FG F6 AD 88 7D C9 06 Dg 29
 6818：A2 03 20 F6 AD 02 7D FD
 6日28：F4 24 5A F4 bi 18 AD 14 EE 68301 7D 69 GA BD 日0 7D AD 15 9A
 6840：7D 日D 48 6日 AD 日1 7D 日D 1D
 6日5月：A9 60 日D 17 7D AD 0 7D 39 6B3日：D 63 CE 91 7D CE 96 7D E 6日68：$A D$（20 7D 日D 6D 68 AD 61 F9 6868：7D BD 6E 6B AD ©S 10 日D CA 6870：6E 7D A9 69 日D 6F 7D A9 2A 6日78： 51 B5 日A A9 日б AE KF 70 6D

6日日g：AC 日E 7D 29 BF 6B BE BF B4 6888：7D BC DE 7D 18 AD 16 7D F5 6日96：6D 6E 7D 9D 16 7D AD 17 3D 6898：7D 6D 日F 7D 日D 17 7D 1819 6EA6：AD 14 7D 6911 日D 日e 7D CF 6日AB，AD 15 7D 69 日の 日D 017091 6日Bg：AD 7D 9D BD 6B AD ©1 CC 6日BB，7D 8D BE $68 \mathrm{AD} \mathrm{O8} 10$ 日D 25 6日C月1 187D A9 日® 日D 19701816 6日CB：AD 14 7D 6918 日D 09 7D 30 6日DE：AD 157069 日6 日D 6170 Bq 6日D8：AD 08 7D 日D E5 68 AD 136 6EE®：7D BD E6 bB AD 19 日D 52 6eEBI 1A 7D A9 go 日D 1B 7D AD DC
 68FB： 60 7D AD øø 7D 6D 076978 6901，AD 11 7D 9D 6869 AD 00 B3 690B1 10 BD 日E 7D A9 96 日D EF 57 69161 7D A9 61 85 日A A9 ga AE 2E 69181 שF 7D AC बE 7D 20 BF 6B 9F 6928：BE GF 7D 8C DE 7D 18 AD BA 6928：1A 7D 6D DE 7D 8D 1A 7D C9 6938：AD 1B 7D 6D gF 7D 日D 1B CB 6938：7D 18 AD 147069 1F BD 24 6940： 00 7D AD 15 7D 6900 日D 9B 694B1 71 7D AD 90 7D 8D 5769 EA 69501 AD 01 7D 日D 5869 AD 0986 695B1 10 8D 1C 7D A9 90 日D 1D 77 6961 7D 18 AD 14 7D 6926 8D 5A 69681 02 7D AD 15706968 日D C1 69701 63 7D AD 62 7D 日D 7F 6984 6978：AD 03 7D 8D B0 69 AD 09 79 6981 10 8D 98 7D A9 80 01 FF 698日：7D AD 62 7D D 03 CE 03 Dの 6990：7D CE 02 7D AD 62 7D 日D EB 6998：A1 69 AD 03 7D 8D A2 69 4D 69A91 AD 10 ED EE 7D A9 ©® DE 69AB1 日D 6F 7D A9 61 85 BA A9 2D

69B9， 08 AE gF 70 AC बE 7D 25 A1 69BE1 BF 6B 8E gF 7D BC DE 7D C0 69C0：18 AD 90 7D 6D GE 7D 日D 6F 69C日：7D AD 91 7D 6D 9F 7D FD 69D6：BD 91 7D 69 A9 60 日D 66 CE 69D8：7D A9 20 8D 67 7D AD 6944 69E®：7D 85 日8 AD 68 7D A2 06 3B

 69FB：AD 98 7D A2 09 AD 40 28 A1 6AEE： 49 6B 日E GD 7D BC OC 7D AA
 6A10：7D AC GA 7D 20 BF 6B 日E 4D 6A1日：gF 7D 8C ge 7D 3日 AD 68 76 6A2G：7D ED 日E 7D BD EE 7D AD 16 6A2B：69 7D ED gF 7D BD 0F 7D 4D 6A30：3B AD OE 7D ED 0C 7D SD 4E 6A3B：DE 7D AD gF 7D ED DD 7D 55 6A46：日D gF 7D A9 ø4 B5 BA A9 DE 6A4B： 06 AE gF 7D AC ©E 7D 20 3B 6A5®： BF 6B 日E GF 7D BC gE 7D 5A 6A5B： 18 AD O6 7D 6D EE 7D BD 69 6A6日：66 7D AD 67 7D 6D ©F 7D FA 6A6日：日D 07 7D A9 08 日S BA A9 E4 6A70：80 AE bB 7D AC OA 7D 2013 6A78：BF 6B BE gF 7D EC gE 7D 82 6ABO：10 AD 66 7D 6D DE 7D BD 91 6ABB：66 7D AD 67 7D 6D GF 7D 23 6A9E：BD 07 7D A9 0® 85 日A A9 6D 6A98： 28 AE ØD 7D AC ©C 7D 20 57 6AAD：BF 6B 8E GF 7D BC ge 7D AA 6AAB： 18 AD 66 7D 6 D OE 7D 日D B9 6ABg：66 7D AD 97 7D 6D gF 7D 4B 6ABE：8D 67 7D 18 AD 66 7D 6D 35 6ACD：64 7D 8D 66 7D AD 67 7D 37 6ACE：6D 05 7D ED 077060 6日 75 GADA： 858968858868957625 6ADE： $6885 \mathrm{D9}$ A9 ED $8 \mathrm{D} \mathrm{g}_{1} \mathrm{E} 2 \mathrm{BF}$

GAEG：A9 118534 A9 DD 8533 C1 6AEE：60 00 C9 84 DO D6 A2 0154 6AFG：BE E9 6A 60 C9 8D Fg bF 5e
 6Bge：EE E9 6A 60 4C ED FD AE E® 6Bg日：E9 6A A9 ©® 6D E9 6A 8A 17 6B10：Fg øD A9 8D 9D FF $\boldsymbol{O}_{1} 20 \mathrm{BF}$ 6B1日：03 BE 90 E7 4C DC BE 4C DD 6B29：日E FD 68 85 8568858682
 6B30：C9 A 906205 F3 20 EA 69 6B38：6A CE D9 EE 38986585 FS 6840： 85859062 E6 86 6C 85 1D 6B4日：00 日5 8784 B9 86 8A A6 D5 6B50： 008486848588 8A 10 D4 6B5日：øE 38 A9 ø0 E5 89858963 6869：A9 E5 EA 85 8A CE AS FE 6868：89 10 øE 38 A9 gб E5 日7 6D 6B70： 8587 A9 68 ES 88 日5 88 06 6878：C8 84 日B A2 $6 F 66872636$ 6B89：8日 26 日5 26 86 38 AS $851 E$ 688日：E5 日9 A日 A5 B6 E5 日A 9095 6B90：06 E6 8785868485 CA 89 6日98： 10 E3 A5 8B D 14 A 38 A9 E6 6BAD： 00 E5 878587 A9 06 E5 03 6BAB： 88 B5 89 38 A9 00 E5 8558 6BBO： 85 日S A9 86 E5 8685 日6 BB 68BB：A6 日8 A4 87 A5 86 60 8595 6BC6： 8984878688 A9 988547 6BCB： 85 日5 86468866879076 6BD6： 6 D 18 A5 896585858593 6BD8：A5 8A 65868586068916 6BED： 26 日A AS 88 日S 87 Dの E3 76 68EB：A4 85 A6 86 68 $8586845 B$ 6BF®： 87 A 06 A9 9091 B5 CB 6 B 6BFB：Dの 02 E6 86 日A Dg 04 C6 64 6Cø0： 873004 CA 4C F3 6B 60 3F 6C 0 B： 592046494920 JA 4A 70


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# IBM Printer Control 

Ronald Dorchester

Now you can send printer control codes from DOS with a program that understands your own commands．

One of the most common，and sometimes bothersome，tasks for any IBM PC／PCjr user is sending control codes to a printer prior to printing．＂IBM Printer Control＂is a compact，convenient program which is customized exactly for your needs．It can send a variety of different commands to the printer， using command names that you have devised．

Before you type in the pro－ gram，decide what control codes you want to use．Consult your printer manual to determine the control codes for the features you want．For each feature，select a de－ scriptive name to be used when you invoke the printer control program from DOS．For instance，you might use the names DS－ON and DS－OFF for the commands that turn double－ strike printing on and off．

Lines 1200－1231 of the pro－ gram contain DATA statements with example commands and con－ trol sequences．The commands are the words you will type from the DOS prompt to invoke the corre－ sponding features，and the num－ bers following the commands are the control characters for those commands．Some commands，such as BKSPC（backspace）are very sim－ ple，consisting of only a single char－ acter．Others contain a sequence of several control characters．If you frequently use a certain sequence of commands，you might want to put the entire sequence into a single command．The NORMAL command in line 1209 is an example of one such sequence．

Notice that each control se－
quence ends with the value -1 ， which is a marker indicating the end of the sequence．The last con－ trol character is a carriage return （character 13）．The carriage return causes the control sequence to take effect immediately，allowing each command to execute independently．

When you type in the program， edit lines 1200－1231，adding or sub－ stituting your commands for the ex－ ample commands．The name of the command must come first，followed by its control characters，and the value -1 ．The command names can be any legal DOS name；however， no name extensions are allowed．

After making all the necessary modifications，save a copy and then run the program．If you made no typing errors in your DATA state－ ments，an executable machine lan－ guage program called PRNCTRL ．COM will be written to disk．Like other machine language programs， this one is run from the DOS prompt by typing its name（the COM extension is optional）．If you type PRNCTRL from the DOS prompt and press RETURN，the program prints all the command names which it understands．This is a convenience in case you forget some of the command names．The normal usage is to supply the name of one or more commands．For in－ stance，assuming you included a command named NORMAL，the following invokes PRNCTRL，send－ ing the NORMAL command to reset the printer to its default condition：

## PRNCTRL NORMAL

You can send more than one control sequence at a time．For instance，you might use this com－ mand to turn on compressed and double－strike mode：
PRNCTRL CMP－ON DS－ON

If you supply an invalid com－ mand name，the program displays the error message Invalid Option and returns to the DOS prompt．

## PRNCTRL．COM Fllemaker

For instructlons on entering this program． please refer to＂COMPUTEI＇s Guide to Typing In Programs＂elsewhere in this issue．

怔 106 －Printer Control
6N 110 P Copyright 1987
FN 111 ，Compute！Publications， Inc．
LK 129 ：All Rights Reserved．
HH 125 ．
60 126 CLS：PRINT＂Copyright 1987＂ ：PRINT＂Compute！Publicati ons，Inc．＂IPRINT＂All Righ te Resurved．＂：FDR X＝1 TO 1590：NEXT
PJ 130 CLS：DEFINT I：FOR I＝g TO 5 ：READ MSGe（I）：NEXT
8n 131 READ PGMt，IIMAX，I2MAX，ORT OTCK，ILDF
NO 14．IPASS＝IPASS＋1：PRINT MSGS $($ IPABS）：IF IPASS＝ø OR IPAS S＝3 THEN 1006
81 150 PRINT：IF IPASS＝2 THEN OPE N PGM AS 1 LEN＝1：FIELD \＃1，1 AS BYTE
BH 160 RESTORE 501：GRTOT＝6：FOR I 1＝1 TO IIMAX：FOR 12＝1 TO I 2MAX
FP 170 READ H＊：IBYTE＝VAL（＂\＆H＂＋H＊ ）：ITOT＝ITOT＋IBYTE
PF 1BO IF IPASS－2 AND ICLOFくILOF THEN LSET BYTE $\quad$ CHR象（IBY TE）：PUT \％1：ICLOF＝ICLOF＋1
JL 196 NEXT 12：READ ICHECK：IF IC HECK＝ITOT BOTD $21 \varnothing$
IL 206 PRINT MSG\＄（4）；5gØ＋I2：IPAS $5=-1$
明 218 GRTOT＝GRTOT＋ITOT：ITOT＝0：N EXT I1：PRINT
日M 226 IF IPASS＞E AND BRTOTCK■日R TOT EOTO 146
AH 236 IF IPASS＜＞－1 THEN PRINT M SG（5）：END ELSE GOTD 146
HA 300 DATA Correct Errors．，Chec king DATA Lines．，Creating Program．
HB 316 DATA Program Created．，Err or（e）On Line－，Check Lin －56．
81 596 DATA＂A：PRNCTRL．COM＂，24，1 6，34236，3日1
MM 501 DATA E9，AC， $010,6 D, 69,6 D, 6 A$ $, 55,52,4 \mathrm{E}, 43,54,52,4 \mathrm{C}, 26$ ， 20． 1063
FO 562 DATA 2D，20，20，4F，75，74，76 $, 75,74,26,50,72,69,6 E, 74$, 65， 1424

LH 503 DATA 72，29，43，6F， $6 \mathrm{E}, 74,72,6 F, 6 \mathrm{G}, 20,43$ ，6F，64，65，73，2E，1455
CC 584 DATA ©D，6A， $43,6 F, 76,79,77,72,69,74,65$ ，20，52，6F，6E，61， 1421
in 565 DATA $6 C, 64,29,44,6 F, 72,63,68,65,73,74$ ，65，72，20，31，39，1421
NN 506 DATA 3日，36， $9 \mathrm{D}, 9 \mathrm{~A}, 09,20,20,31,30,39,34$ $, 37,20,43,72,6 F, 791$
HP 567 DATA $77,6 E, 20,56,61,72,6 B, 6 D, 6 A, 09,20$ ，26，53，61，6E，26，1677
FH 50B DATA $41,6 E, 74,6 F, 6 E, 69,6 F, 2 C, 20,54,5 B$ ，20，20，37，3日，32，1261
$K$ K 509 DATA $33,39,6 D, 6 A, 1 A, 0 D, 9 A, 56,61,6 C, 69$ $, 64,20,4 F, 76,74,1615$
IH 510 DATA $69,6 \mathrm{~F}, 6 \mathrm{E}, 73,26,41,72,65,3 A, 6 \mathrm{D}, \Omega \mathrm{A}$ ，6D，6A，49，6E，76，115B
CK 511 DATA $61,6 \mathrm{C}, 69,64,26,4 F, 76,74,69,6 F, 6 E$ $, 3 A, 20,07,01, B E, 1363$
BE 512 DATA $80,80, A C, 3 C, 90,77,12,80,3 E, A E, 01$ ，61，75，66，E日，7A，1342
Q1 513 DATA 60，EB， $86,69, B B, 60,4 C, C D, 21, B F, 5 C$ $, 09, B 8,63,29, C D, 1585$
JL 514 DATA 21， $\mathrm{ED}, 3 \mathrm{BE}, 5 \mathrm{D}, 09,20,74, \mathrm{DF}, 56, \mathrm{BB}, 7 \mathrm{D}$ ，62，83，उF，60，74，1397
EK 515 DATA 2B，BF，5D， $60, ~ B B, F 3, B 9,6 B, ~ 60, F 3, A 6$ ，74，6日，日B，77，6日，1761
FM 516 DATA 8D，5B， $04, E B, E 7, C 6,06, A E, 81,60,8 B$ ， $4 \mathrm{~F}, \mathrm{~m}, \mathrm{~EB}, \mathrm{DJ}, \mathrm{EJ}, 1791$
CN 517 DATA C2，6A，BB， $64,80, B 4,40, C D, 21,5 E, E B$ ，BD，EB，2C，80，BA， 1 ES7
Dl 518 DATA 9B， $51,89,13,10, E 8,17,96, C 7,66,65$ ， $26,6 \mathrm{D}, 8 \mathrm{~A}, \mathrm{BA}, 5 \mathrm{D}, 1223$
11519 DATA 69， $89,6 C, 60, E B, 68,60, E B, 20,60, B 8$ ，FF，4C，CD，21，59，1534
$K 1520$ DATA $53, B B, 62,00, B 4,40, C D, 21,5 B, 5 B, C 3$ ，C6，66，84，81，20，1497
HM 521 DATA BA，6S，©1，B9，Bח，$\% 9, E B, E 6, F F, C 3, B A$ ，85，61，89，16， 00,1944
DK 322 DATA E日，DC，FF， $\mathrm{BE}, 7 \mathrm{D}, 62, \mathrm{BG}, 20,20,83,3 F$ ， $06,74,1 E, B B, D 3,1959$
KJ 523 DATA BD，7F， $08,8 B, 35,8 \mathrm{D}, 5 \mathrm{~B}, 8 \mathrm{~A}, 83,3 F, 00$ ，75， $03, B 8,6 \mathrm{D}, 6 \mathrm{~A}, 1228$
KF 524 DATA $87,65, B 9,0 A, 60, E B, B 7, F F, 67,65, E B$ ，DD，C3， $06,06,0 \omega_{0} 1776$
LJ 10d』 IF IPASS＝0 THEN END
PA 1010 DIM IB（129）：RESTORE 1206：PRINT＂Addi ng Printer Control Statements．．．＂
CH 1028 CMD $=$＝SPACE $\$(8)$ ：READ RD\＄
 PUT 1：PUT WI：PRINT＂DOne．＂：END
 4）；CMD ${ }^{\text {；}}$ CHR（34）
HI 1 ซ50 FOR $I=1$ TO $B: I C=A S C(M I D \$(C M D *, I, 1)):$ IF IC＞96 AND ICく123 THEN IC＝IC－32
LC 1068 LSET BYTE\＄＝CHR（IC）：PUT \＃I：NEXT
H月 1670 IBX＝g：READ IC：WHILE IC $>=0$ AND IC＜$=25$ 5：IBX＝IBX＋1：IB（IBX）＝IC：READ IC：WEND
 LSET BYTE事＝CHR（IBX\256）：PUT \＃1
OL 1990 FOR I＝1 TO IBX：LSET BYTE ）：PUT 1：NEXT：GOTD 1020
HN 1100
JD 1110 ，Printer Contral Statements．
Q 1120 ＊Format：DATA cmd－name，code，＜co de．．．．．＞－1
H6 1130 ．
OK 1200 DATA CR，13，－1
I6 1201 DATA LF， $10,-1$
W 1202 DATA FF，12， $68,13,-1$
KE 1203 DATA BKSPC， $68,-1$
$6 E 1264$ DATA LPI－6，27，50， $68,13,-1$
CK 1265 DATA LPI－8，27，48，08，13，－1
FK 1209 DATA NORMAL， $18,27,76,27,72,27,50,68$ ， 9日，6日，0日，13，－1
DL 1210 DATA CMP－ON，15，08，13， 1
HB 1211 DATA CMP－DFF，18， $88,13,-1$
FK 1226 DATA EMP－ON， $27,69,88,13,-1$
KJ 1221 DATA EMP－DFF，27，70， $68,13,-1$
E0 1230 DATA DS－ロN，27，71，68，13，－1
BH 1231 DATA DS－OFF，27，72，08，13，－1
PP $15 פ 0$ DATA／
：＂Mar ke End of Printer Contral Statements

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# Auto-Display Hi-Res Picture Maker 

Jaideep Vijan

From a reader in Hong Kong, this utility turns any Apple II hi-res picture into a file that you can BRUN. Several display options are available. The program works under both DOS 3.3 and ProDOS.
"Auto-Display Hi-Res Picture Maker" is an Apple II program which will convert any normal hi-res picture file on disk into a file which can be BRUN. When you BRUN the converted file, the picture isn't instantly displayed on the screen; instead, it is drawn onto the screen. The picture can be drawn in a variety of ways.

To begin, boot up DOS 3.3 or ProDOS, enter the program, and save it to disk. It's important that you save the program with the filename AUTO.HIRES.PIC. When you run the program, it displays the main menu. Option 1 (instructions) outlines the steps needed to convert a file from an ordinary hi-res picture to one which can be BRUN and gives details of the memory locations used by the converted file.

Option 2 (load picture) loads a hi-res picture file from disk into the hi-res screen. When you choose this option, you are prompted for a filename. If you change your mind and decide not to load a file, press $\mathrm{Ctrl}-\mathrm{C}$ and Return to display the main menu again. To view a catalog of the disk, press Return without typing anything. When you are ready to load a file, enter its filename and press Return. Filenames must start with a letter and be no longer than 15 characters for ProDOS or no
longer than 30 characters for DOS 3.3. Once the picture has loaded, you return to the main menu.

Option 3 (try draw routines) lets you try out the various ways in which the picture can be drawn on the screen (there are five). When you select this option, you are given a choice of seeing one of the drawing routines or of returning to the main menu. To try out one of the drawing routines, type in its number and wait until it is POKEd into memory. After the drawing routine has finished, you return to the option 3 menu. Once you have decided which routine you like best, return to the main menu and go to option 4.

Option 4 (make auto-display hi-res picture) is the part of the program which converts the hi-res picture into a file which can be BRUN. When you choose this option, you are asked which drawing routine you want to use. Enter the number corresponding to the drawing routine that you liked best in the previous step. Then you are asked for the name of the file you wish to create (this will be the file that can be BRUN). Again, press Return by itself to view a disk catalog, or use Ctrl-C and Return to go back to the main menu. After you enter a filename, you are asked to confirm that this choice is correct. If you answer in the affirmative, the conversion takes place, and you return to the main menu.

Option 5 (see screen) lets you look at whatever is present on the hi-res screen. After you finish looking at the picture, press any key to return to the main menu.

Option 6 lets you change the disk drive or DOS prefix used by the rest of the program. The slot and drive apply if you are using DOS 3.3, while the DOS prefix is relevant only to ProDOS. If you are using DOS 3.3, enter the slot and drive numbers when prompted and you will return to the main menu. If you are using ProDOS, the program displays the current prefix near the top of the screen and invites you to enter a new prefix. If you enter an illegal prefix, or if ProDOS cannot find the directory you want, you are prompted to enter another prefix. (Note that you must enter a valid prefix in order to exit this option.)

Choose option 7 once you have finished and want to leave the program.

If a DOS error occurs, the program prints an error message and returns you to the main menu. If an Applesoft error occurs, the program stops after printing the error number and the line number in which it happened. Pressing $\mathrm{Ctrl}-\mathrm{C}$ and Return while the program is running always returns you to the main menu, except when you are entering a prefix for ProDOS.

## Auto-Display Hi-Res Picture Maker

For instructions on entering thls progrom, please refer to "COMPUTEI's Guide to Typing in Programs" elsewhere in this issue.

F9 1 REM COPYRIGHT 1997 COMPUTE! PUBLICATIONS, INC. ALL RI GHTS RESERVED
FB 5 IF PEEK (103) + PEEK (104) * 256 < > 25345 THEN POKE 2 5344,6: POKE 1ø3,12 POKE 18 4,99: PRINT : PRINT CHR (4 ): "RUN AUTO. HIRES.PIC"

5220 D $=$ CHR（4）
58 30 SL\＄＝＂，S6，D1＂：SL\％＝6：DR\％ $=1:$ MNS $=" S E T$ SLOT AND D RIVE（NOW 6，1）＂：CT $=$＂CAT ALDG＂：NLY＝30：IF PEEK（4日日96）$=76$ THEN CT $=$＂CAT ＂：NLY＝15：MN $=$＂SET PREF IX＂：PRINT D＊；＂PREFIX＂：IN PUT PX ${ }^{(1) S L}=$＂$"$
82990 DNERR GOTO 63000
明 997 REM
B5 998 REM MAIN MENU
CI 999 REM
981000 TEXT ：HOME ：HTAB 3：PR INT＂AUTO－DISPLAY HI－RES PICTURE MAKER＂：HTAB 3：

 $T$
E0 1003 PRINT＂COPYRIGHT 1987 CO MPUTE！PUBLICATIONS＂：HT AB 10：PRINT＂ALL RIGHTS RESERVED＂
161005 VTAB 8
b 1010 PRINT＂＜1＞INSTRUCTIONS＂ ：PRINT＂＜2＞LOAD PICTUR E FROM DISK＂：PRINT＂〈3＞ TRY DRAW ROUTINES＂：PRI NT＂〈4〉 MAKE AUTO－DISPLA Y HI－RES PICTURE＂：PRINT ＂〈S＞SEE GCREEN IN MEMO RY＂
D2 1011 PRINT＂〈6＞＂；MN\＄：PRINT ＂く7＞日UIT＂：PRINT
明 1015 PRINT＂PLEASE CHOOSE ONE （1－7）：＂；：GET X\＄：PRI NT X＊ IF X 人＜＂1＂OR X ＞＂7＂THEN PRINT CHR 7）：GOTO 1000
E！ $1020 \quad X=$ VAL $(X)$ ：ON $X$ GOTO 2060，3696，4060，5060， 7606 ，日ぁぁぁ，6ぁซぁ
231997 REM
10 1998 REM INSTRUCTIONS
331999 REM
122006 TEXT ：HOME ：PRINT＂INS TRUCTIONS＂：PRINT＂－－－－ 4，3
442010 PRINT＂THIS PROGRAM WILL TAKE ANY HI－REG＂：PRINT ＂PICTURE AND CONVERT IT INTO A FILE WHICHWILL A UTOMATICALLY DISPLAY THE PICTURE＂：PRINT＂WHENT HE FILE IS BRUN．＂：PRINT
672626 PRINT＂WHEN THE FILE IS BRUN，THE PICTURE WILL＂： PRINT＂BE DRAWN DNTD TH E SCREEN．THIS CAN BE＂： PRINT＂DONE IN A NUMBER DF WAYS．TO TRY QUT THED IFFERENT DRAWING ROUTINE S，LOAD A＂：PRINT＂PICTU RE USINB OPTION 2 FROM T HE MAIN＂
D4 2021 PRINT＂MENU AND GO TO OP TIGN 3．＂：PRINT ：GOSUB 10600
CL 2036 HOME ：PRINT＂ONCE YOU H AVE CHOSEN THE DRAWING R OUTINETHAT YOU LIKE BEST ，GO BACK TO THE MAIN ME NU AND GO TO OPTION 4．（ BEFORE GOING＂：PRINT＂TO OPTION 4；MAKE SURE YOU HAVE LOADED YOUR PICTU RE INTD MEMORY．）＂：PRINT
212640 PRINT＂YOU WILL BE ASKED FOR THE NUMBER OF THE D RAWING ROUTINE THAT YOU WANT TO USE FDRYOUR PICT URE AND FQR THE NAME OF A FILE TO SAVE IT TO．WH

EN THE PROGRAM HAS＂
JC 2041 PRINT＂FINISHED CREATING THE FILE，YOU WILL BE R ETURNED TO THE MAIN MENU ．＂：PRINT
A4 2050 PRINT＂NOTE：WHEN THE CR EATED FILE IS BRUN，IT W ILL QUERWRITE MEMORY LOC ATIONS \＄2090－\＄62FF（81 92－23343）．＂：PRINT
812060 GOSUB 10øD0：GOTO $10 \varnothing 0$

## 242997 REM

IJ 2998 REM LOAD PICTURE
342999 REM
833000 TEXT ：HOME ：PRINT＂LOA D PICTURE FROM DISK＂：PR
INT H－－COMN：POKE 34，3
明 3010 PRINT＂ENTER FILENAME（J UST RETURN FOR CATALOG）＂ ：INPUT＂：＂；FI＊
CC 3020 IF FIS $=\cdots \cdots$ THEN POKE 34
 INT：PRINT 3 GOSUB $100 D$ 0：BOTO 3000
18 3030 IF LEN（FI\＄）$>$ NL\％OR AS C（LEFT（FI ${ }^{(1), 1))}$ \＆ASC （＂A＂）DR ASC（ LEFT＂（F I（ ${ }^{(1))}$ ）ASC（＂Z＂）THEN PRINT CHRS（7）：GOTO $3 \varnothing \varnothing$ ${ }^{\circ}$
60 3040 HGR ：POKE 49234， $0:$ PRIN T D\＄；＂BLOAD＂；FIs；＂，A\＄20 Bg＂；SL＊：FOR X＝ 1 TD 15日D：NEXT ：BOTO 1 2ge
253997 REM
6F 3998 REM TRY DRAW ROUTINES
353999 REM
21 400g TEXT ：HOME ：PRINT＂TRY DRAW ROUTINES＂：PRINT＂
$T$
Eq 4010 PRINT＂PLEASE CHOOSE ONE ：＂：PRINT
60 4 620 FOR $X=1$ TO 5：PRINT ${ }^{*}<$ ＂$X^{X ;}$＂）DRAWING RQUTINE＂ ；$X_{\text {：}}$ NEXT ：PRINT＂＜6＞RE TURN TG MAIN MENU＂：PRIN $T$
2E 4030 PRINT＂WHICH（1－6）$?$＂；： BET X＊：PRINT $X{ }^{6}$ ：IF X ＜＂I＂OR Xe＞＂ $\mathbf{K}^{4}$ THEN PRINT CHR（7）：EOTO 40 06
D6 $4046 \times 2=$ VAL $(x): I F \times 2=6$ THEN 1 OOO
3B 4650 RESTORE ：PRINT ：PRINT ＂SKIPPING DATA．．．．＂＂\＆PRI NT：GOSUB 10610
014660 IF $X 2=1$ THEN PO $=2457$ 6：GOSUB 1ઘ63ळ：GOTD 420 ©
15 4070 FOR $\times 1=1$ TO $\times 2-1:$ GO GUB 16616：NEXT
DA 4080 PO $=$ 24576：BOSUB 10030
36 4081 IF X2 $=5$ THEN GOSUB 100 30：GOTO 4200
（9） 4090 FOR X1 $=1$ TO 5－X2：GO SUB 18616：NEXT，GOSUB 10030
3． $428 \%$ CALL 24576：FOR $X=1$ TO 5日ぁ冋：NEXT：GOTO 486g
264997 REM
CC 4998 REM MAKE PIC．
364999 REM
69 S00日 RESTORE ：TEXT ：HOME ： PRINT＂MAKE AUTO－DISPLAY HI－RES PIC．＂：PRINT ${ }^{4-}$
－－－＊：PRINT ：POKE 34，3
A7 5018 PRINT＂USE WHICH DRAWING ROUTINE（1－5）：＂：BET X象：PRINT X\＆：IF $X$＜$<$ 1＂OR $X$（ $>$＂ 5 ＂THEN PRIN

T CHR＊（7）：HOME ：BOTO $501 \%$
20 5620 DR $=$ VAL（ X \＄）
DD 5639 HOME ：PRINT＂ENTER NAME DF FILE TO SAVE TO．＂：$P$ RINT＂（JUST RETURN FQR C ATALOG）＂：PRINT ：INPUT
＂：＂；FI
825040 IF FI $=\cdots \mathrm{MHEN}$ POKE 34 ， $8:$ PRINT De；CTE；SLE：PR INT ：PRINT：GOSUB 1 D日D б：HOME ：PRINT＂MAKE AU TO－DISPLAY HI－RES PIC．＂： PRINT


POKE 34， 38 GOTO 5030
2C 5050 IF LEN（FI＊）$>$ NL\％OR AS C（LEFT $(F I s, 1))$（ASC （＂A＂）OR ASC（ LEFT（F 18，1））＞ASC（＂Z＂）THEN PRINT CHR：（7）：EOTD 593 0
A9 5860 HOME ：PRINT＂FILENAME：＂ ；FIE：PRINT：PRINT＂DRA WING ROUTINE＂：DR：PRINT ：PRINT ：PRINT＂OK（Y／ N）？＂：GET XS：PRINT $X$
\％：IF $X$＝＂N＂THEN 50日g
昭 5670 IF $X$ \＄＂Y＂THEN 5090
155688 PRINT CHR（7）：GOTO 566 g

AE 5698 POKE 34，6：HOME ：POKE 3 4，6：VTAB 10
E3 5100 PRINT＂CREATING FILE．．．． ＂：PRINT
$115110 \times 1=$ PEEK（日192）：X2＝PE EK（日193）：X3＝PEEK（B17 4）
Ad 5129 POKE 日192，76：POKE B193， 0：POKE B194，64
JB $5130 \mathrm{PO}=16384:$ B0SUB 10030
935140 PQKE 16385，X1：PQKE 1639 6，X2：POKE 16395，XJ
$415150 \mathrm{PO}=16640$
AC 5168 IF DR $=1$ THEN GOSUB 100 36：GOTO 5300
iC 5170 FOR $\times 5=1$ TO DR $-1:$ GO SUB 180162 NEXT ：BOSUB 18030
AC 5180 IF DR $=5$ THEN GOSUB 160 36：G0TO 5300
26 5199 FOR $\times 5=1$ TD 5 －DR：GO SUB 1061ซ：NEXT ：GOSUB 18030
65300 PRINT＂SAVING FILE．．．．．＂： PRINT ：PRINT De；＂BSAVE
 SL\＄：PRINT ：PRINT＂DONE ．＂：FOR $X=1$ TO 2006：$N$ EXT ：POKE 8192，X1：POKE 8193，X2：POKE 8194，X3： GOTO 1098
275997 REM
D4 5998 REM QUIT
375999 REM
EI G日®B TEXT ：HOME＝VTAB 12：H TAB 14：PRINT＂．．．．BYE ．．．．＂：VTAB 23：END
296997 REM
976998 REM SEE SCREEN
386999 REM
77 70ロg TEXT ：HOME ：PRINT＂SEE SCREEN IN MEMORY＂：PRIN ：PR－－－
$21701 \varnothing$ PRINT＂PRESS ANY KEY TO GO BACK TO MENU ONCE＂：$P$ RINT＂PICTURE CDMES ON＂： FOR $X=1$ TO 250б：NEXT
EC 7620 POKE 49232， $6:$ POKE 49234 ，D：POKE 49236，8：POKE 4 9239， 0 ：WAIT－16384，128 ：POKE－1636日，D：BOTO 1 066

297997 REM
077998 REM SLOT，DRIVE／PREFIX 397999 REM
28 BøG® TEXT ：HDME ：PRINT MNS： FOR $X=1$ TO LEN（MN ）： PRINT＂－＂；：NEXT ：PRIN $T: P R I N T: I F C T={ }^{\prime \prime} C A$ T＂THEN ESDR
FF B61ø PRINT＂SLQT（1－7） 7 ＂： GET $X$
 THEN PRINT CHR（7）：HTA B 1：VTAB PEEK（37）：GOT 08910
AE B030 SL\％＝VAL（ $X$ ）：PRINT $X \$$ ：PRINT
$2 E$ 日04G PRINT＂DRIVE（1－2）？＂；： GET X
 THEN PRINT CHR（7）：VTA B PEEK（37）：HTAB 1：GOT D B649
36 BEGD DR\％＝VAL $(x \$): M N s=$＂SE $T$ SLOT AND DRIVE（NDW＂ ＋STR（SL\％）＋＂，＂＋STR
 + STR竟（SL\％）＋＂，D＂+5 TR（DRY）：GOTO 1080
9F 日500 PRINT＂CURRENT PREFIX：＂ ；PXS：PRINT ：POKE 34，P EEK（37）＋12 HOME
338510 INPUT＂ENTER NEW PREFIX： ＂；X
398520 ONERR GOTO 8600
 －＝X \＆ONERR GOTD 6J®g\％
688540 GOTO 1060
A5 8600 PRINT CHR（7）：HOME ： 1 OTD 8510
189995 REM
119996 REM SUBROUTINES
2 19997 REM
079998 REM WAIT FOR KEYPRESS
319999 REM
60 1090g UTAB 23：PRINT＂PRESS A NY KEY TO CONTINUE＂； GET X ${ }^{\text {B }}$ ：PRINT ：RETURN
8910907 REM
BJ $1 \varnothing \varnothing \varpi 8$ REM SKIP DNE DATA BLOCK
A9 10909 REM
5110010 READ $X:$ IF $X=301$ THEN RETURN
7月 16920 GDTD 19010
9910.027 REM

4110628 REM POKE DNE DATA BLOCK
日9 16029 REM
6710630 READ $X=I F X=300$ THEN RETURN
$3 E 10040$ POKE $P Q, X: P D=P D+1:$ GOTO 1063g
E日 59995 REM
AS 59996 REM DATA
© 59997 REM
495999 REM MOVER ROUTINE
2C 59999 REM
A7 60606 DATA $169,0,141,6,32,169$
$, 6,141,1,32,169,6,141,2$ ，32，160，6，169，6，133，60， 169，65，133，61，169，255， 1 $33,62,169$
8160610 DATA $67,133,63,169,0,13$ $3,66,169,96,133,67,32,4$ 4，254，76，5，96，306
9E 60127 REM
DF 60928 REM DRAWING ROUTINE 1 BE 6 D日29 REM
EA 60030 DATA 32，216，243，173，82， $192,162,0,189,162,96,29$ $1,255,245,49,141,57,96$ ， $189,115,96,141,61,96,18$ 9，127，96，141，65，76
FJ 69046 DATA $189,139,96,141,69$ ， 96，189，151，96，141，75，96
$, 142,163,96,32,56,96,17$ $4,163,96,232,76,6,96,96$ ，169，32，133，61，169
FC 6ø日5！DATA 46，133，63，169，64，1 $33,67,169,6,133,69,133$ ， $66,169,255,153,62,32,82$ $, 96,76,160,6,177,60,145$ ，66，32，186，202，176
C）606bd DATA $8,169,16,32,168,23$ $2,76,82,76,76,32,57,37$ ， $61,35,49,41,53,44,59,45$ $, 58,255,35,5 日, 41,63,37$, $52,43,56$
DF 69107．DATA 45，61，47，58，64，89， $69,93,67,80,73,85,76,91$ $, 77,96,6,6,128,128,12 B$ ， $0,128,0,6,0,80,128,127$ ． 127， 127
71 6פ®BD DATA 255，127，255，255， 25 $5,127,127,255,255,181,3$ 6月
CE 6O10B7 REM
5！60日BE REM DRAWING RDUTINE 2
EE 690日
AS 6969g DATA 32，216，243，173，82， $192,167,0,141,232,97,16$ 9，191，141，233，97，169，96 ，141，234，97，174，232，97， $189,164,96,133,66,133$
58 601日g DATA $64,189,46,97,133,6$ $1,24,105,32,133,65,174$ ， $233,97,189,104,96,133,6$ 2，133，66，189，40，97，133， $63,24,165,32,133,67$
5369115 DATA $160,6,177,66,145,6$ $4,177,62,145,66,208,192$ $, 46,24 \%, 3,76,63,96,167$ ， 192，32，16日，252，266，234， 97，169，255，205，234，97
IE 60126 DATA $240,9,238,232,97,2$ 96， $233,97,76,21,96,96,3$ （0）
A2 66127 REM
64 GO128 REM DRAWING ROUTINE 3
C2 60129 REM
3069130 DATA 32，216，243，173，82， $192,169,96,141,232,97,1$ 69，75，141，233， $97,169,76$ ，141，234，77，174，232，77， $189,164,96,133,66,133$
7 76 66140 DATA $64,189,46,97,133,6$ $1,24,165,32,133,65,174$ ， $233,97,199,164,96,133,6$ 2，133，66，189，40，97，133， $63,24,105,32,133,67$
7360150 DATA $160,0,177,60,145,6$ $4,177,62,145,66,206,192$ $, 45,240,3,76,63,96,169$, 192，32，16日，252，206，234， 97，169，255，205，234， 97
dF 60160 DATA 240，9，206，232，97，2 $36,233,77,76,21,96,76,3$ 06
C2 60167 REM
C4 69168 REM DRAWING ROUTINE 4 E2 60169 REM
9269170 DATA 32，216，243，173，82， $192,169,9,141,7,78,169$ ， $191,141,8,98,169,96,141$ ，9，98，174，7，98，189，135， $96,133,69,133$
if 6曰18曰 DATA $64,289,71,97,133,6$ $1,24,165,32,133,65,174$ ， 8，98，189，135，96，133，62， $133,66,189,71,97,133,63$ ，24，125，32，133，67
EF 60190 DATA $169,0,177,60,73,25$ 5，145，64，177，62，73，255， $145,66,206,192,40,249,3$ ，76，63，96，169，192，32，16 B，252，206，9，98， 169
4A 6ஏ20® DATA 255，205，9，98，240，9 $, 236,7,98,206,8,98,76,2$
$1,96,169,32,133,61,169$ ， $63,133,63,169,64,133,67$ ，169， $5,133,60$
AE 68210 DATA 133，66，169，255， 133 ，62，166，6，32，44，254，76， 300
9E 63217 REM
EI 6021 REM DRAWINB ROUTINE 5
㫙 66219 REM
2B 60220 DATA 32，216，243，173，82， $192,169,6,141,77,96,169$ ，191，141，7日，98，169，96，1 41，79， $78,174,77,98,189$, 205，96，133，60，133
18 66230 DATA 64，189，141，97，133， $61,24,165,32,133,65,174$ ，78，98，189，205，96，135，6 $2,133,66,189,141,97,133$ ，63，24，165，32，133，67
3A 60240 DATA $160,0,177,60,73,25$ $5,145,64,177,62,73,255$, $145,66,269,192,40,246,3$ ，76，63，76，169，76，32，168 ，252，296，79，9日，169
FD 66256 DATA 255，205，79，79，246， 9，23日，77，7日，266，7日，98，7 $6,21,96,169,96,141,77,9$日，169，95，141，78，98，167， 96，141，79，9日，174
3A 60260 DATA 77，98，189，205，76， 1 $33,69,133,64,189,141,77$ ，133，61，24，165，32，133，6 5，174，78，98，189，295，76， $133,62,133,66,189,141$
AS 66270 DATA $97,133,63,24,165,3$ $2,133,67,160,6,177,69,1$ $45,64,177,62,145,66,200$ ，192，46，240，3，76，164，96 ，167，96，32，16B， 252
E4 68280 DATA 206，79，98，169，255， $205,79,98,240,9,266,77$, 98，238，78，98，76，122，76， 76，360
06 66297 REM
31 6028B REM COMMDN DATA
F6 60299 REM
9960290 DATA $0,0, \varnothing, \sigma, \varnothing, \varnothing, \varnothing, \varnothing, 12$日，12日，12日，128，12日，128， 1
 $128,128,128,128,128,128$
F5 $6 \boxed{360}$ DATA $12 \theta, 12 \theta, 0,6, \sigma, \sigma, \varnothing$ ， $0,0,16,12 \theta, 12 \theta, 12 \theta, 12 \theta, 1$ $28,128,12 \theta, 12 \theta, 6,0,0,8$, $6,6,6,8,128,128,128,128$ ，12日
B9 6031פ DATA 12日，12日，128，40，40， $4 \omega, 40,4 \%, 4 \%, 40,46,168,1$ $6 \mathrm{~B}, 16 \mathrm{~B}, 16 \mathrm{~B}, 16 \mathrm{~B}, 16 \mathrm{~B}, 16 \mathrm{~B}$, $16 日, 40,40,40,40,40,40,4$ 6，40，16B，16日，168， 16 B
E2 66320 DATA $168,168,168,168,40$ $, 40,40,40,40,40,40,40,2$ 6B，16日，16B，16日，16日，16日， $16 \theta, 169,49,4 \theta^{\circ}, 49,40,4 \%$ ， 40，40，4\％，16日，168，16日
9560330 DATA $168,168,168,168,16$
日曰，29日，208，20日，208，20B， 298，208，208，日0， $89,86,89$ ， 8 ， 89,8 ， $89,268,208$
9860346 DATA 208，20日，208，20B，20 B，208， $89,80,80,89,89,89$ ， 8 ， $80,208,290,298,208$ ， $208,208,208,208,80,80,8$ $6,86,86,8 \varnothing, 86,80,26 \theta$
D4 60350 DATA 208，208，208，208，20 $8,268,268,32,36,46,44,4$ B，52， $56,66,32,36,46,44$ ， $48,52,56,60,33,37,41,45$ ，49，53，57，61
67 60360 DATA 33，37，41，45，49，53， $57,61,34,38,42,46,50,54$ $, 58,62,34,38,42,46,50,5$ $4,58,62,35,39,43,47,51$ ，

```
    55,59
27 60370 DATA 63,35,39,43,47,51,
    55,59,63,32,36,40,44,48
    ,52,56,60, 32, 36,40,44,4
    6,52,56,60,33,37,41,45,
    49,53
17 6038% DATA 57,61,33,37,41,45,
    49,53,57,61,34,38,42,46
    ,56,54,5日, 62, 34, 38, 42,4
    6,50,54,5B,62,35, 39,43,
    47,51
64 68396 DATA 55,59,63,35,39,43,
    47,51, 55,59, 63, 32, 36, 40
    ,44,4日,52, 56, 60, 32, 36,4
    6,44,4日, 52,56,6%,33,37,
    41,45
7160406 DATA 49,53,57,61,33,37,
    41,45,49,53,57,61,34,39
    ,42,46,50,54,58,62,34,3
    日,42,46,51,54,5日,62,35,
    39,43
C3 60410 DATA 47,51,55,59,63,35,
    35,43,47,51,55,59,63,16
    0,237,160,5,306
FE 62997 REM
6E 6299B REM ERROR HANDLER
IF 62999 REM
D4 630.0 E1 = PEEK (222):E2 = PE
    EK (218) + PEEK (219) :
        256
70 63010 IF E1 = 255 THEN 1000
1463ø20 IF EL = 4 THEN ER$ = ''D
    ISK WRITE PROTECTED" +
    CHR( (13) + CHR悉 (13) +
        "PLEABE REMOVE WRITE P
    ROTECT STICKER": BOTO 6
    390g
96 63@30 IF E1 = 8 THEN ER* = "D
    ISK I/D ERROR" + CHR* (
    13) + CHR* (13) + "PLEA
    SE TRY ANOTHER DISK": G
    OTO 639@E
15 63640 IF EI = 9 THEN ER* = "D
    ISK FLLL" + CHR* (13) +
        CHR* (13) + "PLEASE TR
    Y ANOTHER DISK": GOTO 6
    390%
FA 63050 IF E1 = 10 THEN ER$ = "
    FILE LOCKED" + CHR象 (13
    ) + CHR( (13) + "PLEASE
        TRY ANOTHER FILE": GOT
    0 6399B
6963060 IFE1 = 13 THEN ER$ = "
    FILE IS NDT A BINARY FI
    LE" + CHR$ (13) + CHR*
    (13) + "PLEASE TRY ANDT
    HER FILE": GOTO 6390%
57 63070 IFE1 = 6 OR (E1 = 7 AN
    D PEEK (48B96) = 76) TH
    EN ERS - "FILE NOT FOUN
    D" + CHR悉 (13) + CHR悉 (
    13) + "PLEASE TRY ANOTH
    ER FILE": GOTO 6390%
AE 630B8 IF E1 = 11 OR (E1 = 16
    AND PEEK (48896) = 76)
    THEN ER* = "DO9 9YNTAX
    ERROR" + CHR( (13) + CH
    R$ (13) + "PLEASE TRY A
    GAIN": GOTO 6J99%
A3 63499 TEXT : HOME : PRINT "ER
    ROR ND. ";E1:" AT LINE
    ND. ";E2: END
EC 6396% TEXT : HOME : PRINT ER*
    G GOSUB 1000巳: BOTO 100
```

＂Autoload＂simplifies the use of the RAMdisk by automatically copying as many as ten BASIC programs to the 130XE＇s RAMdisk when you boot the computer．That task has been accomplished before，but this program does it with only seven
lines of code．You can watch the program at work，and it also offers an instructive and unusual demon－ stration of Atari＇s forced read mode．

In order to squeeze the pro－ gram into only eight lines，we＇ll be pushing to the limit Atari＇s 120－ character restriction on the length of a logical line．Before you start to enter the program，type POKE 82,0 and press RETURN to get wider－ than－normal screen margins．Note， too，that the listing includes several abbreviations．The abbreviations are present to save crucial space，so type each line exactly as it＇s listed， including the abbreviations．

Line 12 of Autoload contains a list of the programs you want to copy to the RAMdisk at boot time． The names in the listing are merely examples；replace them with file－ names of your own．Every name must be exactly 12 characters long， so add blank spaces as needed to the end of any shorter filenames－ except for the very last name， which doesn＇t require extra spaces． Other than in line 12，you should not type extra spaces anywhere in the program．

When you are finished typing in Autoload，be sure to save a copy


Author Rubenking's goals are straightforward: to have fun with computers and get paid for it. So far he is batting 1000. Along with his technical support pesition he also edits a column in PC Magazine tilled 'Turbo Power User". His PIANOMAN and NAMEGRAM programs evalved while he was teaching himself Turbo Pascal programming. Finding basic computer tunes "offensive" his PIANOMAN used his musical background as a source to create music on a PC (within the limits of its $2^{\prime \prime}$ speaker).
PIANOMAN allows you to:
Play your PC keyboard as if it were a piano. Save and edit your tunes, Compile your tunes to a selfrunning program \& another option furns your tune into a macro for Superkey.

NAMEGRAM is wild, wacky and is a must for anagram (the ability to make a word or phrase from another word or phrase) freaks. After experimenting with algorithms, author Rubenking came up with a program that would handle any size of input and any size of dictionary.

[^7]before you run it. This is important because the program erases itself when it runs. Save the program with the filename AUTOLOAD. You should save the program on a boot disk-one that you use to start the computer. If you use more than one boot disk, you should save a copy of Autoload on all boot disks for which you wish to use the autoloading feature. To set up the RAMdisk, your working boot disks must also have a copy of the RAMDISK.COM file from the DOS 2.5 master disk.

Now, remove your working boot disk and place a copy of the DOS master disk in the drive. Type DOS and press RETURN to bring up the DOS command menu; then use option $L$ to call up the SETUP.COM utility from the DOS disk. Remove the master disk from the drive and replace it with the boot disk containing Autoload. Follow the prompts of SETUP.COM to create an AUTORUN.SYS file that points to the AUTOLOAD program. Finally, copy to the same disk the programs you wish to load into the RAMdisk when the computer boots. At this stage, the program is ready to use. Whenever you start the computer with this boot disk in the drive, Autoload will automatically be executed to transfer the specified programs into the RAMdisk.

## How It Works

Autoload works in an interesting way. The program itself actually runs, in the technical sense, only for a fraction of a second: It merely writes some instructions to the screen and erases itself. The instructions form a sequence of commands which are, in effect, carried out in direct mode, just as if an invisible hand were pressing RETURN over each line. Atari literature calls this technique forced read mode; it is also called the dynamic keyboard technique on other systems.

In a sense, this set of commands on the screen is a miniature program. Each command is performed in order, just as in an ordinary BASIC program. However, the command lines don't begin with line numbers. You also can branch around in a program of this typenot with GOTO, but with a POSITION command which places the cursor over the command you want
to execute next.
This series of instructions contains LOAD commands, each of which performs a NEW. But since NEW doesn't erase the screen, our set of instructions can be performed in its entirety. Variables are erased after each LOAD, however, so it is necessary to redefine them after each program loads. When all files have been copied into the RAMdisk, the screen clears and execution stops. If desired, you can automatically run the last program in the chain. Simply add the characters :RUN before the quotation mark in line 4 and make sure that the program you want to run is the last one listed in line 12.

## Autoload

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

MO 1 REM COPYRIBHT 1987 COMP UTE! PUBLICATIONS, INC. \{3 SPACES\}ALL RIGHTS RE SERVED.
पC 2 POKE 82, : GRAPHICS $\emptyset$
KD 4 POSITION 6, 2:? "POKETS2 , 1: $9=4684$ : IFPEEK (S) -0 THEN POKE 842,12:BR.6"
AA 6 POSITION $0,6: ?$ "POS., 2 $1: J=48448$ z FOR $I=40568 \mathrm{~T}$ 0 40579:POKEI. PEEK(S):P DKE J, PEEK(S):J=J+1: PCH R*(254): NEXT I:POS. 0. 9 "
BC P POSITION $0,11: ? ~ " L O A D " ;$ CHRE(34);"D1:":POSITION פ, 14:? GAVE"; CHR (34) 3DE: ": PQEITION 0,17
FD 10 ? "POSITIUN $\quad$, 0 ":POSIT IDN 6, 21
6H 12 ? "FLQORWAX\{4 GPACES\}L ONGNAME. EXTPROES.BAS〔3 SPACES\}MENU"
PN 14 POSITION 0, : POKE B42, 13

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# Smooth-Scrolling Billboard For Commodore 64 

Paul W. Carison


#### Abstract

This program turns your Commodore 64 into an electronic billboard, smoothly scrolling large, multicolored messages across the screen.


Would you like to be able to glide a message across the Commodore 64's screen in giant, multicolored letters? The program with this article makes it easy. Or perhaps you're a machine language programmer interested in smoothscrolling techniques. This article explains how it's done.

## Jumbo Billboard

To see smooth scrolling in action, type in, save, and run the program. The program takes a few seconds to read the machine language in the DATA statements and then asks if you want multicolored letters. Respond by pressing $Y$ (yes) or $N$ (no); do not press RETURN. The upper part of the screen fills with arrow symbols, with the cursor positioned over the first arrow symbol. Starting at the cursor, type in the text that you want to scroll across the screen. Your text will replace the arrow symbols as you type. Any nongraphics characters can be used (although lowercase letters will scroll as uppercase). You can make changes to your text by overtyping the unwanted letters or by using the DEL key.

Press RETURN when you have
entered the entire message. The program reads all of the text up to the first arrow symbol. If the program doesn't find an arrow symbol, it uses the first 250 characters (including blanks) of the message. After you press RETURN, the billboard immediately starts to scroll. The message continues to scroll with two spaces separating the end of the text from the beginning. If you want more separation, add extra spaces at the end of your text. To stop the program, press any key while the text is scrolling.

## Changing Colors

You can easily modify the program to display colors of your own choosing. The numbers in lines $70-90$ can be changed to any legal color number ( $0-15$ ). When multicolor letters are in use, the program uses the color numbers in lines $160-230$ instead of the foreground color in line 80 . The color numbers in lines $160-230$ can also be changed to any legal color number. This allows you to match the colors to the content of your message. For example, the letters in a patriotic message might have alternating red and white stripes against a blue background.

If you simply want to use the program, you needn't read any further. The remainder of this article discusses techniques which machine language programmers may find interesting.

## Text Input

In order to work, this program must pass a long string-the text of your message-to a machine language subroutine. You may wonder why a simple INPUT statement isn't used to enter the message. After all, that's what INPUT is designed to do. There are two reasons why it isn't used. First, certain characters that you might want to use in your text, such as quotation marks, colons, and commas, can cause problems with INPUT. Second, INPUT can only handle strings up to 80 characters in length, but you might want to display a longer message.

The same limitations apply to the INPUT\# statement. In fact, the program takes advantage of the way that INPUT\# responds to a colon as input. The INPUT\# statement in line 280 halts the program, reads data from the keyboard buffer, and continues execution when you press RETURN. Before we execute that INPUT\#, however, the program manipulates the keyboard buffer to prevent INPUT\# from processing the text that you type. Line 240 POKEs four values into the keyboard buffer, where they will be found by the INPUT\# in line 280. The four values are the ASCII codes for a colon, left cursor, arrow symbol, and left cursor. The colon, because it is a delimiter, causes INPUT\# to disregard anything that follows. This allows you to type anything you want without
causing an error message. When INPUT\# is executed, anything in the keyboard buffer is displayed. The left cursor, arrow symbol, and left cursor are placed in the keyboard buffer to restore the screen by overwriting the colon with an arrow symbol and moving the cursor back to the first screen location.

## Smooth Scrolling

As you can see by looking carefully, the large letters move horizontally one pixel (screen dot) at a time, making for very smooth movement. The 64's VIC (Video Interface Controller) chip can instantly position the screen at any one of eight pixel positions. This, combined with the VIC's ability to instantly change the location screen memory, allows you to scroll shapes one pixel at a time. For machine language programmers, here are the steps this programs uses for smooth scrolling:

1. Set aside two 1000 -byte memory areas for screen data. One of these can be the normal screen memory area, which starts at location 1024 (\$0400). Next, set up pointers in zero-page memory to the two screen memory locations. We'll refer to these locations as SRCE and DEST (for source and destination). In this program, the two screen memory locations are 1024 (\$0400) and 15360 ( $\$ 3 C 00$ ). It makes no difference which location is initially SRCE or DEST.
2. Clear both screens and fill color memory at locations 55296-56295 (\$D800-\$DFE7). The four highorder bits of location 53272 (\$D018) control which screen is active. Make DEST the active screen. Set the screen size to 38 columns by clearing bit three of location 53270 (\$D016). Set the scroll position to seven by setting the three low-order bits of 53270 (\$D016).
3. Swap the pointers to SRCE and DEST and copy columns 1-39 of the SRCE screen to columns $0-38$ of the DEST screen.
4. Fill column 39 of the DEST screen with new data.
5. Using a time delay, decrement 53270 (\$D016) until the three loworder bits are zero. The time delay is approximately equal to the execution time of steps 3 and 4 to
prevent jerking.
6. Wait until location 53266 (\$D012) equals zero (indicating raster line zero), and then make the inactive screen the active screen and immediately set the scroll position to seven. Go to step 3.

Steps 3 and 4 are performed only on screen rows 9-17 in this program, since these are the only rows that change. In many programs that use smooth scrolling, the time delay between each decrement of 53270 (\$D016) in step 5 would be replaced with routines that move sprites, check for collisions, and so on. When this is the case, a time delay loop will usually be needed at the end of step 4 to make the execution time of steps 3 and 4 equal the execution time between decrements of 53270 (\$D016).

Smooth scrolling is not as difficult as you may think. The VIC chip does much of your work for you. This article has described only horizontal smooth scrolling, but that's the most difficult direction to scroll. Vertical smooth scrolling is much easier. If you've never tried smooth scrolling, I hope that this article will encourage you to do so. You can find more information about scrolling in Programming the 64 by Raeto West, and Mapping the 64 and 64C by Sheldon Leemon; both books are available from COMPUTE! Books.

## Smooth-Scrolling Billboard

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

PG 5 REM COPYRIGHT 1987 COMPUT E! PUBLICATIONS, INC (3 SPACES)ALL RIGHTS RESE RVED.
RS 16 POKE55,255: POKE56,59:CLR : POKE53272, (PEEK(53272)A ND15)OR16
RX 11 PRINT"\{CLR\}"
RS 12 PRINTTAB(12): "COPYRIGHT [SPACE]1987": PRINTTAB(6) : "COMPUTEI PUBLICATIONS, INC.
JK 14 PRINTTAB(16):"ALL RIGHTS RESERVED."
PF 15 FOR $\mathrm{X}=1$ TO1206: NEXT
KH 26 PRINTCHRS(147);"READING (SPACE]MACHINE CODE...": PRINT
BR $30 \mathrm{~T}=\emptyset:$ FORN=49152TO49640:RE ADK : POKEN, $\mathrm{K}: \mathrm{T}=\mathrm{T}+\mathrm{K}:$ : NEXT
FF 40 IFT=72434THEN70
XA 50 PRINT"***ERROR IN DATA $S$ TATEMENTS***": END
RX 60 REM ** SCREEN COLORS ** XK $70 \mathrm{BG}=\varnothing$ : REM BACKGROUND CR 80 FG=15:REM FOREGROUND JF 90 BR=ø : REM BORDER

KC 100 PRINT"MULTI-COLOR LETTE RS (Y/N)? ";
MP 110 GETAS:IFAS=""THEN110
BM 120 PRINTA\$:IF AS<<"Y"ANDAS <>"N"THEN100
BK 130 IF AS="N"THENPOKE49649, 0: GOTO240
DM 140 POKE49649,1
EP 150 REM ** MULTI-COLOR LETT ER COLORS **
MF 160 POKE4964B, 4 :REM TOP
OJ 170 POKE49647,2 :REM 2ND
GF 186 POKE49646.8 :REM 3RD
HR 190 POKE49645,7 :REM 4TH
XJ 200 POKE49644,3 :REM 5TH
SR 210 POKE49643,5 :REM 6TH
SD 220 POKE49642,6 :REM 7TH
XS 236 POKE49641,14:REM 8TH
EK 248 POKE198,4:POKE631,58:PO KE632,157: POKE633, 95 : PO KE634,157
BF 250 PRINTCHR (147): $\mathrm{FORN}=1 \mathrm{TO}$ 12:PRINT: NEXT
EA 260 PRINT" ${ }^{2}$ SPACES $\}$ ENTER T EXT AT CURSOR - press [ RETURN][3 SPACES]WHEN F INISHED.": CHRS(19);
QC 270 FORN=ØTO250:PRINTCHRS(9 5): : NEXT: PRINTCHRS (19):

BG 280 OPEN1, $9: I N P U T$ 1,AS
CD 290 POKE53280, BR: POKE53281, BG: POKE49261, FG
XH 360 SYS49152
BH 310 POKE53280.14:POKE53281, 6:PRINTCHR\$(147);CHR\$(1 54):

ER 320 POKE55,0:POKE56,160:CLR : END
JG 330 DATA 173,14,220,41,254, 141,14,220
DK 340 DATA $165,1,41,251,133,1$ -169.0
HC 350 DATA $133,251,133,253,16$ 9,208,133,252
RD 360 DATA $169,196,133,254,16$ 2,2,160,0
XQ $37 \varnothing$ DATA $177,251,145,253,2 \varnothing$ 0,208,249,230
CG 380 DATA 252,230,254,202,26 8,240,165,1
SS 390 DATA 9,4,133,1,173,14,2 20,9
EM 400 DATA 1,141,14,220,162,0 , 160.0
QR 410 DATA $189,0,4,201,31,240$ ,11,153
BS 42® DATA 0,198,232,224,250, 240, 3, 260
KE 430 DATA 298,238,169,32,153 - $0,198,200$

HB 446 DATA $153,0,198,200,169$, 0,153.8
KF 450 DATA $198,173,241,193,20$ 8,24,133,253
BO 460 DATA $169,216,133,254,16$ 9,14,162,4
BG 470 DATA $160,0,145,253,200$. 208,251,238
JK 48ø DATA 254,202,208,246,24 6,38,169,164
MP 490 DATA $133,253,169,217,13$ 3,254,162,8
JJ 500 DATA 160,8,189,232,193, 145,253,286
RX 510 DATA $192,49,208,246,165$ ,253,24,105
MA 526 DATA $40,133,253,165,254$ ,165,0,133
CG 530 DATA $254,202,208,228,16$ 9,4,133,252
BA 540 DATA $169,69,133,254,169$ .0,133,251
CM 550 DATA $133,253,162,4,160$,

54 0,169,32
SH 560 DATA $145,251,145,253,20$ $0,208,249,230$
SK 570 DATA 252,230,254,202,20 8,242,173,22
HM 580 DATA 208,41,247,141,22, 208,169,0
BH 596 DATA 141,250,193,172,25 $0,193,238,250$
CD 600 DATA 193,185,0,198,240, 242,133,251
PR 610 DATA $169,0,133,252,6,25$ 1,38,252
EX 620 DATA 6,251,3B,252,6,251 , 38, 252
DA 630 DATA $169,196,24,101,252$ , 133, 252,160
PF 640 DATA $0,177,251,153,242$, 193,200,192
DJ 650 DATA $8,208,246,32,228,2$ 55,281,0
HA 660 DATA $240,27,173,22,208$, 9, B, 141
SA 676 DATA 22,208,173,24,298, 41,15,9
KM 680 DATA 16, 141, 24, 208,173, 22,208,41
FE 690 DATA 24B,141,22,208,96, 169,61,133
HA $76 \emptyset$ DATA $252,169,5,133,254$, 169, 0, 141
DB 710 DATA $251,193,165,252,16$ 4, 254, 133, 254
QQ 720 DATA $132,252,169,104,13$ 3,251,133,253
FC 730 DATA $162,8,160,39,177,2$ 51, 136, 145
KG 740 DATA $253,192,0,208,247$, 202,240, 28
EG 750 DATA $165,251,24,165,40$, 133,251,165
FH 760 DATA 252,165,0,133,252, 165,253,24
XX 770 DATA $105,40,133,253,165$ , 254, 105,0
DH 780 DATA $133,254,208,214,19$ 8,254,169,143
MD 796 DATA $133,253,162,0,160$, 6, 30, 242
XP 800 DATA $193,144,4,169,160$, 2日8, 2, 169
RQ 810 DATA $32,145,253,232,165$ , 253, 24, 105
JR 820 DATA $40,133,253,165,254$ , 105, 0, 133
CK 830 DATA 254,224,8,208,225. 173,22,208
RP 840 DATA 9,7,141,22,208,162 . 0.160
AB 850 DATA 6,202,208,253,136. 208,250,206
RB 860 DATA $22,208,173,22,208$, 41, 7, 208
ED 870 DATA $236,198,252,198,25$ 4,173,24,208
HS 880 DATA 41,15,166,254,224, 61,20B, 4
PQ 890 DATA $9,240,208,2,9,16,1$ 62.0

EF 900 DATA $236,18,208,208,251$ .141,24,208
KH 910 DATA $173,22,208,9,7,141$ , 22,208
DF 920 DATA 174, 251, 193,232,22 4,8,240,6
HM 930 DATA $142,251,193,76,50$. 193,76,211
8H 940 DATA 192

# Vanishing Directory 

Paul W. Carlson

This handy utility for the IBM PC/ PCjr and compatibles allows you to display all the files in your current directory without losing the information displayed on the screen. It works with both monochrome and color displays.

The DIR command is used perhaps more often than any other DOS command. Quite often, however, DIR causes valuable information to scroll off the screen. It can help somewhat to use the /W switch with DIR, since that option lists files in wide screen format, without indicating the number of bytes or date of a file. However, this format usually overwrites some information, too, and it can be harder to read than the normal DIR display.
"Vanishing Directory" can display all the normal files (not hidden or system files) on a floppy disk or in the current directory of a hard disk. What makes this program so useful is that it literally vanishes when it's no longer needed, leaving the screen as it appeared before you summoned the program. (You may lose the top line of the screen if you invoke the program when the cursor is on the very bottom screen line.)

The program listed in this article is a BASIC filemaker. Type in the program and save a copy, then run it. The program uses an internal checksum to check for typing errors. If no errors are found, it cre-
ates an executable machine language file named VDIR.COM. (Because the BASIC program creates a file named VDIR.COM, you must not use that name for the BASIC program itself.)

VDIR.COM is very easy to use. At the DOS prompt, simply type VDIR and press Enter. The program clears the screen and displays a directory similar to that shown by DIR/W. Filenames are separated with double vertical bars for easier reading. If there are more than 100 files on the disk, the display pauses after the first 100 files are listed, waiting until you press a key. After all the files are listed, you can press any key to restore the previous screen instantly.

The program always displays the contents of the current disk and does not allow an opportunity for swapping disks. If you have two floppy disk drives, put VDIR.COM on your working copy of the system disk. To display the contents of another disk, place the disk containing VDIR.COM in the inactive drive and place the disk you want to examine in the active drive. Then invoke VDIR.COM, preceding the command with the inactive drive's designation. For instance, if the drive $A$ : is the active drive, place the disk containing VDIR.COM in drive $B$ : and enter the command B:VDIR.COM.

If you have a single drive, put VDIR.COM on any disk where you


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might want to use it．Fortunately， VDIR．COM is a small program and does not take up much disk space．

Hard disk users should put a copy of VDIR．COM in the same directory that contains other DOS commands that load from disk （such as FORMAT）or in any direc－ tory included in the DOS search path．If you want a display of the files in some other directory，use a CHDIR or CD command to change directories before invoking VDIR．COM．

## VDIR．COM Fliemaker

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

II 100 ，VDIR．COM filemaker
88 110
FE 126 ，Copyright 1987 COMPUTE！ Publicatione，Inc．
FH 130 ．All rights reserved．
IN 140 CLS\＆PRINT＂COPYRIGHT 1987＂ ：PRINT＂COMPUTE！PUBLICATI DNS，INC．＂：PRINT＂ALL RIGH TS RESERVED．＂\＆FOR $X=1$ TO 1506：NEXT X
4 145 ．
MC 150 CLOSE：OPEN＂VDIR．COM＂FOR DUTPUT AS 1
KH 160 PRINTW1，CHR（\＆HE9）；CHR \＆（\＆ HSE）；CHR（\＆H11）；
OD 170 FOR $N=1$ TO 4327：PRINT筆1，$C$ HR（ 0 ）；B NEXT
FJ 1日ø T＝9：FOR $J=1$ TO 579：READ $A$ ＊$N=$ VAL（＂\＆H＂＋As）
 XT：CLOSE 1
FI 206 IF T＝55374！THEN PRINT＂VD IR．COM succesesfully creat ed＂ 2 END
时 216 KILL＂VDIR．COM＂：PRINT CHR （7）；＂Typing error．Check DATA statements＂
PC 220 DATA $65,66,00,6 \varnothing, 2 A, 2 E, 2 A$ ，60，43，75
KC 230 DATA 72，72，65， $6 E, 74,29,64$ ，69，72，65
KK 240 DATA 63，74，6F，72，79，20，69 ，73，20，20
O） 250 DATA $3 F, 3 A, 5 C, 24,44,69,73$ ，6B，20， 61
CA 265 DATA $63,63,65,73,73,26,65$ ，72，72，6F
FG 270 DATA $72,0 A, 0 D, 24,6 A, 0 D, 58$ ，72，65，73
EC 280 DATA 73，29，61，6E，79，26，6B ，65，79，26
KI 290 DATA 74，6F，26，63，6F， $6 E, 74$ ，69，6E，75
JH 3 D® DATA $65,20,6 C, 69,73,74,69$ ，6E，67，2E
DK 310 DATA 2E，2E，24，6A， $2 A, 0 D, 50$ ，72，65，73
DH 326 DATA $73,26,61,6 E, 79,20,68$ ，65，79，20
FO 330 DATA $74,6 F, 20,72,65,73,74$ ，6F，72，65
 ，72，65，65
LN 350 DATA $6 E, 2 E, 2 E, 2 E, 24, B 4,0 F$ ，$C D, 16, A 2$
PO 360 DATA A3，10， $8 B, 3 E, A G, 10, C 7$ ，66，A7， 16
OC 370 DATA BA， $03, C 7,66, A 4,10,0 \square$ ，BD，AB， 84

EP 380 DATA 75， $6 C, C 7,86, A 4,18,00$ ，B8，C7， 66
QN 390 DATA A7，19，DA，63，B4，63，8A ， $3 E, A B, 10$
06406 DATA CD，16，88，2E，AA，19， 89 ， $8 \mathrm{E}, \mathrm{AB}, 1 \mathrm{E}$
CH 410 DATA 8B，36，A9，16，B9，A6，BF ，1E， $\operatorname{DE}, 57$
is 420 DATA $8 B, 16, A 7,10,8 D, 3 E, 63$ ， $61, A 1, A 4$
OI 430 DATA $10,8 E, D B, B E, ~ O \sigma, ~ G \varnothing, E C$ ，AB， 01,75
HM 446 DATA FB，EC，AB，61，74，FB， $8 A$ ，24，26， 88
MO 450 DATA 25，46，47，E2，ED， $1 F, \mathrm{CB}$ ， $66, A C, 19$
IK 460 DATA 6®，BE，00，06，B7，67，33 ，C9，BA，4F
CI 470 DATA 18，CD，16，B8， $60,62,33$ ，DB，33， 12
WF 48® DATA CD，10，BG， $6 \sigma, \varnothing 0, A \varnothing, A 3$ ，10，3C， 67
CG 496 DATA 74，62， $86,02, C D, 15, C 6$ ， $06, A D, 16$
LH 506 DATA $0 \oplus, F 6,06, A C, 10,01,75$ ，36，B4， 19
OL 510 DATA CD，21，04，41，8D，36，F2 ，11，日3，C6
NK 520 DATA $16,88,04,84,47,80,36$ ， $\mathrm{AE}, 11, \mathrm{B2}$
HM 530 DATA 68，CD，21，ED，36，AE， 11 ， 1 A， 84,46
昛 540 DATA 3C， 0 ， $75, F 9,4 E, B 0,0 A$ ，88， 64,46
CM 559 DATA $88,04, B 6,9 D, 46,88,64$ ，46，B4， 24
OL 566 DATA E日， $04, B 4,69,8 D, 16, F 2$ ，11，CD， 21
OK 570 DATA BD，16，AE，11，CD，21，F6 ， $66, A C, 15$
CA 580 DATA $01,75,48,8 \mathrm{D}, 16, A E, 16$ ，B4，1A，CD
ER 59ø DATA 21，C6， $06, A C, 10,01, B 4$ ，4E，日D， 16
PI $\angle 00$ DATA EE，11，B9，01，00，CD， 21 ，72，5\％，FE
MM $61 \varnothing$ DATA $06, A D, 10, B 9,11,06,8 D$ ，1E，AE， 18
HK 629 DATA $83, C 3,1 E, 49,8 A, 17,89$ ，FA，DE， 74
PF 630 DATA 67，B4，©2，CD，21，43，EB ，F1，B4， 92
6C 64ø DATA 83，F9，02，75，64，日2，BA ，EB，02，B2
K1 650 DATA 26，CD，21，E2，F1，B0，3E ，AD，16，64
IH 660 DATA 75, ， $6, ~ 日 D, 16,20,12, B 4$ ，89，CD， 21
EK 670 DATA B4， $67, C D, 21, E 9,28, F F$ ，BD，16，EE
HH 680 DATA $11, B 4,4 F, C D, 21,72,8 A$ ，EB，BO，BD
EF 690 DATA 16，日C，12，B4， $99, C D, 21$ ，80，16，47
IH 709 DATA 12，B4，69，CD，21，B4， 67 ，CD，21，B4
11716 DATA $00, A 0, A 3,10, C D, 10, B 4$ ， 15 ，AO，A6
KO 720 DATA $10, C D, 10, B 9, A \varnothing$, ©F， $8 D$ ，36，63， 61
BH 730 DATA $A 1, A 4,10,8 B, 16, A 7,10$ ，1E，$\sigma E, 1 F$
DH 746 DATA BE，C®，BF， $06,06, E C, A B$ ， $01,75, F B$
ND 750 DATA EC，$A B, 61,74, F B, 8 A, 24$ ，26，88， 25
EP 760 DATA $46,47, E 2, E D, 1 F, B 4,61$ ，$B A, 2 E, A A$
FK 770 DATA $10, \boxminus A, G E, A B, 10, C D, 10$ ，B4， $02,8 A$
JF 780 DATA $3 E, A 6,10,8 A, 36, A 9,10$ ， $80, F E, 8 D$
6H 796 DATA $74,02, F E, C E, B 2,06, C D$ ，10，C3

# Relative Files On The 1571 Disk Drive 

Myron Achtman

This article demonstrates reliable methods for using relative files. A Commodore 128 and 1571 disk drive are required.

What is a relative file? A file, as you may know, is simply a collection of information stored on disk. A relative file differs from other files in that you can access any part of the file instantly, without having to read through other items of information first. Relative files have been considered a mystery by many Commodore 64 owners, because they are cumbersome to manipulate in BASIC 2.0.

The introduction of the Commodore 128 and 1571 disk drive changed this situation dramatically. BASIC 7.0 contains several commands for handling relative files, and the Commodore 1571 Disk Drive User's Guide contains an entire chapter devoted to explaining them.

This is not a general tutorial on using relative files on the 1571. That information can be found in Chapter 6 of the User's Guide. Instead, this article demonstrates several factors that affect the reliability of relative file handling on the 1541
and 1571 drives, including a bug in the 1571 DOS (Disk Operating System).

## Beginning The Test

Before typing in the program, format a new, blank disk for use. It is important that you use a new disk for this demonstration because the bug in 1571 DOS can corrupt all the files on a disk.

Type in and save the program on disk (but not on the new one which you just formatted). Insert the newly formatted disk in the drive and run the program.

When questions appear on the screen, answer them as follows. (We'll begin conservatively.) First, request that the 128 operate in SLOW mode (enter S). Second, request that the disk drive operate as a 1541 drive (enter 41). Third, indicate that you want the program to check the disk drive error channel (enter ON). The error check also includes a slight time delay, which is explained below. Next, indicate that you want to create a total of 15 records (enter 15). Finally, indicate that you want to position the record pointer to the last record in the file (enter $Y$ ).

As the program runs, it displays the number of each record that it writes. When it prompts you to press a key, the program is ready to read back the file that it just created. Notice that each record consists of five items, or fields; each field is a different length. When all records have been read, the program displays the disk directory. As you can see, the name of the newly created file ( $\mathrm{R}-\mathrm{S}-41-\mathrm{ON}-\mathrm{Y}-15$ ) is descriptive, showing the options you selected when creating the file. The $S$ in the filename stands for SLOW, and so forth. You will not need this file again, so you may enter $Y$ for yes when the program asks whether to scratch this file.

## FAST Mode

So far, everything worked perfectly. The program created and read back the file with complete accuracy. Now let's try some different options. Rerun the program and enter $F$ for FAST mode when prompted. Select 1541 mode as before, but enter OFF when prompted to choose error checking. Choose 15 records as before, but do not position the record pointer to the last record in the file.


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If you are using a 40 -column monitor, your screen will blank while portions of this program run. However, some messages appear from time to time to assure you that everything is proceeding properly. When the program is finished, we see that it worked properly, reading back every record as written. When the drive is in 1541 mode, it doesn't seem to matter whether we use SLOW or FAST mode, whether we use error checking, or whether we position the record pointer at the last record in the file.

## 1571 Mode

Now let's try the test in 1571 mode. Select SLOW mode and 1571 mode, turn on error checking, select 15 records, and select to position the record pointer. At the end of this test, you should see that everything worked properly again.

Rerun the test, selecting FAST mode and 1571 mode. Turn error checking off this time. Choose 15 records, and tell the program not to position the record pointer. After the tenth record is written, you should see the drive light blink, accompanied by sounds of protest from the drive. You will see an ILLEGAL TRACK OR SECTOR error message. (Even though error checking is turned off, the program automatically checks the error status after every tenth record.) The program continues trying to write the remaining five records, and eventually finishes with another error message.

At this point, the disk contains a corrupted relative file. If it had contained other files, the corrupted relative file might have damaged those files, as well.

It is nearly impossible to read a corrupted relative file reliably. When a program tries to do so, several things may happen.

The subroutine in lines $2050-2160$ is designed to detect corrupted records. When this occurs, you will see a flashing message and hear a bell sound. If the data is not too badly corrupted, this routine is called repeatedly, each time it encounters a garbled record.

If the data is more seriously corrupted, the program itself may abort with the error message STRING TOO LONG. If this hap-
pens, press RUN/STOP-RESTORE to recover control, then type DCLOSE:DCLEAR and press RETURN before proceeding further.

In the worst case of corruption, the computer and disk drive will silently lock up, ceasing all activity. If this occurs, follow the same procedure described in the preceding paragraph.

The test shows that it is necessary to check the error channelwith a slight time delay as shown in lines 2010-2020 of the programwhen creating relative files in 1571 mode. To confirm that the corruption does not result from failing to position the record pointer, you can rerun the test if you like, entering $Y$ when asked about the pointer, As long as the error/delay option is turned off, the file is corrupted.

Perhaps, you might think, the errors result because we are in FAST mode? To test this possibility, rerun the program, choosing SLOW mode and 1571 mode, turning the delay/error check option off, choosing 15 records and answering yes to the record pointer question. With these parameters, the relative file usually writes with accuracy, but occasionally aborts with the error message DEVICE NOT PRESENT. Reading the records back is a real problem. It is nearly impossible to read record 15 without a DEVICE NOT PRESENT error. (If this error occurs, press RUN/STOPRESTORE, then type DCLOSE: DCLEAR and press RETURN.)

## Time Delay

Clearly, some errors will occur when writing a relative file in SLOW mode on the 1571 without the time delay and error check used in this program. In 1541 mode, it didn't matter if we turned that option on or off, but it seems essential in 1571 mode.

Let's see whether the time delay is actually doing anything. Modify lines 2010-2020 so they look like this:
2010 REM: T2 $=$ TI +5
2020 REM: IF Tl<T2 THEN 2020
We have disabled the delay (which normally consumes about $1 / 12$ second), but line 2030 still checks the disk drive error channel. Rerun the program, choosing FAST mode and 1571 mode, turning error
checking on, choosing 200 records, and choosing not to position the record pointer (that last option is actually irrelevant). In most tests, you will find 1 or 2 corrupted records for each 100 records that you create. The time delay does seem to have an effect, after all.

As a rule, you can enhance the reliability of relative file handling by checking the error channel, with this slight time delay, upon every file access. If you use the method employed in this program, the time delay will be consistent even if you later compile the program (compiling BASIC programs greatly speeds up their execution). It also is recommended that you follow Commodore's advice in positioning the record pointer both before and after you access a record.

This advice is imperative when using the 1571 drive in 1571 mode. When using it in 1541 mode (or when using an ordinary 1541 drive), you can often get away without the time delay/error check-provided that you access records in numerical sequence (record 1, record 2, and so on). However, if your program writes files in nonnumerical order (for instance, record 1, record 5, and so on), it is necessary to position the record pointer before and after each operation, and to use the time delay/ error check, as well.

## Relative File Test

For instructions on entering this progrom.
please refer to "COMPUTEI's Guide to Typing In Programs" elsewthere in this issue.

JH 1øØØ REM: RELATIVE FILE TES TING PROGRAM FOR THE C -128 COMPUTER AND 1571 DISK DRIVE.
BR 1010 REM: COPYRIGHT 1987 CO MPUTE 1 PUBLICATIONS, I NC. $\{3$ SPACES \}ALL RIGHT S RESERVED.
BA 1011 PRINT"\{CLR\}COPYRIGHT 1 987": PRINT" COMPUTE! PU BLICATIONS, INC."
FX 1012 PRINT"ALL RIGHTS RESER VED."
QX 1613 FORX=1TO1200:NEXT
ES 1020 SLOW: $\operatorname{IFPEEK}(3300)=0 T H E$ N2170
HF 1Ø3Ø CLR:SCNCLR:COLOR5,14:N N\$="\{38 SPACES $\}$ "
AX 1040 CHAR, 0,1 , "ONE MOMENT P LEASE...":SCRATCH"R*": GOSUB2030: COLLECT: GOSU B2030
PQ 1050 CHAR, $0,3, " \mathrm{C}-128$ : SLOW \{SPACE\}MODE OR FAST MO DE": CHAR, 0, 4, "ENTER 'S OR 'F' ': INPUTMO\$


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DC 1060 IFMOSく＞＂S＂ANDMOSくく＂F＂T HENCHAR， 6,4, NNS ：PRINTC HRS（7）：GOTOL650
XC 1670 CHAR，0，6，＂DRIVE： 1541 \｛SPACE\}MODE OR 1571 MO DE＂：CHAR，0，7，＂ENTER＇4 1＇OR＇71＇＂：INPUTDDS
PD 1080 IFDDSく＞＂41＂ANDDDSく＞＂71 ＂THENCHAR， 0,7, NNS：PRIN TCHRS（7）：GOTO1670
QC 1090 CHAR， $0,9, "$ WANT TO CHEC K ERROR CHANNEL＂：CHAR， Ø．10，＂ENTER＇ON＇OR＇O FF＇＂：INPUTCK
PD 1100 IFCK\＄く＞＂ON＂ANDCKSく＞＂OF F＂THENCHAR，0，10，NN\＄：PR INTCHRS（7）：GOTOI69®
XR 1110 CHAR， 0,12, HOW MANY RE CORDS DO YOU WANT＂：CHA R，D，13，＂TO CREATE（10 （SPACE\}TO 999)": INPUTN R\＄：NR＝VAL（NR\＄）
XR 1120 IFNR＜18ORNR＞999THENCHA R，0，13，NNS：PRINTCHRS（7 ）：GOTO1110
KB $113 \emptyset$ CHAR， $0,15, " W A N T$ TO POS ITION POINTER TO＂：CHAR ，0，16．＂LAST RECORD＇Y＇ OR＇N＇＂：INPUTPPS
KM 1140 IFPPS＜＞＂Y＂ANDPP\＄く＞＂N＂T HENCHAR， 0,16, NN§：PRINT CHR（7）：GOTOI130
RA 1150 IFDD $\$=$＂ 41 ＂THENOPEN15，8 ，15，＂UØ＞M0＂：GOSUB2038： CLOSE15
JP 1160 IFDD $\$=$＂ 71 ＂THENOPEN15，8 ，15，＂Uø＞M1＂：GOSUB2б3б： CLOSE15
JE 1170 FTS＝＂R－＂＋MOS＋＂－＂＋DD\＄＋＂ －＂＋CK\＄＋＂－＂+ PP $\$+$＂－＂+NR \＄
MF 1180 IFPPS＝＂N＂THEN1250
CP 1190 PRINT：PRINT＂WAIT－WRI TING POINTER TO REC．＊ ＂＋STRS（NR）＋＂．＂：SLEEP2
FJ 1200 IFMOS $=$＂ $\mathrm{F}^{\prime \prime}$ THENFAST
GQ 1210 DOPEN\＃1，（FT\＄），L1Ø2
CD $122 \varnothing$ RECORD\＃1，（NR），1
XC 1230 IFDS $=50$ THENPRINT＊1，CHR \＄（255）：GOTO1220
DX 1240 GOSUB2030：DCLOSE\＃1
EJ 1250 PT＝ø
JE 1260 SLOW：SCNCLR：PRINT＂CREA TING TEXT FOR THE RELA TIVE FILE．＂：SLEEP2
RC 1276 FORJ＝1TO1D
PA 1280 Fl\＄（J）$=023$ CHARACTER $F$ IELD＊＊＊＊＊＂
DE $1290 \mathrm{~F} 2 \$(\mathrm{~J})=16$ CHARACTER $F$ IE＂
DJ 1300 F3\＄（J）＝＂09 CHARAC＂
BX 1310 F4S（J）＝＂19 CHARACTER F IELD＊＂
GH 1320 F5 $\$(J)=" 29$ CHARACTER $F$ IELD＊＊＊＊＊＊＊＊＊＊＊
BE 1330 NEXT
AD 1340 SLOW：PRINT：PRINT＂WRITI NG ARRAY ITEMS ON DISK ．＂：SLEEP2
KC 1350 IFMOS＝＂F＂THENFAST
RB 1360 DOPEN\＃3，（FT\＄），L1Ø2：GOS UB2030
HJ 1370 FORJ＝1 TOI $\varnothing$
MA 1380 PT $=$ PT $+1:$ PRINTPT；
QH 1390 IFCKS＝＂ON＂THENBEGIN
PK 1400 RECORD\＃3，（PT），1：GOSUB2 010：PRINT\＃3，F1\＄（J）：GOS UB2010：RECORD $\ddagger$ 3，（PT）， 1 ：GOSUB2g10
QF 1410 RECORD＊3，（PT），25：GOSUB 2010：PRINT\＃3，F2\＄（J）：GO


25 ：GOSUB2010
CH 1420 RECORD\＃3，（PT），42：GOSUB 2010：PRINT\＃3，F3\＄（J）：GO SUB2010：RECORD＊3，（PT）， 42 ：GOSUB2ø1ø
CS 1430 RECORD\＃3，（PT），52：GOSUB 2010：PRINT\＃3，F4S（J）：GO SUB2016：RECORD\＃3，（PT）． 52：GOSUB2ø16
RJ 1440 RECORD\＃3，（PT），72；GOSUB 201日：PRINT\＃3，F5\＄（J）：GO SUB2ø10：RECORD\＃3．（PT）， 72：GOSUB2010
CQ 1450 BEND
HQ 1460 IFCK $\$=$＂OFF＂THENBEGIN
CR 1470 RECORD＊3，（PT），1：PRINT\＃ 3，F1\＄（J）：RECORD\＃3，（PT） .1
RR 1480 RECORD\＃3，（PT），25：PRINT \＃3，F2\＄（J）：RECORD＊3，（PT ）． 25
RD 1490 RECORD $13,(\mathrm{PT}), 42:$ PRINT \＃3，F3S（J）：RECORD\＃3，（PT ），42
HK 1500 RECORD\＃3，（PT），52：PRINT \＃3，F4\＄（J）：RECORD\＃3，（PT ）， 52
SQ 1516 RECORD ${ }^{2}$ 3，（PT），72：PRINT \＃3，F5\＄（J）：RECORD\＃3，（PT ）， 72
EA 1520 BEND
XA 1530 IFJ＝16THENPRINT：PRINTD s\＄
BM 1540 IFPT＝NRTHENPRINT：PRINT DSS：GOTOL560
EC 1550 NEXT
AB 1560 DCLOSE\＃3
MA 1578 IFPT＝NRTHENSLOW：PRINT： PRINT＂TOTAL \＃OF RECOR DS WRITTEN＝＂；PT：COLOR5 ，2：PRINT：PRINT＂END OF \｛SPACE\}WRITING PROGRAM ＂：PRINT＂PRESS ANY KEY \｛SPACE\}NOW.": GETKEYKS: GOTOL590
MQ $158 \varnothing$ PRINT：PRINT＂TOTAL \＃OF RECORDS SO FAR＝＂；PT：G OTO1270
SF 1596 SCNCLR：COLOR5，14
XR 1606 PRINT＂READING BACK REC ORDS \＃ 1 TO＂＋STRS（NR）＋ ＂．＂：SLEEP2
MC 1610 IFMOS＝＂F＂THENFAST
GX 1620 DOPEN\＃5，（FT\＄），L102：GOS UB2030
AQ 1630 FORI＝1TONR
QB 1640 CHAR， 23,5, CHRS（158）+CH R\＄（95）＋CHRS（153）＋＂ ［6 SPACES］＂
SG 1650 CHAR， $16,6, \operatorname{CHR}(158)+\mathrm{CH}$ RS（95）＋CHRS（153）＋＂ \｛13 SPACES\}"
MG 1660 CHAR， 9,7, CHRS（158）+ CHR \＄（95）＋CHRS（153）＋＂ （20 SPACES）＂
CC 1670 CHAR， $19,8, \operatorname{CHR} \$(158)+\mathrm{CH}$ RS（95）＋CHRS（153）＋＂ （10 SPACES）${ }^{1}$
RR 1680 CHAR，29，9，CHRS（158）+ CH RS（95）+ CHRS（153）
QX 1690 COLOR5，2：CHAR，0，3，＂REC ORD \＃＂＋STR\＄（I）：COLOR5， 14 ：CHAR， 0,5
MB 1700 IFCK $\$=$＂ON＂THENBEGIN
XM 1716 RECORD\＃5，（I），1：GOSUB2の 10：INPUT\＃5，F1\＄：GOSUB2あ 30：PRINTF1\＄：IFLEN（F1\＄） ＜＞23THENCD＝5：SUS＝F1\＄：G osub2a50
CE 1720 RECORD\＃5，（I），25：GOSUB2 610：INPUT\＃5，F2\＄：GOSUB2

030：PRINTF2\＄：IFLEN（F2\＄ ）＜＜16THENCD＝6：SUS＝F2\＄： GOSUB2050
RC 1730 RECORD\＃5，（I），42：GOSUB2 010：INPUT 15 ，F3\＄：GOSUB2 030：PRINTF3\＄：IFLEN（F3\＄ ）＜＞9THENCD＝7：SUST＝F3S：G OSUB2050
AM 1740 RECORD\＃5，（I），52：GOSUB2日10：INPUT\＃5，F4\＄：GOSUB2 030：PRINTF4S：IFLEN $\langle$ F4\＄ ）＜＞19THENCD＝8：SUS＝F4\＄： GOSUB2050
CR 1750 RECORD\＃5，（I），72：GOSUB2 010：INPUT\＃5，F5\＄：GOSUB2 030：PRINTF5S：IFLEN（F5\＄ ）＜＞29THENCD＝9：SUS＝F5\＄： GOSUB2050
PB 1760 BEND
HJ 1770 IFCK $\$=$＂OFF＂THENBEGIN
CG 1780 RECORD＊5，（I），1：INPUT\＃5 ，F1S：PRINTFIS：IFLEN（F1 \＄）＜＞23THENCD＝5：SUS＝F1\＄ ：GOSUB2g50
GB 1790 RECORD\＃5，（I），25：INPUT\＃ 5，F2\＄：PRINTF2\＄：IFLEN（F 2S）＜＞16THENCD＝6：SUS＝F2 \＄：GOSUB2658
EJ 1800 RECORD ${ }^{2}$ ，（I），42：INPUT\＃ 5，F3\＄：PRINTF3S：IFLEN（F $3 \$)<>9$ THENCD $=7:$ SUS $=$ F3 $\$$ ：GOSUB2050
SX 1810 RECORD＊5，（I），52：INPUT＊ 5，F4S：PRINTF4\＄：IFLEN（F 4S）＜＞19THENCD＝8：SUS＝F4 \＄：GOSUB205ø
AQ 1820 RECORD＊5．（I），72：INPUT＊ 5，F5\＄：PRINTF5\＄：IFLEN（F 5\＄）＜＞29THENCD＝8：SU\＄＝F5 \＄：GOSUB2050
MF 1830 BEND
BA 1840 SLEEP1：IFI＝NRTHEN1910
RQ 1850 CHAR， 0,5, LEFTS（NNS，23）
KP 1860 CHAR， 0,6, LEFTS（NN\＄，16）
PB 1870 CHAR，0，7，LEFT $\$($ NN $\$, 9)$
DD 1880 CHAR， $0,8, \operatorname{LEFT}($（NN $\$, 19)$
QQ 1890 CHAR， 0,9 ，LEFTS（NNS，29）
MK 1900 NEXT
CG 1910 DCLOSE\＃ 5
SM 1920 SLOW：PRINT：PRINT：PRINT ＂TOTAL \＃OF RECORDS RE $A D="$ ；NR：COLOR5， 2 ：PRINT ＂END OF READING PROGRA M．＂
dX 1930 CATALOG：GOSUB203Ø
GR 1940 COLOR5，14：INPUT＂WANT T －SCRATCH RELATIVE FIL E\｛SHIFT－SPACE\}(Y/N)";N $Y \$$
XX 1950 IFNYS＝＂Y＂THENSCRATCH＂R
＊＂：GOSUB2030：COLLECT：G OSUB2630
JK 1960 CATALOG：GOSUB2030
PB 1970 COLOR5， $2:$ PRINT＂PRESS A NY KEY TO RE－RUN PROGR AM．＂：PRINT＂PRESS＇＂＋CH RS（95）＋＂＇TO QUIT PROG RAM．＂
AC 1980 GETKEYK\＄
AR 1990 IFK $\$=$ CHR $\$(95)$ THENEND
EM 2000 GOTOL 1030
HH 2016 T2＝TI＋5
KH 2820 IFTI＜T2THEN2020
DQ 2630 IFDS＜200RDS＝50THENRETU RN
EB 2640 PRINTDS $\$: E N D$
KC 2050 SLOW
HF 2060 CHAR， $0, C D, N N \$$
GK 2070 FORB $=1 T 03$
MP 2080 CHAR， 0, CD，SUS， $1:$ CHAR， 0 ，12，＂CORRDPTED RECORD＂

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## Ice Hockey Simulation From Mindscape

Mindscape has introduced Superstar Ice Hockey, a computer hockey simulation that allows one or two players the chance to compete against the computer or each other, to coach a team, and to manage a league. As a player, you take the ice as center or goalie: fire slapshots, hip-check opponents, make slick passes, and block shots. As the coach, you set up and rotate your players' lines. And as general manager, you trade and draft players, send them to training camp, and aim to build a weak franchise into a contender for the SportTime Cup.

Superstar Ice Hockey is currently available for the Commodore 64 for $\$ 34.95$; IBM PC and Apple II versions are planned.

Mindscape, 3444 Dundee Rd., Northbrook, IL 60062
Circle Reader Service Number 236.

## First Amiga Title From MicroProse

An enhanced version of Silent Service is MicroProse's first title available for the Commodore Amiga.

Silent Service puts the player in command of a World War II submarine in the South Pacific. Enhancements for the new Amiga version take special advantage of the computer's graphics, sound, and animation capabilities. Sunsets, burning ships, oil slicks, and the intricately designed battle station screens are displayed using more than 32 colors. Enemy cruisers, escorts, and aircraft carriers can now be differentiated on the map views, and digitized sound recordings from actual submarine listening devices add to the realism of the simulation. Game controls have been simplified to employ onscreen icons for all function and activity selections. Using these icons, the player can control the submarine with the mouse.

The player-selected and historical scenarios range from single-ship attacks to multipatrol missions with heavily escorted convoys. All of a submarine's critical battle stations are represented, including the conning tower, periscope, engine room, and bridge. Multiple diffi-
culty levels and automatic time scaling are also included as game features.

The new Silent Service version works on all Amiga computers with 512 K of memory. It was designed to be operated with a mouse, although joystick and keyboard controls are also supported. Suggested retail price is \$39.95.

MicroProse Simulation Software, 120 Lakefront Dr., Hunt Valley, MD 21030
Circle Reader Service Number 237.

## Atarl St Version Of True BASIC Released

True BASIC, developers of the True BASIC language system and publishers of TBI Educational Software, has announced that version 2.0 of the True BASIC language is now available for the Atari ST. This version, which was recently released for the IBM PC, offers a high level of graphics support and is significantly faster than ST BASIC, which makes it a language tailored for use with the sophisticated graphics capabilities of the ST. In addition, Version 2.0 offers modules, a programming concept found in languages like Modula-2 and Ada, which can be used within a program to facilitate data sharing between program segments, or can be compiled separately and stored as libraries for use with other programs.

The Atari ST version of True BASIC is available for $\$ 99.95$.

True BASIC, 39 S. Main St., Hanover, NH 03755
Circle Reader Service Number 238.

## Atari And Macintosh Versions Of Springboard Products

Springboard has announced the release of Atari and Macintosh versions of its popular programs, Certificate Maker and Certificate Library Volume 1. Together, these two programs provide the user with more than 300 predesigned certificates, awards, diplomas, and licenses covering everything from academic, business, and athletic achievements to activities involving families and friends. Each certificate can be personalized for a different occasion or
person. The user selects a title or headline, chooses a border to frame it, enters a personalized message, fills in the signature and date line, and prints out the certificate. Certificate Maker provides more than 200 certificates, 24 border choices, and three dozen gold-foil and colorful stickers for a finishing touch.

Certificate Maker and Certificate Library Volume 1 supports most popular dot-matrix printers. Suggested retail price for the Atari and Macintosh versions of Certificate Maker are $\$ 49.95$ and $\$ 59.95$, respectively; both versions of Certificate Library 1 are $\$ 34.95$.

Springboard Software, 7808 Creekridge Cir., Minneapolis, MN 55435 Circle Reader Service Number 239.

## New Simulations From SSI

SSI is now distributing Phantasie III: The Wrath of Nikademus, the final confrontation between a band of adventurers and the dark Lord Nikademus with his army of vile beasts and creatures.

The sequel boasts improved features such as a detailed method of handling wounds that determines location and extent of injuries; more strategy and combat options, such as the ability to move each character to different positions in the party; enhanced graphics with all new character and monster displays; more potent magic spells; and increased playing speed while traveling across the wilderness or into dungeons. Players can also reuse favorite characters from previous Phantasie games.

Phantasie III is a multiple-character role-playing game wherein players assemble a party of up to six adventurers. Players can create a wizard elf, a fighter dwarf, or combine in other ways the eight races and six classes of characters which include humans, elves, dwarves, thieves, warriors, and wizards. The characters use spells and weapons to invade difficult terrain, escape dungeons, destroy demons, and confront and finally destroy the evil power of Nikademus, the Dark Lord. Over 36 types of monsters are fought by players in their quest which takes them through a myriad of dungeons. Suggested retail price is $\$ 39.95$.

SSI has also begun shipping its


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newest Civil War simulation, Rebel Charge at Chickamauga, for the Commodore 64, Apple II, and Atari eight-bit computers. It uses a refined version of the game system used in Gettysburg: The Turning Point. All units are now brigade size and may be broken down into smaller units, then built up. Command Control may be altered by the player(s), and each turn now represents two hours rather than one. The entire battle is recreated in 13 turns. Both strategic and tactical screen displays are available; the larger strategic display shows 40 squares by 20 squares of the battlefield, while the tactical display enables the players to zoom in for a more detailed view. Introductory, intermediate, and advanced versions of the game are included. Both the Union and Confederate sides may be managed by human players, or you can choose the computer as opponent. Suggested retail price is $\$ 49.95$.

Strategic Simulations, 1046 N. Rengstorff Ave., Mountain View, CA 94043
Circle Reader Service Number 240.

## New Text Adventure From Cosmi Software

Cosmi Software has introduced Delta Man, a survival simulation featuring realistic survival simulations and 3-D scrolling graphics.

The scenario: A nuclear holocaust has reduced Chicago to a smoldering, poisonous ruin. Having survived because of your discovery of a high-tech, robotic space suit, you pick through the wreckage to find supplies, weapons, and fuel. You ward off roaming bands of genetic mutants while searching for other surviving humans until you can escape.

Delta Man is available for the Commodore 64 for $\$ 19.95$.

Cosmi, 415 N. Figueroa, Wilmington, CA 90744
Circle Reader Service Number 241.

## Ilgs Clip Art

Clip Art Gallery from Activision offers more than 600 graphic images for the Apple Ilcs. This database of designs can be used with Paintworks Plus and the soon-to-be-released Writer's Choice elite to design invitations, cards, and logos, or to add artwork to any document. There are 24 categories, including business, school, sports, bugs, gadgets, food, symbols, birds, and vehicles. You can redraw parts of the images, change the colors and size, add words, and mix or match images from the different files.

Suggested retail price for Clip Art

## Gallery is $\$ 29.95$.

Activision, 2350 Bayshore Frontage Rd., Mountain View, CA 94043
Circle Reader Service Number 242.

## New Street Sport Game From Epyx

Epyx has announced plans to release Street Sports Baseball, a unique new baseball game for the Commodore 64, Apple II series, and IBM PC and compatibles.

In keeping with the winner-takeall, neighborhood pick-up game approach of the Street Sports line, the game will feature the 52 nd Street Gang-hitters, fielders, and pitchers from which players can choose their team. The rules of the game are the same as those of big-league baseball, but the rules of the street provide a special challenge. Players must run and field around tree stumps and bushes, and contend with trash can lids, spare tires, or flattened cardboard boxes. After you select the members of your team, you assign positions and decide on a batting order. Then you control the pitches, time the swings, and regulate the field action. You can play against a friend or the computer using a splitview screen with perspectives from above and close up, so you can keep an eye on the whole field as well as a specific playing area.

The price of Street Sports Baseball was unavailable at press time.

Epyx, 600 Galveston Dr., P.O. Box 8020, Redwood City, CA 94063
Circle Reader Service Number 243.

## New Civil War Game

Blue Powder Grey Smoke from Gardé is now available for the Commodore 64. This war game uses strategy and tactics to simulate actual Civil War combat along with a zoom-in feature for combat display. All the game mechanics are joystick controlled with onscreen menus.

Blue Powder Grey Smoke is also available for the Apple II series. Retail price for each version is $\$ 49.95$.

Gardé Games of Distinction, 8 Bishop Ln., Madison, CT 06443
Circle Reader Service Number 244.

## EA Buys Batteries Included

Electronic Arts has purchased the assets, inventory, contracts, trademarks and brand names of Batteries Included. All of Batteries Included's operations will be consolidated into the San Mateo offices of Electronic Arts. The EA customer service department will fulfill all requests for upgrades, warranty replacements, product inquiries, and promotional of-
fers from Batteries Included customers.
The Batteries Included name will exist as a separate line of products within EA. Representatives believe the Batteries Included line will benefit from EA's distribution channels and sales program.
Circle Reader Service Number 245.

## Amiga Math Aquarium

Doug's Math Aquarium (DMA) compiles expressions for high-speed display on the Amiga. It uses single-purpose math programs-like the Mandelbrot set-to create artlike fractal images on the screen.
$D M A$ is available for $\$ 79.95$.
Seven Seas Software, 35 Cape George Wye, Port Townsend, WA 98368
Circle Reader Service Number 246.

## New Stickybear Programs

Two new software packages from the Stickybear series are designed to help elementary school kids improve their math and grammar skills. Stickybear Parts of Speech contains four drills to help children ages 8-12 learn the parts of speech-nouns, pronouns, adjectives, verbs, adverbs, conjunctions, prepositions, and interjections. Animated sequences reward users who choose the correct part of speech from sentences and paragraphs. The word lists can be customized by level of difficulty. There's also a print option for printing out tests.

The Stickybear Word Problems disk contains hundreds of different math word problems for children ages 7 and up. It has adjustable levels of difficulty, a print option to print out practice problems, and a report-card option. Colorful screen graphics reward correct answers. And teachers and parents can customize the problems for individualized math instruction.

Both Stickybear Parts of Speech and Word Problems are available for the Apple II series with 48 K and DOS 3.3.

Each software package contains one floppy disk, a Stickybear poster, user's guide, and Stickybear stickers. The suggested retail price for each program is $\$ 39.95$.

Weekly Reader Family Software, 245 Long Hill Rd., Middletown, CT 06457 Circle Reader Service Number 247.
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# COMPUTE''s Author's Guide 

Most of the following suggestions serve to improve the speed and accuracy of publication. COMPUTE! is primarily interested in new and timely articles on the Commodore 64/128, Atari, Apple, IBM PC/PCjr, Amiga, and Atari ST. We are much more concerned with the content of an article than with its style, but articles should be clear and well-explained.

The guidelines below will permit your good ideas and programs to be more easily edited and published:

1. The upper left corner of the first page should contain your name, address, telephone number, and the date of submission.
2. The following information should appear in the upper right corner of the first page: If your article is specifically directed to one make of computer, please state the brand name and, if applicable, the BASIC or ROM or DOS version(s) involved. In addition, please indicate the memory requirements of programs.
3. The underlined title of the article should be placed about $2 / 3$ of the way down the first page.
4. Following pages should be typed normally, except that in the upper right corner there should be an abbreviation of the title, your last name, and the page number-for example: Memory Map/Smith/2.
5. All lines within the text of the article must be double- or triple-spaced. A one-inch margin should be left at the right, left, top, and bottom of each page. No words should be divided at the ends of lines. And please do not right-justify. Leave the lines ragged.
6. Standard typing paper should be used (no erasable, onionskin, or other thin paper), and typing should be on one side of the paper only (upper- and lowercase).
7. If you are submitting more than one article, send each one in a separate mailer with its own tape or disk.
8. Short programs (under 20 lines) can easily be included within the text. Longer programs should be separate listings. It is essential that we have a copy of the program, recorded twice, on a tape or disk. If your article was written with a word processor, we request that you include a copy of the text file on the tape or disk. If you include a copy of your article on disk, please save the article as plain text, without any special formatting characters or control codes. Most word processors provide an option for saving a document as plain ASCII text or in unformatted form. Please use high-quality 10 - or 30 -minute tapes with the program recorded on both sides. The tape or disk should be labeled with your name, the title of the article, and, if applicable, the BASIC/ROM/DOS version(s). Tapes are fairly sturdy, but disks need to be enclosed within
plastic or cardboard mailers (available at photography, stationery, or computer supply stores). If possible, programs written in machine language or a compiled language should include source code (or an annotated disassembly if the program was written with a machine language monitor).
9. A good general rule is to spell out the numbers zero through ten in your article and write higher numbers as numerals (1024). The exceptions to this are: Figure 5, Table 3, TAB(4), and so on. Within ordinary text, however, the zero through ten should appear as words, not numbers. Also, symbols and abbreviations should not be used within text: Use and (not \&), reference (not ref.), through (not thru).
10. For greater clarity, use all capitals when referring to keys (RETURN, TAB, ESC, SHIFT), BASIC words (LIST, RND, GOTO), and three languages (BASIC, APL, PILOT). Headlines and subheads should, however, be initial caps only, and emphasized words are not capitalized. If you wish to emphasize, underline the word; then it will be italicized during typesetting.
11. Articles can be of any length-from a singleline routine to a multiple-issue series. The average article is about four to eight double-spaced, typed pages.
12. We do not consider articles which are submitted simultaneously to other publishers. If you wish to send an article to another magazine for consideration, please do not submit it to us.
13. COMPUTE! pays between $\$ 70$ and $\$ 800$ for published articles. In general, the rate reflects the length and quality of the article. Payment is made upon acceptance. Following submission (to Editorial Department, COMPUTE! Magazine, P.O. Box 5406, Greensboro, NC 27403), it will take from four to eight weeks for us to reply. If your work is accepted, you will be notified by a letter which will include a contract for you to sign and return. Rejected manuscripts are returned to authors who enclose a self-addressed, stamped envelope.
14. If your article is accepted and you have since made improvements to the program, please submit an entirely new tape or disk and a new copy of the article reflecting the update. We cannot easily make revisions to programs and articles. It is necessary that you send the revised version as if it were a new submission entirely, but be sure to indicate that your submission is a revised version by writing Revision on the envelope and the article.
15. COMPUTE! does not accept unsolicited product reviews. If you are interested in serving on our panel of reviewers, contact the Features Editor for details.

# COMPUTEI＇s Guide To Typing In Programs 

Computers are precise－type the pro－ gram exactly as listed，including neces－ sary punctuation and symbols，except for special characters noted below．We have provided a special listing conven－ tion as well as a program to check your typing－＂The Automatic Proofreader．＂

Programs for the IBM，TI－99／4A， and Atari ST models should be typed exactly as listed；no special characters are used．Programs for Commodore， Apple，and Atari $400 / 800 / \mathrm{XL} / \mathrm{XE}$ computers may contain some hard－to－ read special characters，so we have a listing system that indicates these con－ trol characters．You will find these Commodore and Atari characters in curly braces；do not type the braces．For example，\｛CLEAR\} or \{CLR\} instructs you to insert the symbol which clears the screen on the Atari or Commodore machines．A complete list of these sym－ bols is shown in the tables below．For Commodore，Apple，and Atari，a single symbol by itself within curly braces is usually a control key or graphics key．If you see \｛A\}, hold down the CONTROL key and press A．This will produce a reverse video character on the Commo－ dore（in quote mode），a graphics char－ acter on the Atari，and an invisible control character on the Apple．

Graphics characters entered with the Commodore logo key are enclosed in a special bracket：$K A \gg$ ．In this case， you would hold down the Commodore logo key as you type A．Our Commo－ dore listings are in uppercase，so shifted symbols are underlined．A graphics heart symbol（SHIFT－S）would be listed as S．One exception is \｛SHIFT－ SPACE\}. When you see this, hold down SHIFT and press the space bar．If a number precedes a symbol，such as $\{5$ RIGHT\}, $\{6$ S \}, or $\{8 \mathrm{Q}>$ ，you would enter five cursor rights，six shifted S＇s， or eight Commodore－Q＇s．On the Atari， inverse characters（white on black） should be entered with the inverse video

## Atarl 400／800／XL／XE

| When you see | Type |  | See |  |
| :---: | :---: | :---: | :---: | :---: |
| ［CLEAR） | ESC | SHIFT＜ | F | Clear Screen |
| \｛UP\} | ESC | CTRL－ | ＋ | Cursor Up |
| ［DOWN） | ESC | CTRL＝ | $+$ | Cursor Down |
| \｛LEFT\} | ESC | CTRL＋ | 4 | Cursor Left |
| ［RIGHT\} | ESC | CTRL | $\rightarrow$ | Cursor Right |
| \｛BACK S ${ }^{\text {S }}$ | ESC | DELETE | 4 | Backspace |
| \｛DELETE\} | ESC | CTRL DELETE | L1 | Delete character |
| ［INSERT） | ESC | CTRL INSERT | 15 | Insert character |
| CDEL LINE | ESC | SHIFT DELETE | $\underline{1}$ | Delete line |
| \｛INS LINE\} | ESC | SHIFT INSERT | E | Insert 1 ine |
| \｛TAB | ESC | TAB | － | TAB key |
| （CLR TAB） | ESC | CTRL TAB | E | Clear tab |
| ［SET TAB） | ESC | SHIFT TAB | E | Set tab stop |
| ＜BELL 3 | ESC | CTRL 2 | ［5］ | Ring buzzer |
| CESC） | ESC | ESC | 5 | ESCape key |

Commodore PET／CBM／VIC／64／128／16／＋4

| When You Read： <br> \｛CLR\} | Press： |  | See： | When You Read： | Press： |  |  | See： |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | SHIIT | CLR／HOME |  |  | COMM | DORE | 1 | P |
| \｛HOME\} |  | CLR／HOME | 5 | $\mathrm{E} 2 \mathrm{~B}$ | COMM | DORE | 2 |  |
| \｛UP\} | SHIFT | $\dagger$ CRSR $]$ |  | ¢38］ | COM | DORE | 3 | ． |
| ［DOWN |  | $\dagger$ CRSR 1 | ［］ | E48 | COM | DORE | 4 | ［1］ |
| \｛LEFT\} | SHIFT | $\square$ CRSR $\rightarrow$ | 蓡 | ［5］ | COMM | DORE | 5 | 2 |
| \｛RIGHT\} |  | $\leftarrow$ CRSR $\rightarrow$ | 1 | E6 ${ }^{\text {P }}$ | COM | DORE | 6 |  |
| \｛RVS\} | CTRL | 9 | E | ［73 | COM | DORE | 7 |  |
| \｛OFF\} | CTRL | 0 |  | ［8］ | COMM | DORE | 8 |  |
| \｛BLK ${ }^{\text {d }}$ | CTRL | 1 |  | $\{\mathrm{F} \mid\}$ |  | 5 |  |  |
| \｛WHT\} | CTRL | 2 | $E$ | \｛ F2 \} | SHIFT | a |  |  |
| \｛RED \} | CTRL | 3 | 4 | \｛ 53 \} |  | 3 |  |  |
| \｛CYN \} | CTRL | 4 | 员 | \｛ F4 \} | SHIFT | ${ }^{6}$ |  |  |
| ［PUR） | CTRL | 1 5 | 多 | \｛ F5 \} |  | 6 |  |  |
| \｛GRN ${ }^{\text {d }}$ | CTRL | 6 |  | \｛ $\mathrm{F6}$ \} | SHIFT | 45 |  |  |
| \｛BLU\} | CTRL | 17 | 5 | \｛ F7 \} |  | 8 |  |  |
| \｛YEL\} | CTRL | 8 | TT | \｛ F8 \} | SHIFT | 8 |  |  |
|  |  |  |  | 4 | $\square$ |  |  | 结 |

key（Atari logo key on 400／800 models）．
Whenever more than two spaces appear in a row，they are listed in a special format．For example，\｛6 SPACES \} means press the space bar six times．Our Commodore listings never leave a single space at the end of a line， instead moving it to the next printed line as \｛SPACE \}.

Amiga program listings contain only one special character，the left ar－ row $(\mapsto)$ symbol．This character marks the end of each program line．Wherever you see a left arrow，press RETURN or move the cursor off the line to enter that line into memory．Don＇t try to type in the left arrow symbol；it＇s there only as a marker to indicate where each pro－ gram line ends．

## The Automatic Proofreader

Type in the appropriate program listed below，then save it for future use．The Commodore Proofreader works on the Commodore 128，64，Plus／4，16，and VIC－20．Don＇t omit any lines，even if they contain unfamiliar commands or you think they don＇t apply to your com－ puter．When you run the program，it installs a machine language program in memory and erases its BASIC portion automatically（so be sure to save sever－ al copies before running the program for the first time）．If you＇re using a Commodore 128，Plus／4 or 16，do not use any GRAPHIC commands while the Proofreader is active．You should disable the Commodore Proofreader before running any other program．To do this，either turn the computer off and on or enter SYS 64738 （for the 64），SYS 65341 （128），SYS 64802 （VIC－20），or SYS 65526 （Plus／4 or 16）．To reenable the Proofreader，reload the program and run it as usual．Unlike the original VIC／64 Proofreader，this version works the same with disk or tape．

On the Atari，run the Proofreader to activate it（the Proofreader remains active in memory as a machine lan－ guage program）；you must then enter NEW to erase the BASIC loader．Press－ ing SYSTEM RESET deactivates the Atari Proofreader；enter PRINT USR（1536）to reenable it．

The Apple Proofreader erases the BASIC portion of itself after you run it， leaving only the machine language por－ tion in memory．It works with either DOS 3.3 or ProDOS．Disable the Apple Proofreader by pressing CTRL－RESET before running another BASIC program．

The IBM Proofreader is a BASIC program that simulates the IBM BASIC line editor，letting you enter，edit，list， save，and load programs that you type． Type RUN to activate．Be sure to leave Caps Lock on，except when typing low－ ercase characters．

Once the Proofreader is active，try typing in a line．As soon as you press RETURN，either a hexadecimal number （on the Apple）or a pair of letters（on the Commodore，Atari，or IBM）appears． The number or pair of letters is called a checksum．

Compare the value displayed on the screen by the Proofreader with the checksum printed in the program list－ ing in the magazine．The checksum is given to the left of each line number． Just type in the program a line at a time （without the printed checksum），press RETURN or Enter，and compare the checksums．If they match，go on to the next line．If not，check your typing； you＇ve made a mistake．Because of the checksum method used，do not type abbreviations，such as ？for PRINT．On the Atari and Apple Proofreaders， spaces are not counted as part of the checksum，so be sure you type the right number of spaces between quote marks．The Atari Proofreader does not check to see that you＇ve typed the char－ acters in the right order，so if characters are transposed，the checksum still matches the listing．The Commodore Proofreader catches transposition er－ rors and ignores spaces unless they＇re enclosed in quotation marks．The IBM Proofreader detects errors in spacing and transposition．

## IBM Proofreader Commands

Since the IBM Proofreader replaces the computer＇s normal BASIC line editor，it has to include many of the direct－mode IBM BASIC commands．The syntax is identical to IBM BASIC．Commands simulated are LIST，LLIST，NEW， FILES，SAVE，and LOAD．When listing your program，press any key（except Ctrl－Break）to stop the listing．If you enter NEW，the Proofreader prompts you to press $Y$ to be especially sure you mean yes．

Two new commands are BASIC and CHECK．BASIC exits the Proof－ reader 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 pro－ gram as usual（this replaces the Proof－ reader in memory）．You can now run the program，but you may want to re－ save it to disk．This will shorten it on disk and make it load faster，but it can no longer be edited with the Proofread－ er．If you want to convert an existing BASIC program to Proofreader format， save it to disk with SAVE＂filename＂，A．

## Program 1：Atarl Proofreader

By Charles Brannon
10D．GRAPHICS
110 FDR I＝1536 TO 1700：REA $D$ A：POKE I，A：CK＝CK＋A：N EXT I
120 IF CK＜＞19072 THEN ？＂E rror in DATA Statement 5．Check Typing．＂：END

130 A＝USR（1536）
146 ？：？＂Automatic Proofr eader Now Activated．＂
150 END
160 DATA $164,160,8,185,26$ ， 3，201，69，240，7
170 DATA 206，260，192，34，20 B，243，96，200，169，74
180 DATA $153,26,3,200,169$, 6，153，26，3，162
190 DATA $\varnothing, 189, \mathscr{6}, 228,157,7$ 4，6，232，224，16
200 DATA 208，245，169，93，14 $1,78,6,169,6,141$
210 DATA $79,6,24,173,4,228$ ，105，1，141，95
220 DATA $6,173,5,228,165, \varnothing$ ，141，96，6，169
230 DATA $0,133,263,96,247$ ． 238，125，241，93，6
240 DATA 244，241，115，241，1 24，241，76，205，238
250 DATA $0,0,0,6,0,32,62,2$ $46,8,201$
260 DATA 155，240，13，201，32 ，246，7，72，24，161
270 DATA $263,133,203,164,4$ 6，96，72，152，72，13日
280 DATA 72，160，6，169，128， 145，88，20 $2,192,46$
290 DATA 268，249，165，263，7 $4,74,74,74,24,165$
30ø DATA $161,160,3,145,88$ ， 165，203，41，15，24
310 DATA $105,161,200,145,8$ 8，169， $0,133,203,164$
320 DATA $179,164,168,164,4$ 6．96

Program 2：IBM Prootreader
By Charles Brannon
10 ．Automatic Proofreader Vers ion 3． 5 （Lines 205，206 adde d／190 deleted／476，490 chang ed from V2．8）
106 DIM L（50ळ），LNUM（5छळ）：COLO R $0,7,7: K E Y$ OFF：CLS：MAX＝0： LNUM（日）$=65536$ ！
110 ON ERROR GOTO 126：KEY 15，C HR（ 4 ）＋CHR（70）：ON KEY（15） GOSUB 640：KEY（15）ON：GOT － 130
120 RESUME 130
130 DEF SEG＝\＆H4 $\quad$ ：$=$ PEEK（ $\% \mathrm{H} 4 \mathrm{~A}$ ）
140 DN ERRDR BOTO 659：PRINT：PR INT＂Proofreader Ready．＂
150 LINE INPUT L\＄：Y＝CSRLIN－INT （LEN（L\＄）／W）－1：LOCATE Y， 1
160 DEF SEG＝8：POKE 1050，30：POK E 1052，34：POKE 1054，6：PDKE 1055，79：POKE 1056，13：POKE 1057，2日：LINE INPUT L\＄：DEF SEG：IF L
$17 \boldsymbol{1}$ IF LEFTS $(L \$, 1)=*$ THEN L $\$$


186 IF VAL（LEFT $\$(L \leqslant, 2))=0$ AND MID $(L \$, 3,1)="$ THEN L $\$=M$ ID\＄（L\＄，4）
200 IF ASC（L\＄）$>57$ THEN 260＇no Iine number，therefore co mmand
 HEN BL $=$＝L $\$$ GOTO 206 ELSE B L\＄＝LEFT $\$$（L＊，BL－1）
266 LNUM＝VAL（BL\＄）：TEXTs＝MID＊（L \＄，LEN（STR＊（LNUM））＋1）
210 IF TEXT\＄＝＂＂THEN GOSUB 540 ：IF LNUM＝LNUM（P）THEN GOSU B 56\％：GOTO 150 ELSE 150
226 CKSUM＝Ø：FOR I＝1 TO LEN（LS） ：CKSUM＝（CKSUM＋ASC（MID\＄（L\＄， I））（I）AND 255：NEXT：LOCATE Y，1：PRINT CHR\＄（65＋CKSUM／1 6）+ CHR $(65+$（CKSUM AND 15）$)$ ＋＂＂+ L
236 GロSUB 540：IF LNUM（P）＝LNUM THEN LS（P）＝TEXT\＄\＆GOTD 158 Preplace line
246 GOSUB 580：GOTO 150 Finsert the line
260 TEXTS＝＂4：FOR I＝1 TD LEN（L\＄ ）：A＝ASC（MID\＄（L\＄，I））：TEXT\＄＝ TEXT $\$+$ CHR $\$(A+32$（ $A>96$ AND A（123））：NEXT
276 DELIMITER＝INSTR（TEXT\＄，＂＂） © COMMAND $=$ TEXT $\$$ ：AREs $=^{* *}$ m IF DELIMITER THEN COMMAND $\$=L$ EFT $\$$（TEXT $\$$ ，DELIMITER－1）：AR E\＄＝MID（TEXT ${ }^{\text {（ }}$ ，DELIMITER＋1） ELSE DELIMITER＝INSTR（TEXT主，CHR（34：）：IF DELIMITER T HEN COMMAND ${ }^{\text {B }}=$ LEFTS（TEXT $\$$ ，D ELIMITER－1）：ARG＊＝MID\＄（TEXT \＄，DELIMITER）
280 IF COMMAND $\$\langle>$＂LIST＂THEN 4 10
290 DPEN＂sern：＂FDR DUTPUT AS W1
300 IF ARG $\$=" 1$ THEN FIRST $=\varnothing$ ：$P=$ MAX－1：GOTO 346
310 DELIMITER＝INSTR（ARG\＄，＂－＂）： IF DELIMITER＝O THEN LNUM＝V AL（ARG\＄）：GDSUB 540：FIRST＝P ：GOTO 340
320 FIRST＝VAL（LEFT\＄（ARG\＄，DELIM ITER））：LAST＝VAL（MID\＄（AREs； DELIMITER＋1）\}
330 LNUM＝FIRST：GOSUB 540：FIRST EP：LNUM $=$ LAST：GOSUB 540：IF Pm6 THEN P＝MAX－1
340 FOR X＝FIRST TO P：N $\$=M I D \$(S$ TR\＄（LNUM $(X)), 2)+" "$
350 IF CKFLAG＝g THEN A\＄ $\mathbf{x " n}^{\prime \prime}$ ：GOT － 376
360 CKSUM＝ 0 ：$A=N \$+L \$(X):$ FOR $I=$ 1 TO LEN（As）：CKSUM＝（CKSUM＋ ASC（MID\＄（As，I））\＆I）AND 255 ：NEXT：A $\$=$ CHR （ $65+$ CKSUM／16） + CHR $\$(65+($ CKSUM AND 15）$)+"$

370 PRINT 单1，$A \$+N \$+L \leqslant(X)$
3日0 IF INKEY\＄〈〉＂n THEN $X=P$
390 NEXT ：CLOSE \＃1：CKFLAG＝g
460 GOTO 130
410 IF COMMAND $\$=$＂LLIST＂THEN 0 PEN＂1ptis＂FOR OUTPUT AS H1：GOTO 300
420 IF COMMAND\＄＝＂CHECK＂THEN C KFLAB＝1：GDTD 290
430 IF COMMAND\＄＜＞＂SAVE＂THEN 4 50
440 GOSUB 6D日：DPEN ARG\＄FOR OU TPUT AS \＃1：ARE\＄＝＂＂：GOTD 30 $\square$
455 IF CDMMAND\＄く＞＂LDAD＂THEN 4 96

469 GOSUB 6GO：OPEN ARG\＄FOR IN PUT AS 㳟1： $\mathrm{MAX}=\varnothing$ ：$P=\varnothing$
479 WHILE NOT EDF（1）：LINE INPU T（\＃1，L\＄：BL＝INSTR（L\＄，＂＂）：B L\＄＝LEFT $\$(L$ ；$;$ BL－1）：LNUM $(P)=$ VAL（BL $⿻$ ）：L $\$(P)=M I D \$(L$ B，LEN （STR\＄（VAL（BL\＄）））+1 ）：P＝P＋1： WEND
480 MAX＝P：CLDSE Wi：BOTO 130
49 IF COMMAND $\$=$＂NEW＂THEN INP UT＂Erase program－Are yo
 ＂y＂OR LEFT\＄（Ls，1）$=$＂Y＂THE N MAX＝G：LNUM（6）$=65536$ ： $50 T$ －139：ELSE 139
500 IF COMMAND $5=$＂BASIC＂THEN C OLOR 7， $0, \emptyset: O N$ ERROR GOTO $\varnothing$ ：CLS：END
516 IF COMMAND $\$\left\rangle^{\text {MFFIFILES＊THEN }}\right.$ 520
515 IF ARG＊＝＊m THEN ARG $\$=^{\circ} A \neq "$ ELSE SEL＝1：GOSUB 680
517 FILES ARG\＄：GOTO 138
520 PRINT＊Syntax error＂：GOTD 1 38
 $P<M A X: P=P+1$ ：WEND：RETURN
566 MAX $=$ MAX－1：FOR $X=P$ TO MAX：L $\operatorname{NUM}(X)=\operatorname{LNUM}(X+1): \operatorname{L} \$(X)=L \$($ $X+1\rangle$ ：NEXT：RETURN
58 G MAX $=$ MAX $+1:$ FOR $X=$ MAX TO $P+1$ STEP－1：LNUM $(X)=\operatorname{LNUM}(X-1)$ $: L \leqslant(X)=L \$(X-1):$ NEXT：L $\$(P)=$ TEXT＊：LNUM（P）＝LNUM：RETURN
600 IF LEFT $\$$（ARG\＄，1）＜＞CMR \＄（34） THEN 520 ELSE ARG $=$ MID ${ }^{(1)}$ RE＊2）
610 IF RIGHT ${ }^{6}$（ARG $\$, 1$ ）$=$ CHR $\$$（34） THEN ARG $\$=$ LEFT $\$$（ARE $\$$ ，LEN （

620 IF SEL＝g AND INSTR（ARGs，＂． ＂）$=0$ THEN ARG $\$=A R G \$+"$ ．BAS＂ 630 SEL $=0$ aRETURN
640 CLOSE \＃1：CKFLAG＝6：PRINT＂St opped．＂：RETURN 156
65 PRINT＂Error＂；ERR：RESUME 150

## Program 3：Commodore Proofreader

By Philip Nelson，Assistant Editor
10 VEC＝PEEK（772）＋256＊PEEK（773） ：LO＝43： $\mathrm{HI}=44$
20 PRINT＊AUTOMATIC PROOFREADE R FOR＂：$:$ IF VEC＝42364 THEN ［SPACE］PRINT＂C－64＂
30 IF VEC＝56556 THEN PRINT＂VI C－20＂
40 IF VEC＝35158 THEN GRAPHIC C LR：PRINT＂PLUS／4 \＆16＂
50 IF VEC＝17165 THEN LO $=45: \mathrm{HI}=$ 46：GRAPHIC CLR：PRINT＂ $128^{\prime \prime}$
60 SA $=($ PEEK（LO）+256 ＊ PEEK $(\mathrm{HI}))+$ 6：ADR＝SA
70 FOR J＝0 TO 166：READ BYT：POK E ADR，$B Y T: A D R=A D R+1: C H K=C H K$ ＋BYT：NEXT
80 IF CHK＜＞20570 THEN PRINT＊＊ ERROR＊CHECK TYPING IN DATA STATEMENTS＂：END
90 FOR J＝1 TO 5：READ RF，LF，HF： $R S=S A+R F: H B=I N T(R S / 256): L B=$ RS－（ 256 ＊ HB ）
106 CHK＝CHK + RF + LF +HF ； $\mathrm{POKE} \mathrm{SA}+\mathrm{L}$ F，LB：POKE SA＋HF；HB：NEXT
110 IF CHK＜＞22054 THEN PRINT ${ }^{n}$ ＊ERROR＊RELOAD PROGRAM AND
［SPACE］CHECK FINAL LINE＂：EN D
12Ø POKE SA＋149．PEEK（772）：POKE SA＋150，PEEK（773）
130 IF VEC＝17165 THEN POKE SA＋ 14，22：POKE SA＋18，23：POKESA＋ 29，224：POKESA＋139， 224
140 PRINT CHRS（147）；CHRS（17）：＂ PROOFREADER ACTIVE＂：SYS SA
150 POKE HI，PEEK（HI）＋1：POKE（P $\operatorname{EEK}(\mathrm{LO})+256 * \operatorname{PEEK}(\mathrm{HI}))-1, \varnothing: \mathrm{N}$ EW
160 DATA $120,169,73,141,4,3,16$ 9，3，141，5，3
170 DATA $88,96,165,20,133,167$ ． $165,21,133,168,169$
180 DATA 0，141，0，255，162，31，18 $1,199,157,227,3$
190 DATA 202，16，248，169，19，32， 210，255，169，18，32
200 DATA $210,255,160,0,132,180$ $, 132,176,136,230,180$
210 DATA 200，185，0，2，240，46， 20 $1,34,208,8,72$
220 DATA $165,176,73,255,133,17$ 6，104，72，201，32，208
230 DATA $7,165,176,208,3,104,2$ 08，226，104，166，180
240 DATA $24,165,167,121,0,2,13$ $3,167,165,168,165$
250 DATA ©，133，168，202，208，239 ．240，262，165，167，69
260 DATA $168,72,41,15,168,185$, 211，3，32，216，255
270 DATA $104,74,74,74,74,168,1$ 85，211，3，32，210
280 DATA $255,162,31,189,227,3$ ， 149，199，202，16，248
290 DATA 169，146，32，210，255，76 ，86，137，65，66，67
300 DATA 68，69，70，71，72，74，75， $77,80,81,82,83,88$
310 DATA 13，2，7，167，31，32，151， $116,117,151,128,129,167,136$ .137

## Program 4：Apple <br> Proofreader

By Tim Victor，Editorial Programmer
$10 \mathrm{C}=0:$ FQR $I=768$ TO $76 \mathrm{~B}+$ 68：READ AsC $=C+A:$ POKE I －A：NEXT
28 IF $C$＜$>7258$ THEN PRINT＂ER ROR IN PRODFREADER DATA STAT EMENTS＂：END
36 IF PEEK（190 256）＜＞ 76 T HEN POKE 56，0：POKE 57，3：CA LL 1062：GOTO 50
40 PRINT CHRS（4）：＂IN\＃A $\$ 306$＂
50 POKE 34， 0 ：HOME ：POKE 34，1： VTAB 2：PRINT＂PRODFREADER INSTALLED＊
68 NEW
100 DATA 216，32，27，253，201，141
116 DATA 208，66，138，72，169， 6
120 DATA $72,189,255,1,261,160$
130 DATA $246, B, 164,16,125,255$
140 DATA $1,165,8,72,262,208$
150 DATA 238， $104,170,41,15,9$
166 DATA $48,261,58,144,2,233$
176 DATA $57,141,1,4,138,74$
180 DATA $74,74,74,41,15,9$
196 DATA 4B，261，5B，144，2，233
200 DATA $57,141,6,4,104,170$
216 DATA 169，141，96

# 1/ Machine Language Entry Program For Commodore 64 And 128 

Otlis Cowper, Technical Editor
"MLX" is a labor-saving utility that allows almost fail-safe entry of machine language programs. Included are versions for the Commodore 64 and 128.

Type in and save some copies of whichever version of MLX is appropriate for your computer (you'll want to use it to enter future ML programs from COMPUTEI). Program 1 is for the Commodore 64, and Program 2 is for the 128 (128 MLX can also be used to enter Commodore 64 ML programs for use in 64 mode). When you're ready to enter an ML program, load and run MLX. It asks you for a starting address and an ending address. These addresses appear in the article accompanying the MLX-format program listing you're typing.

If you're unfamiliar with machine language, the addresses (and all other values you enter in MLX) may appear strange. Instead of the usual decimal numbers you're accustomed to, these numbers are in hexadecimal-a base 16 numbering system commonly used by ML programmers. Hexadecimal-hex for short-includes the numerals $0-9$ and the letters A-F. But don't worryeven if you know nothing about ML or hex, you should have no trouble using MLX.

After you enter the starting and ending addresses, you'll be offered the option of clearing the workspace. Choose this option if you're starting to enter a new listing. If you're continuing a listing that's partially typed from a previous session, don't choose this option.

A functions menu will appear. The first option in the menu is ENTER DATA. If you're just starting to type in a program, pick this. Press the E key, and type the first number in the first line of the program listing. If you've already typed in part of a program, type the line number where you left off typing at the end of the previous session (be sure to load the partially completed program before you resume entry). In any case, make sure the address you enter corresponds to the address of a line in the listing you are entering. Otherwise, youll be unable to enter the data correctly. If you pressed $E$ by mistake, you can return to the command menu by pressing RETURN alone when asked for the address. (You can get back to the menu from most options by pressing RETURN with no other input.)

## Entering A Listing

Once you're in Enter mode, MLX prints the address for each program line for you. You then type in all nine numbers on that line, beginning with the first twodigit number after the colon (:). Each line represents eight data bytes and a checksum. Although an MLX-format listing appears similar to the "hex dump" listings from a machine language monitor program, the extra checksum number on the end allows MLX to check your typing. (Commodore 128 users can enter the data from an MLX listing using the built-in monitor if the rightmost column of data is omitted, but we recommend against it. It's much easier to let MLX do the proofreading and error checking for you.)

Figure 1: 64 MLX Keypad


Figure 2: 128 MLX Keypad

| $\mathbf{A}$ | $\mathbf{B}$ | $\mathbf{C}$ | $\mathbf{D}$ |
| :---: | :---: | :---: | :---: |
| $\mathbf{( F 1 )}$ | (F3) | (F5) | (F7) |


| 7 | 8 | 9 | $E$ <br> $(+)$ |
| :--- | :--- | :--- | :---: |
| 4 | 5 | 6 | F <br> $(-)$ |
| 1 | 2 | 3 | E <br> N <br> T <br> E <br> R |

When you enter a line, MLX recalculates the checksum from the eight bytes and the address and compares this value to the number from the ninth column. If the values match, you'll hear a bell tone, the data will be added to the workspace area, and the prompt for the next line of data will appear. But if MLX detects a typing error, you'll hear a low buzz and see an error message. The line will then be redisplayed for editing.

## Invalid Characters Banned

Only a few keys are active while you're entering data, so you may have to unlearn some habits. You do not type spaces between the columns; MLX automatically inserts these for you. You do not press RETURN after typing the last number in a line; MLX automatically enters and checks the line after you type the last digit.

Only the numerals 0-9 and the letters A-F can be typed in. If you press any other key (with some exceptions noted below), you'll hear a warning buzz. To simplify typing, 128 MLX redefines the function keys and + and keys on the numeric keypad so that you can enter data one-handed. In either case, the keypad is active only while entering data. Addresses must be entered with the normal letter and number keys. The figures below show the keypad configurations for each version.

MLX checks for transposed characters. If you're supposed to type in AO and instead enter 0A, MLX will catch your mistake. There is one error that can slip past MLX: Because of the checksum formula used, MLX won't notice if you accidentally type FF in place of 00 , and vice versa. And there's a very slim chance that you could garble a line and still end up with a combination of characters that adds up to the proper checksum. However, these mistakes should not occur if you take reasonable care while entering data.

## Edifing Features

To correct typing mistakes before finishing a line, use the INST/DEL key to delete the character to the left of the cursor. (The cursor-left key also deletes.) If you mess up a line really badly, press CLR/HOME to start the line over. The RETURN key is also active, but only before any data is typed on a line. Pressing RETURN at this point returns you to the command menu. After you
type a character of data, MLX disables RETURN until the cursor returns to the start of a line. Remember, you can press CLR/HOME to quickly get to a line number prompt.

More editing features are available when correcting lines in which MLX has detected an error. To make corrections in a line that MLX has redisplayed for editing, compare the line on the screen with the one printed in the listing, then move the cursor to the mistake and type the correct key. The cursor left and right keys provide the normal cursor controls. (The INST/ DEL key now works as an alternative cursor-left key.) You cannot move left beyond the first character in the line. If you try to move beyond the rightmost character, you'll reenter the line. During editing, RETURN is active; pressing it tells MLX to recheck the line. You can press the CLR/HOME key to clear the entire line if you want to start from scratch, or if you want to get to a line number prompt to use RETURN to get back to the menu.

## Display Data

The second menu choice, DISPLAY DATA, examines memory and shows the contents in the same format as the program listing (including the checksum). When you press D, MLX asks you for a starting address. Be sure that the starting address you give corresponds to a line number in the listing. Otherwise, the checksum display will be meaningless. MLX displays program lines until it reaches the end of the program, at which point the menu is redisplayed. You can pause the display by pressing the space bar. (MLX finishes printing the current line before halting.) Press space again to restart the display. To break out of the display and get back to the menu before the ending address is reached, press RETURN.

## Other Menu Options

Two more menu selections let you save programs and load them back into the computer. These are SAVE FILE and LOAD FILE; their operation is quite straightforward. When you press S or L, MLX asks you for the filename. You'll then be asked to press either $D$ or $T$ to select disk or tape.

You'll notice the disk drive starting and stopping several times during a load or save (save only for the 128 version). Don't panic; this is normal behavior. MLX opens and reads from or writes to the file instead of using the usual LOAD and SAVE commands ( 128 MLX makes use of BLOAD). Disk users should also note that the drive prefix 0 : is automatically added to the filename (line 750 in 64 MLX ), so this should not be included when entering
the name. This also precludes the use of @ for Save-with-Replace, so remember to give each version you save a different name. The 128 version makes up for this by giving you the option of scratching the existing file if you want to reuse a filename.

Remember that MLX saves the entire workspace area from the starting address to the ending address, so the save or load may take longer than you might expect if you've entered only a small amount of data from a long listing. When saving a partially completed listing, make sure to note the address where you stopped typing so you'll know where to resume entry when you reload.

MLX reports the standard disk or tape error messages if any problems are detected during the save or load. (Tape users should bear in mind that Commodore computers are never able to detect errors during a save to tape.) MLX also has three special load error messages: INCORRECT STARTING ADDRESS, which means the file you're trying to load does not have the starting address you specified when you ran MLX; LOAD ENDED AT address, which means the file you're trying to load ends before the ending address you specified when you started MLX; and TRUNCATED AT ENDING ADDRESS, which means the file you're trying to load extends beyond the ending address you specified when you started MLX. If you see one of these messages and feel certain that you've loaded the right file, exit and rerun MLX, being careful to enter the correct starting and ending addresses.

The 128 version also has a CATALOG DISK option so you can view the contents of the disk directory before saving or loading.

The QUIT menu option has the obvious effect-it stops MLX and enters BASIC. The RUN/STOP key is disabled, so the Q option lets you exit the program without turning off the computer. (Of course, RUN/STOP-RESTORE also gets you out.) You'll be asked for verification; press $Y$ to exit to BASIC, or any other key to return to the menu. After quitting, you can type RUN again and reenter MLX without losing your data, as long as you don't use the clear workspace option.

## The Finished Product

When you've finished typing all the data for an ML program and saved your work, you're ready to see the results. The instructions for loading and using the finished product vary from program to program. Some ML programs are designed to be loaded and run like BASIC programs, so all you need to type is LOAD "filename", 8 for disk
(DLOAD "filename" on the 128) or LOAD "filename" for tape, and then RUN. Such programs will usually have a starting address of 0801 for the 64 or 1 C 01 for the 128 . Other programs must be reloaded to specific addresses with a command such as LOAD "filename", 8,1 for disk (BLOAD "filename" on the 128) or LOAD "filename", 1,1 for tape, then started with a SYS to a particular memory address. On the Commodore 64, the most common starting address for such programs is 49152, which corresponds to MLX address C000. In either case, you should always refer to the article which accompanies the ML listing for information on loading and running the program.

## An Ounce Of Prevention

By the time you finish typing in the data for a long ML program, you may have several hours invested in the project. Don't take chances-use our "Automatic Proofreader" to type the new MLX, and then test your copy thorough$l y$ before first using it to enter any significant amount of data. Make sure all the menu options work as they should. Enter fragments of the program starting at several different addresses, then use the Display option to verify that the data has been entered correctly. And be sure to test the Save and Load options several times to insure that you can recall your work from disk or tape. Don't let a simple typing error in the new MLX cost you several nights of hard work.

## Program 1: MLX For Commodore 64

SS 10 REM VERSION 1.1: LINES 8 30,950 MODIFIED, LINES 4 85-487 ADDED
EK 100 POKE 56,50:CLR:DIM INS, $I, J, A, B, A S, B S, A(7), N S$
DM 110 C4=48:C6=16:C7=7:22=2:2 $4=254: Z 5=255: Z 6=256: Z 7=$ 127
CJ $129 \mathrm{FA}=\mathrm{PEEK}(45)+\mathrm{Z6}$ *PEEK (46) : $\operatorname{BS}=\operatorname{PEEK}(55)+Z 6 * \operatorname{PEEK}(56$ ): H ="g123456789ABCDEF"
SB 130 R $\$=$ CHR (13):L\$=" (LEFT)" : $S \$="$ ": DS $=$ CHR $\$(20): z \$=$ CHRS ( $\varnothing$ ): TS $=$ =" $\{13$ RIGHT \}"
CQ $140 \mathrm{SD}=54272:$ FOR $\mathrm{I}=\mathrm{SD}$ TO SD +23:POKE I, 0 :NEXT:POKE \{SPACE]SD+24,15:POKE 78 8,52
FC 150 PRINT" $\{C L R\}$ "CHRS(142)CH RS(8):POKE 53280,15:POK E 53281,15
EJ 160 PRINT TS" \{RED\}\{RVS\}
\{2 SPACES $\}$ E8 9
\{2 SPACES]"SPC(28)"
\{2 SPACES\}\{OFF\}\{BLU\} ML $X$ II (RED) (RVS) (2 SPACES]"SPC(28)" ( 12 SPACES\}\{BLU\}"
FR 176 PRINT"[3 DOWN] \{3 SPACES\}COMPUTEI'S MA

CHINE LANGUAGE EDITOR ［3 DOWN］＂
JB 180 PRINT＂\｛BLK\}STARTING ADD RESSE4푸：GOSUB300：SA＝A D：GOSUB1040：IF F THEN18 $\emptyset$
GF 190 PRINT＂$\{$ BLK $\}\{2$ SPACES $\}$ EN DING ADDRESSE4\＃＂：GOSUB 300：EA＝AD：GOSUB1030：IF \｛SPACE\}F THEN190
KR 200 INPUT＂\｛3 DOWN\}\{BLK\}CLEA R WORKSPACE［Y／N］E4］＂：A \＄：IF LEFT $(\mathrm{A} \$, 1)<>" Y " T H$ EN220
PG 210 PRINT＂\｛2 DOWN\}\{BLU\}WORK ING．．．＂：：FORI＝BS TO BS＋ EA－SA＋7：POKE I，D：NEXT：P RINT＂DONE＂
DR 220 PRINTTAB（10）＂\｛2 DOWN\} \｛BLK］［RVS\} MLX COMMAND ［SPACE］MENU \｛DOWN\}E4习": PRINT T\＄＂\｛RVS\}E\{OFE\}NTE R DATA＂
BD 230 PRINT TS＂\｛RVS）D［OFF\}ISP LAY DATA＂：PRINT T\＄＂ \｛RVS\}L\{OFF\}OAD FILE"
IS 240 PRINT TS＂\｛RVS\}S\{OFF\}AVE FILE＂：PRINT TS＂［RVS］O ［OFF］UIT（2 DOWN\}(BLK)"
JH 250 GET AS：IF AS＝N\＄THEN 250
HK $260 \mathrm{~A}=0: \mathrm{FOR} \mathrm{I}=1$ TO $5: I F \mathrm{~A}=$ MID\＄（＂EDLSO＂．I，1）THEN A $=I: I=5$
FD 270 NEXT：ON A GOTO420．610．6 90，700，280：GOSUB1060：GO TO250
ES 280 PRINT＂\｛RVS\} QUIT ":INPU T＂${ }^{\text {ID }}$ DOWN $\}$ EABARE YOU SURE ［ $Y / N]^{\prime \prime}$ ；AS：IF LEFTS（AS． 1）$<$＞＂$Y^{\prime \prime}$ THEN2 20
EM 29б POKE SD＋24， $0:$ END
JX 300 INS＝NS：AD＝0：INPUTINS：IF LEN（IN\＄） $6>4$ THENRETURN
KF $310 \mathrm{~B}=\mathrm{IN}$ ：$G O S U B 320: \mathrm{AD}=\mathrm{A}: \mathrm{B}$ S $=\mathrm{MID}($（IN\＄， 3 ）：GOSUB320：A $D=A D * 256+A:$ RETURN
PP 32ø $A=\varnothing$ ：FOR $J=1$ TO 2：AS＝MID \＄（ $\mathrm{B} \$, \mathrm{~J}, 1): \mathrm{B}=\mathrm{ASC}(\mathrm{AS})-\mathrm{C4}+$ （A§＞＂＠＂）＊C7：A＝A＊C6＋B
JA 330 IF $\mathrm{B}<\varnothing$ OR $\mathrm{B}>15$ THEN $\mathrm{AD}=$ $0: A=-1: J=2$
GX 340 NEXT：RETURN
$\mathrm{CH} 350 \mathrm{~B}=$ INT $(\mathrm{A} / \mathrm{C} 6):$ PRINT MIDS $($ H\＄，$B+1,1):: B=A-B * C 6: P R I$ NT MIDS（H\＄，B＋1，1）；：RETU RN
RR $360 \mathrm{~A}=\mathrm{INT}(\mathrm{AD} / \mathrm{Z} 6)$ ） $\operatorname{GOSUB} 350: \mathrm{A}$ ＝AD－A＊Z6：GOSUB350：PRINT ＂：＂；
BE 37ø CK＝INT（AD／Z6）：CK＝AD－Z4＊ CK＋Z5＊（CK＞27）：GOTO390
PX 380 CK＝CK＊Z2＋Z5＊（CK＞Z7）+ A
JC $390 \mathrm{CK}=\mathrm{CK}+\mathrm{Z5}$＊（CK＞Z5）：RETURN
QS 406 PRINT＂${ }^{\text {（DOWN }}$ ）STARTING AT E4ヨ＂：：GOSUB3日の：IE IN\＄く＞ NS THEN GOSUB1030：IF F ［SPACE］THEN4もの
EX 410 RETURN
HD 420 PRINT＂\｛RVS\} ENTER DATA \｛SPACE\}":GOSUB400:IF IN \＄＝NS THEN220
JK 43ø OPEN3，3：PRINT
SK 440 POKE198，0：GOSUB360：IF F THEN PRINT IN\＄：PRINT＂ ［UP］（5 RIGHT］＂：
GC 450 FOR I＝0 TO 24 STEP 3：B ＝S $\$$ ：FOR J＝1 TO 2：IF FT HEN BS＝MIDS（INS，I＋J，I）
HA 460 PRINT＂ （RUS）＂BSLS：：IF I＜ 24THEN PRINT＂\｛OFF\}";
HD 476 GET AS：IF AS＝NS THEN470

FK 480 IF（AS＞＂／＂ANDASく＂：＂）OR（A \＄＞＂＠＂ANDA\＄く＂G＂）THEN54
 3＊（AS＝＂．＂$)-$ 4＊$^{*}\left(A S=" /{ }^{\prime \prime}\right)-5$

FX $486 \mathrm{~A}=A-7{ }^{*}\left(\mathrm{AS}==^{\prime \prime} \mathrm{L}^{\prime \prime}\right)-\mathrm{B}^{*}\left(\mathrm{AS}={ }^{\prime \prime}\right.$ ： ＂）$-9 *\left(A \$=" U^{\prime \prime}\right)-10^{*}(A \$=" I$ ＂）$-11 *\left(A S=" O^{\prime \prime}\right)-12 *(A S="$ $P^{\prime \prime}$ ）
CM $487 \mathrm{~A}=\mathrm{A}-13^{*}(\mathrm{AS}=\mathrm{S} \$$ ）：IF A THE N AS＝MIDS（＂ABCD123E456F $\left.0^{\prime \prime}, \mathrm{A}, 1\right)$ ：GOTO 540
MP 490 IF AS＝RS AND（ $(I=8)$ AND（ $J$ ＝1）OR F）THEN PRINT BS；： J＝2：NEXT：I＝24：GOTO55ø
KC 500 IF AS＝＂（HOME）＂THEN PRI NT B\＄：J＝2：NEXT：I＝24：NEX T：F＝Ø：GOTO44Ø
MX 510 IF（AS＝＂\｛RIGHT\}")ANDF TH ENPRINT B\＄LS；：GOTO540
GK 520 IF AS＜＜LS AND AS＜＜DS OR （ $(I=0)$ AND $(J=1)$ ）THEN GOS UB1060：GOT047ø
HG 530 AS＝L\＄＋S\＄＋LS：PRINT BSLS； ：$J=2-J: I F$ J THEN PRINT ［SPACE］LS；：I＝I－3
QS 540 PRINT AS：：NEXT J：PRINT ［SPACE］SS：
PM 550 NEXT I：PRINT：PRINT＂［UP］ ［5 RIGHT］＂：INPUT\＃3，INS ：IF INS＝NS THEN CLOSE3： GOTO220
QC 56B FOR I＝1 TO 25 STEP3：BS＝ MIDS（INS，I）：GOSUB326：IF I＜25 THEN GOSUB380：A（I （3）＝A
PK 570 NEXT：IF Aく＞CK THEN GOSU B1066：PRINT＂\｛BLK\}[RVS\}
［SPACE \}ERROR: REENTER L INE［4］＂： $\mathrm{F}=1: \mathrm{GOTO440}$
HJ 580 GOSUB1080：B＝BS $+A D-S A: F O$ R I＝Ø TO 7：POKE B＋I，A（I 1：NEXT
Q 590 AD $=A D+8: I F$ AD $\triangle E A$ THEN $C$ LOSE3：PRINT＂\｛DOWN\}\{BLU\} ＊＊END OF ENTRY＊＊＊ BLK \} ［2 DOWN］＂：GOTO7ש日
GQ 600 F＝0：GOTO440
QA 610 PRINT＂ ［CLR］\｛DOWN\} \{RVS\} ［SPACE］DISPLAY DATA＂：G OSUB40日：IF INS＝NS THEN2 20
RJ 620 PRINT＂\｛DOWN\}\{BLU\}PRESS: \｛RVS\}SPACE [OFF] TO PAU SE，\｛RVS］RETURN\｛OFF\} TO BREAKE43\｛DOWN\}"
KS 630 GOSUB360：B＝BS＋AD－SA：FOR $I=B T O \quad B+7: A=P E E K(I): G O S$ UB350：GOSUB380：PRINT S\＄ ；
 ：GOSUB350：PRINT
KH 650 $\mathrm{F}=1: \mathrm{AD}=\mathrm{AD}+8: I \mathrm{~F}$ AD＞EA TH ENPRINT＂［DOWN\}\{BLU\}** E ND OF DATA＊＊＂：GOTO220
KC 660 GET AS：IF AS＝RS THEN GO SUB1ø8Ø：GOTO220
EQ 670 IF AS＝S UB1080
AD 680 ONFGOTO630，660，63ø
CM 690 PRINT＂$\{$ DOWN \}\{RVS \} LOAD ［SPACE ］DATA＂：OP＝1：GOTO 710
PC 700 PRINT＂［DOWN］\｛RVS SAVE \｛SPACE\}FILE ":OP=Ø
RX 710 INS＝NS：INPUT＂${ }^{(D O W N\}}$ ）FILE NAME K 4 ＂${ }^{\prime \prime}$ INS：IF IN $\$=$ N $\$$ ［SPACE］THEN226
 ［RVS］T\｛OFF\}APE OR (RVS\} D\｛OFF\}ISK: E4 ${ }^{\prime \prime}$＂

FR 730 GET AS：IF ASロ＂T＂THEN PR INT＂T \｛ DOWN ］＂：GOTOB8』
HQ 740 IF A§々＞＂D＂THEN736
HH 750 PRINT＂D\｛DOWN\}":OPEN15,8 8
B：＂＋INS：IF OP THEN816
SQ 760 OPEN $1, B, B, I N S+{ }^{\prime \prime}, P, W^{\prime \prime}: G$
OSUB860：IF A THEN220
FJ 770 AH＝INT（SA／256）：AL＝SA－（A
H＊256）：PRINT\＃1，CHRS（AL）
：CHRS（AH）：
PE 780 FOR $\mathrm{I}=\emptyset$ TO B：PRINT\＃1， CH RS（PEEK（BS＋I））：：IF ST T HENBø日
FC 790 NEXT：CLOSE1：CLOSE15：GOT 0940
GS 8øø GOSUBIの60：PRINT＂\｛DOWN\}
\｛BLK\}ERROR DURING SAVE:
［4］＂：GOSUB860：GOTO220
MA 810 OPEN $1,8,8$, IN\＄＋＂，P，R＂：G OSUB860：IF A THEN22g
GE $82 \sigma$ GET\＃1，A\＄，BS：AD＝ASC（AS＋Z \＄）$+256 * A S C(B \$+Z \$): I F A D$ ＜＞SA THEN F＝1：GOTO850
RX 83ø FOR $\mathrm{I}=0$ TO B：GET\＃1，AS：P OKE BS＋I，ASC $(A \$+Z \$): I F($ I（＞B）AND ST THEN $\mathrm{F}=2$ ：AD $=I: I=B$
FA 846 NEXT：IF STく＞64 THEN $\mathrm{F}=3$
FQ 850 CLOSE1：CLOSE15：ON ABS（F ＞0）+1 GOTO960．976
SA 860 INPUT＊ $15, A, A S: I F A$ THEN CLOSE1：CLOSE15：GOSUBIG 60：PRINT＂\｛RVS\}ERROR: "A \＄
GQ 870 RETURN
EJ 880 POKE183，PEEK（FA +2 ）：POKE 187，PEEK（FA +3 ）：POKE188，
PEEK（FA＋4）：IFOP＝0THEN92 0
HJ 890 SYS 63466：IF（PEEK（7B3）A ND1）THEN GOSUBI660：PRIN T＂［DOWN\} [RVS] FILE NOT
［SPACE fFOUND＂：GOTO69б
CS $900 \mathrm{AD}=\mathrm{PEEK}(829)+256$＊ PEEK （ 8 36）：IF AD＜＞SA THEN $F=1$ ： GOTO976
SC $910 \mathrm{~A}=\operatorname{PEEK}(831)+256$＊PEEK（ 83 2）$-1: F=F-2^{*}(A<E A)-3 *(A>$ EA）：AD＝A－AD：GOTO930
KM $920 \mathrm{~A}=\mathrm{SA}: \mathrm{B}=\mathrm{EA}+1:$ GOSUB1010：P OKE780，3：SYS 63338
JF $930 \mathrm{~A}=\mathrm{BS}: \mathrm{B}=\mathrm{BS}+(E A-S A)+1: G O S$ UB1ø10：ON OP GOTO950：SY S 63591
AE 940 GOSUB1080：PRINT＂$\{B L U\}$＊＊ SAVE COMPLETED＊＊＂：GOT 0220
XP 950 POKE147，0：SYS 63562：IF ［SPACE］ST＞8 THEN970
FR 960 GOSUB1980：PRINT＂\｛BLU\}** LOAD COMPLETED＊＊＂：GOT 0220
DP 970 GOSUBlø60：PRINT＂$[$ ELK $]$ （RVS）ERROR DURING LOAD： ［DOWN］E4Z＂：ON E GOSUB9B Ø，99ø，1906：GOTO22ø
PP 986 PRINT＂INCORRECT STARTIN G ADDRESS（＂：：GOSUB367： PRINT＂）＂：RETURN
GR 990 PRINT＂LOAD ENDED AT＂；： $A D=S A+A D: G O S U B 360: P R I N T$ D $\$$ ：RETURN
FD 1000 PRINT＂TRUNCATED AT END ING ADDRESS＂：RETURN
RX 1010 AH＝INT（A／256）：AL＝A－（AH ＊256）：POKE193，AL：POKE1 94，AH
FF $1020 \mathrm{AH}=\mathrm{INT}(\mathrm{B} / 256): \mathrm{AL}=\mathrm{B}-(\mathrm{AH}$ ＊256）：POKE174，AL：POKE1 75，AH：RETURN

FX 1030 IF AD＜SA OR AD＞EA THEN 1050
HA 1040 IF（AD＞ 511 AND AD $<40960$ JOR（AD＞49151 AND AD＜53 248）THEN GOSUBI $68 \varnothing: F=\emptyset$ ：RETURN
HC 1050 GOSUB1060＝PRINT＂\｛RVS\} \｛SPACE\}INVALID ADDRESS ［DOWN］（BLK\}": F=1:RETU RN
AR 1060 POKE SD＋5，31：POKE SD＋6 ，208：POKE SD，240：POKE \｛SPACE \}SD+1,4:POKE SD+ 4，33
DX 1070 FOR $S=1$ TO 100：NEXT：GO TOI090
PF 1øBø POKE SD＋5，8：POKE SD＋6， 240：POKE SD， $0:$ POKE SD＋ 1，90：POKE SD＋4，17
AC 1090 FOR $S=1$ TO 100：NEXT：PO KE SD＋4，$\varnothing:$ POKE SD，$\quad$ ：PO KE SD＋1，Ø：RETURN

## Program 2：MLX For Commodore 128

AE 100 TRAP 960：POKE 4627，128： DIM NLS，A（7）
XP 116 $\mathrm{z} 2=2: \mathrm{Z4=254:25=255:26=2}$ 56：Z7＝127：BS＝256＊PEEK（4 627）： $\mathrm{EA}=6528 \varnothing$
FB $120 \mathrm{BE} \$=\mathrm{CHR} \$(7): \operatorname{RT} \$=\mathrm{CHR} \$(13$ ）：DLS＝CHRS（20）：SP\＄＝CHR\＄ （32）：LF\＄＝CHR\＄（157）
KE 130 DEF FNHB（A）$=\operatorname{INT}(A / 256):$ $\operatorname{DEF} \operatorname{FNLB}(A)=A-F N H B(A) * 2$ 56： $\operatorname{DEF} \operatorname{FNAD}(\mathrm{A})=\operatorname{PEEK}(\mathrm{A})+$ 256＊PEEK（A＋1）
JB 14Ø KEY I，＂A＂：KEY 3，＂B＂：KEY 5，＂C＂：KEY 7，＂D＂：VOL 15 ：IF RGR（ $\sigma)=5$ THEN FAST
FJ 150 PRINT＂\｛CLR\}"CHRS(142);C HRS（8）：COLOR 0,15 ：COLOR 4，15：COLOR 6，15
GQ 160 PRINT TAB（12）＂\｛RED $\}$ \｛RVS\}\{2 SPACES\}E9 © ［2 SPACES］＂RTS：TAB（12）＂ \｛RVS\}\{2 SPACES\}\{OFF\} ［BLU］ 128 MLX ［RED］ \｛RVS\}\{2 SPACES]"RT\$:TAB （12）＂\｛RVS\}\{13 SPACES \} \｛BLU］＂
FE 170 PRINT＂\｛2 DOWN \}
［3 SPACES $]$ COMPUTEI＇S MA CHINE LANGUAGE EDITOR ［2 DOWN \}"
DK 18ø PRINT＂${ }^{\text {（BLK }}$ \}STARTING ADD RESSE4习习：GOSUB 260：IF \｛SPACE\}AD THEN SA=AD:EL SE $18 \varnothing$
FH 190 PRINT＂\｛BLK\}\{2 SPACES\}EN DING ADDRESS区4き＂：$G O S U B$ 260：IF AD THEN EA＝AD：E LSE 190
MF 200．PRINT＂\｛DOWN\}\{BLK]CLEAR \｛SPACE\}WORKSPACE [Y/N]? E4키：GETKEY AS：IF ASく＞＂ $\Psi^{\prime \prime}$ THEN 220
OH 216 PRINT＂\｛DOWN\}\{BLU\}WORKIN G．．．＂：：BANK 6：FOR A＝BS \｛SPACE\}TO BS+(EA-SA) +7 ： POKE A，$\varnothing$ ：NEXT A：PRINT＂D ONE＂
DC 220 PRINT TAB（10）＂\｛DOWN\} \｛BLK\}\{RVS\} MLX COMMAND \｛SPACE\}MENU E4Z(DOWN\}": PRINT TAB（13）＂\｛RVS］E \｛OFF\}NTER DATA"RTS;TAB( 13）＂\｛RVS\}D\{OFF\}ISPLAY D ATA＂RTS：TAB（13）＂［RVS］L \｛OFF\}OAD FILE"

HB 230 PRINT TAB（13）＂\｛RVS\}S \｛OFF\}AVE FILE"RT\$:TAB(1 3）＂$\{$ RVS $] C$（OFF］ATALOG DI SK＂RTS：TAB（13）＂\｛RVS\}Q \｛OFF\}UIT \{DOWN\} \{BLK\}"
AP 240 GETKEY AS：A＝INSTR（＂EDLS CQ＂，AS）：ON A GOTO 340,5 50，640，650，930，940：GOSU B 950：GOTO 240
SX 250 PRINT＂STARTING AT＂：$: G O S$ UB 260：IF（ $A D<>\varnothing$ ）OR（ $A \$=N$ L\＄）THEN RETURN：ELSE 250
BG 260 AS＝NLS：INPUT AS：IF LEN（ $A \$)=4$ THEN $A D=D E C(A S)$
PP $27 \varnothing$ IF AD＝ø THEN BEGIN：IF A \＄＜＞NLS THEN 30日：ELSE RE TURN：BEND
MA 280 IF AD＜SA OR AD＞EA THEN \｛SPACE\}300
PM 290 IF AD＞511 AND AD＜65280 \｛SPACE\}THEN PRINT BES:: RETURN
SQ 300 GOSUB 950：PRINT＂\｛RVS\} I NVALID ADDRESS［DOWN\} \｛BLK\}":AD=ø : RETURN
RD $310 \mathrm{CK}=\mathrm{FNHB}$（ AD ）： $\mathrm{CK}=\mathrm{AD}-\mathrm{Z} 4$＊ CK ＋Z5＊（CK＞Z7）：GOTO 336
DD 32 С $\mathrm{CK}=\mathrm{CK} * 22+25$＊（ $\mathrm{CK}>27$ ）+A
AH $33 \varnothing$ CK＝CK +25 ＊（CK＞Z5）：RETURN
QD 34■ PRINT BES：＂（RVS）ENTER
［SPACE］DATA＂：GOSUB 250 ：IF AS＝NLS THEN 220
JA 35ø BANK $9: P R I N T: F=\varnothing: O P E N 3$ ． 3
BR 360 GOSUB 318：PRINT HEXS（AD ）+ ＂：＂：：IF F THEN PRINT ［SPACE］LS：PRINT＂［UP］ （5 RIGHT）＂；
QA 370 FOR $\mathrm{I}=\emptyset$ TO 24 STEP $3: B \$$ $=S P S: F O R$ J＝1 TO 2：IF F \｛SPACE］THEN BS＝MIDS（LS， I $+\mathrm{J}, 1$ ）
PS 380 PRINT＂\｛RVS\}"BS+LFS;:IF ［SPACE］I＜24 THEN PRINT＂ \｛OFF\}":
RC 390 GETKEY AS：IF（AS＞：＂／＂AN D AS＜＂：＂）OR（AS＞＂＠＂AND ASく＂G＂）THEN 470
AC 400 IF AS＝＂＋＂THEN AS＝＂E＂：G OTO 470
QB 410 IF $A \$=" \sim "$ THEN $A S=" F ": G$ ото 470
FB 42ø IF AS＝RT\＄AND（ $(I=\varnothing)$ AN D（ $J=1$ ）OR F）THEN PRIN T BȘ；：J＝2：NEXT：I＝24：GOT 0480
RD 430 IF AS＝＂$\{$ HOME $\}$＂THEN PRI NT BS：J＝2：NEXT：I＝24：NEX T：F＝ø：GOTO 36ø
XB 440 IF （AS＝＂（RIGHT\}") AND $F$ THEN PRINT BS＋LFS：：GOT 0470
JP 450 IF AS＜＜LFS AND AS＜＞DLS \｛SPACE\}OR ( $(\mathrm{I}=6)$ AND（J ＝1））THEN GOSUB 95ø：GOT － 390
PS $460 \mathrm{~A}=\mathrm{LF} \$+\mathrm{SP} \$+\mathrm{LF} \$:$ PRINT B S ＋LF\＄；：J＝2－J：IF J THEN P RINT LFS；：I＝I－3
GB 470 PRINT AS；：NEXT J：PRINT \｛SPACE\}SPS:
HA 4B＠NEXT I：PRINT：PRINT＂\｛UP\} （5 RIGHT\}": :L $\$=$＂ \｛27 SPACES\}"
DP 490 FOR I＝1 TO 25 STEP 3：GE T\＃3，A\＄，BS：IF AS＝SP\＄THE N I＝25：NEXT：CLOSE 3：GOT － 220
BA 500 AS＝AS＋BS：A＝DEC（AS）：MIDS （ $\mathrm{L} \$, I, 2$ ）$=\mathrm{A}$ S：$I F \quad I<25$ THE N GOSUB $320: A(I / 3)=A: G E$ T\＃3，AS

AR 510 NEXT I：IF A＜＞CK THEN GO SUB 950：PRINT：PRINT＂
\｛RVS\} ERROR: REENTER LI NE＂：F＝1：GOTO 360
DX 52б PRINT BES：B＝BS＋AD－SA：FO R $I=0$ TO 7：POKE B＋I，A（I ）：NEXT I
$\mathrm{XB} 530 \mathrm{~F}=0: \mathrm{AD}=\mathrm{AD}+8: 1 \mathrm{~F} \mathrm{AD}<=\mathrm{EA} T$ HEN 360
CA 540 CLOSE 3：PRINT＂$\{D O W N\}$ \｛BLU\}** END OF ENTRY ** \｛BLK\}\{2 DOWN)":GOTO 650
MC 550 PRINT BES；＂\｛CLR］\｛DOWN\} \｛RVS\} DISPLAY DATA ":GO SUB 250：IF AS＝NLS THEN ［SPACE 220
JF $56 \emptyset$ BANK Ø：PRINT＂（DOWN\}
\｛BLU\}PRESS: \{RVS\}SPACE \｛OFF\} TO PAUSE, \{RVS\}RE TURN \｛OFF\} TO BREAKE4 ［DOWN］＂
XA 570 PRINT HEXS（AD）＋＂：＂：：GOS UB 310：B＝BS＋AD－SA
DJ $58 \emptyset$ FOR $\mathrm{I}=\mathrm{B}$ TO $\mathrm{B}+7: \mathrm{A}=\mathrm{PEEK}$（I ）：PRINT RIGHTS（HEXS（A）， 2）：SPS：：GOSUB 320：NEXT ［SPACE］I
XB 590 PRINT＂$\{\text { RVS })^{\prime ;}$ RIGHT\＄（HEX \＄（CK），2）
GR $600 \mathrm{~F}=1: \mathrm{AD}=\mathrm{AD}+8: I F \mathrm{AD}$ ：EA TH EN PRINT＂\｛BLU\}** END OF DATA＊＊＂：GOTO 220
EB 610 GET AS：IF AS＝RTS THEN P RINT BES：GOTO 220
OK 62б IF AS＝SPS THEN $F=F+1: P R$ INT BES；
XS 630 ON F GOTO 576，610，570
RF 640 PRINT BES＂\｛DOWN\} \{RVS $\}$ OAD DATA＂：OP＝1：GOTO 66 ©
BR 650 PRINT BES＂\｛DOWN\} (RVS\} S AVE FILE＂：OP＝$\varnothing$
DM $660 \mathrm{~F}=\mathrm{D}: \mathrm{F} \$=\mathrm{NL} \$:$ INPUT＂FILENA MEE4才＂； $\mathrm{FS}: \mathrm{IF}$ F\＄＝NLS THE N 220
RF 670 PRINT＂${ }^{\prime \prime}$ DOWN\} \{BLK\} [RVS]T \｛OFF\}APE OR \{RVS\}D\{OFF\} ISK：E43］：
SQ 680 GETKEY AS：IF AS＝＂T＂THE N 850：ELSE IF ASく＞＂D＂T HEN 680
SP 69ø PRINT＂DISK\｛DOWN\}":IF OP THEN 760
EH 700 DOPEN\＃1，（FS＋＂，${ }^{n}$ ），W：TF \｛SPACE］DS THEN AS＝DS：GO TO 740
JH $71 \varnothing$ BANK $\varnothing$ ：POKE BS－2，FNLB（S A）：POKE BS－1，FNHB（SA）：P RINT＂SAVING＂；FS：PRINT
MC 720 FOR A＝BS－2 TO BS＋EA－SA： PRINT\＃1，CHRS（PEEK（A））：： IF ST THEN AS＝＂DISK WRI TE ERROR＂：GOTO 75छ
GC 730 NEXT A：CLOSE $1:$ PRINT＂ ［BLU］＊＊SAVE COMPLETED \｛SPACE\}WITHOUT ERRORS * ＊＂：GOTO $22 \varnothing$
RA 740 IF DS＝63 THEN BEGIN：CLO SE 1：INPUT＂\｛BLK\}REPLACE EXISTING FILE［Y／N］\＆4 ＂：AS：IF AS＝＂Y＂THEN SCR ATCH（FS）：PRINT：GOTO 700 ：ELSE PRINT＂\｛BLK］＂：GOTO 660：BEND
GA 750 CLOSE 1：GOSUB 950：PRINT ＂\｛BLK\}\{RVS) ERROR DURIN G SAVE：E4才＂：PRINT AS：G OTO 220
FD 760 DOPEN\＃1，（F\＄＋＂，P＂）：IF DS THEN $A S=D S \$: F=4: C L O S E$ \｛SPACE\}1:GOTO 790

PX 770 GET\#1,AS,B\$:CLOSE 1:ADe ASC(AS)+256*ASC(BS):IF [SPACE]ADC>SA THEN F=1: GOTO 790
KB 780 PRINT"LOADING ": FS:PRIN T: $\operatorname{BLOAD}(F S), B \emptyset, P(B S): A D$ $=S A+F N A D(174)-B S-1: F=-2$ * ( $A D<E A)-3^{*}$ ( $A D>E A$ )

RO 790 IF F THEN 800:ELSE PRIN T" $\left\{\right.$ BLU ${ }^{* *}$ * LOAD COMPLETE D WITHOUT ERRORS **":GO то 220
ER 800 GOSUB 950:PRINT" [BLK]
\{RVS] ERROR DURING LOAD : E4g":ON F GOSUB B16,8 20,830,840:GOTO220
QJ BlD PRINT"INCORRECT STARTIN G ADDRESS (";HEXS(AD):" )": RETURN
DP 820 PRINT"LOAD ENDED AT ": H EXS(AD): RETURN
EB 830 PRINT"TRUNCATED AT ENDI NG ADDRESS ("HEX\$(EA)") ": RETURN
FP B40 PRINT"DISK ERROR ";AS:R ETURN
KS 850 PRINT"TAPE": AD=POINTER( F ) : $\operatorname{BANK} 1: A=\operatorname{PEEK}(A D): A$ $L=P E E K(A D+1): A H=\operatorname{PEEK}(A D$ +2)
XX 860 BANK 15:SYS DEC("FF68") , 0,1:SYS DEC("FFBA"),1, 1, $0: S Y S$ DEC("FFBD"), A, A L, AH:SYS DEC("FF9g"),12 B:IF OP THEN 890
FG 876 PRINT:A=SA:B=EA $1:$ GOSUB 920:SYS DEC("E919"), 3: PRINT"SAVING "; FS
$\mathrm{AB} \mathrm{BB} \quad \mathrm{A}=\mathrm{BS}: \mathrm{B}=\mathrm{BS}+(\mathrm{EA}-\mathrm{SA})+1: \mathrm{GOS}$ UB 920:SYS DEC("EA18"): PRINT"\{DOWN]\{BLU\}** TAP E SAVE COMPLETED **":GO TO 220
CP 890 SYS DEC("E99A"):PRINT:I F PEEK (2816)=5 THEN GOS UB 950:PRINT" $\{$ DOWN $\}$
[BLK\}\{RVS) FILE NOT FOU ND ":GOTO 220
GQ 9ø0 PRINT"LOADING ....\{DOWN\} ": $A D=F N A D(2817): I F$ AD<> SA THEN F=1:GOTO 800:EL SE $A D=\operatorname{FNAD}(2 B 19)-1: F=-2$ * (AD<EA) -3* (AD>EA)

JD $910 \mathrm{~A}=\mathrm{BS}: \mathrm{B}=\mathrm{BS}+(\mathrm{EA}-\mathrm{SA})+1: \mathrm{GOS}$ UB 920:SYS DEC("E9FB"): IF ST>日 THEN 8ø日:ELSE 7 90
XB 920 POKE193,FNLB(A): POKE194 - $\operatorname{FNHB}(\mathrm{A})$ : POKE 174 , FNLB $($ B): POKE 175,FNHB(B):RET URN
CP 930 CATALOG: PRINT" [DOWN\} \{BLU\}** PRESS ANY KEY F OR MENU **":GETKEY AS:G OTO 22ø
MM 940 PRINT BES" $\{$ RVS $\}$ QUIT
E43":RTS;"ARE YOU SURE (SPACE][Y/N]?":GETKEY A \$:IF AS<<"Y" THEN 220:E LSE PRINT" $\{C L R$ \}": BANK 1 5:END
JE 950 SOUND 1,500,10:RETURN
AF 960 IF ER=14 AND EL=260 THE N RESUME 300
MK 970 IF ER=14 AND EL=580 THE n RESUME REXT
KJ 980 IF ER=4 AND EL=780 THEN $F=4: A \$=D S \$$ :RESUME B 80
DQ 990 IF ER=30 THEN RESUME:EL SE PRINT ERR\$(ER):"ERR OR IN LINE"; EL

# MLX Entry Program For Apple Im Victor: Ediaioicl Progammer 

To make it easier to enter machine language programs into your computer without typos, COMPUTE is introducing its "MLX" entry program for the Apple II series. It's our best MLX yet. It runs on the II, II +, IIe, and IIc, and with either DOS 3.3 or ProDOS.

A machine language (ML) program is usually listed as a long series of numbers. It's hard to keep your place and even harder to avoid making mistakes as you type in the listing, since an incorrect line looks almost identical to a correct one. To make error-free entry easier, COMPUTE! generally lists ML programs for Commodore and Atari computers in a format designed to be typed in with a utility called "MLX." The MLX program uses a checksum system to catch typing errors almost as soon as they happen.

Apple MLX checks your typing on a line-by-line basis. It won't let you enter invalid characters or let you continue if there's a mistake in a line. It won't even let you enter a line or digit out of sequence. Best of all, you don't have to know anything about machine language to enter ML programs with MLX. Apple MLX makes typing ML programs almost foolproof.

## Using Apple MLX

Type in and save some copies of Apple MLX on disk (you'll want to use MLX to enter future ML programs in COMPUTE!). It doesn't matter whether you type it in on a disk formatted for DOS 3.3 or ProDOS. Programs entered with Apple MLX, however, must be saved to a disk formatted with the same operating system as Apple MLX itself.

If you have an Apple IIe or IIc, make sure that the key marked CAPS LOCK is in the down position. Type RUN. You'll be asked for the starting and ending addresses of the ML program. These values vary for each program, so they're given at the beginning of the ML program listing and in the program's accompanying article. Find them and type them in.

## Invalid Characters Banned

Apple MLX is fairly flexible about how you type in the numbers. You can put extra spaces between numbers or leave the spaces out entirely, compressing a line into 18 keypresses. Be careful not to put a space between two digits in the middle of a number. Apple MLX will
read two single-digit numbers instead of one two-digit number ( F 6 means F and 6, not F6).

You can't enter an invalid character with Apple MLX. Only the numerals 0-9 and the letters A-F can be typed in. If you press any other key (with some exceptions noted below), nothing happens. This safeguards against entering extraneous characters. Even better, Apple MLX checks for transposed characters. If you're supposed to type in A0 and instead enter 0A, Apple MLX will catch your mistake.

The next thing you'll see is a menu asking you to select a function. The first is (E)NTER DATA. If you're just starting to type in a program, pick this. Press the E key, and the program asks for the address where you want to begin entering data. Type the first number in the first line of the program listing if you're just starting, or the line number where you left off if you've already typed in part of a program. Hit the RETURN key and begin entering the data.

Once you're in Enter mode, Apple MLX prints the address for each program line for you. You then type in all nine numbers on that line, beginning with the first two-digit number after the colon (i). Each line represents eight bytes and a checksum. When you enter a line and hit RETURN, Apple MLX recalculates the checksum from the eight bytes and the address. If you enter more or less than nine numbers, or the checksum doesn't exactly match, Apple MLX erases the line you just entered and prompts you again for the same line.

Apple MLX also checks to make sure you're typing in the right line. The address (the number to the left of the colon) is part of the checksum recalculation. If you accidentally skip a line and try to enter incorrect values, Apple MLX won't let you continue. Just make sure you enter the correct starting address; if you don't, you won't be able to enter any of the following lines. Apple MLX will stop you.

## Edifing Features

Apple MLX also includes some editing features. The left- and right-arrow keys allow you to back up and go forward on the line that you are entering, so you can retype data. Pressing the CONTROL (CTRL) and D keys at the same time (delete) removes the character under the
cursor，shortening the line by one charac－ ter．Pressing CTRL－I（insert）puts a space under the cursor and shifts the rest of the line to the right，making the line one character longer．If the cursor is at the right end of the line，neither CTRL－D nor CTRL－I has any effect．

When you＇ve entered the entire list－ ing（up to the ending address that you specified earlier），Apple MLX automati－ cally leaves Enter mode and redisplays the functions menu．If you want to leave Enter mode before then，press the RE－ TURN key when Apple MLX prompts you with a new line address．（For in－ stance，you may want to leave Enter mode to enter a program listing in more than one sitting；see below．）

## Display Data

The second menu choice，（D）ISPLAY DATA，examines memory and shows the contents in the same format as the pro－ gram listing．You can use it to check your work or to see how far you＇ve gotten． When you press D，Apple MLX asks you for a starting address．Type in the address of the first line you want to see and hit RETURN．Apple MLX displays program lines until you press any key or until it reaches the end of the program．

## Save And Load

Two more menu selections let you save programs on disk and load them back into the computer．These are（S）AVE FILE and（L）OAD FILE．When you press S or L，Apple MLX asks you for the filename．The first time you save an ML program，the name you assign will be the program＇s filename on the disk．If you press L and specify a filename that doesn＇t exist on the disk，you＇ll see a disk error message．

If you＇re not sure why a disk error has occurred，check the drive．Make sure there＇s a formatted disk in the drive and that it was formatted by the same operat－ ing system you＇re using for Apple MLX （ProDOS or DOS 3．3）．If you＇re trying to save a file and see an error message，the disk might be full．Either save the file on another disk or quit Apple MLX（by pressing the Q key），delete an old file or two，then run Apple MLX again．Your typing should still be safe in memory．

## Apple MLX：Machine

Language Entry Program
For instructions on entering this program．
please refer to＂COMPUTE1＇s Guide to Typing in Programs＂elsewhere in this issue．
$8100 \mathrm{~N}=9$ ：HOME ：NORMAL ：PR INT＂APPLE MLX＂：POKE 34， 2：ONERR GOTO 615
cC 110 VTAB 1：HTAB 29：PRINT＂S TART ADDRESS＂；：GOSUB 53ø ：IF $A=\varnothing$ THEN PRINT CHR （ 7 ）：GOTO 116
BC $120 \mathrm{~S}=\mathrm{A}$

E3 130 UTAB 2：HTAB 20：PRINT＂E ND ADDRESS ${ }^{n} ;=$ GOSUB 530 $=$ IF $S>=A$ OR $A=$ THE N PRINT CHR\＄（7）：BOTO 13 $\emptyset$
26140 E＝A
B5 150 PRINT ：PRINT＂CHOOSE：（E） NTER DATA＂：：HTAB 22：PRI NT＂（D）ISPLAY DATA＂：HTAB B：PRINT＂（L）OAD FILE \＆ S）AVE FILE（Q）UIT＂：PRIN $T$
AE 160 GET AS：FOR I＝ 1 TO 5：I F A＜＞MID＊（＂EDLSQ＂，I， 1）THEN NEXT ：BOTO 160
${ }^{93} 170$ ON I GOTO 279，220，186， 260 ：POKE 34，0：END
AF 180 INPUT＂FILENAME：＂；A＊：IF A\＄＜＞＂＂THEN PRINT CHR （4）；＂BLOAD＂；A＂；＂，A＂：S
A1 190 GOTO 150
38206 INPUT＂FILENAME：＂；A\＄：IF A \ll＞＂＂THEN PRINT CHR
 L＂：（E－3）＋1
92210 GOTO 150
t2 220 EASUB 590：IF $\mathrm{B}=\mathrm{\sigma}$ THEN 156
$9 E 230$ FDR $\mathrm{B}=\mathrm{B}$ TO E STEP B：L $=$ 4：A＝B：GOSUE 500：PRIN TAs；＂：＂；a＝ 2
65 240 FDR－F $=\varnothing$ TO 7：V（F +1$)=$ PEEK（B＋F）：NEXT ：GOS UB 560：V $(9)=C$
F2 250 FOR $F=1$ TO $N: A=V(F):$ GOSUB 5Bg：PRINT AB＂＂3： NEXT ：PRINT ：IF PEEK（4 9152）＜ 128 THEN NEXT
94 260 POKE 4916日，ब：вOTO 150
CC 270 GOSUB 590：IF B $=\sigma$ THEN 150
48289 FOR B $=$ B TO E STEP B
A6 290 HTAB 1：A $=\mathrm{B}: \mathrm{L}=4:$ GOSUB SE日：PRINT AS：＂：＂；CAL
 SUB 330：IF L $=$ THEN 15 －
F9 369 GOSUB 479：IF F $<>$ N THE N PRINT CHR＊（7）： 90
27310 IF N $=9$ THEN BOSUB 566： IF $C$＜$\rangle$ V（9）THEN PRINT CHR ${ }^{\text {（ }}$（7）：$:$ EDTO 290
72320 FOR $F=1$ TO 日：POKE B＋ F－1，V（F）：NEXT ：PRINT ：NEXT ：BOTO 15®
BE 336 IF LEN（A\＄）$=33$ THEN A ＝O\＆：P＝O：PRINT CHRs（7 1；
 P：L＊＝＂n：IF P＞THEN $L$＝$=\operatorname{LEFT}$（ $A *, P$ ）
Ef $350 \mathrm{R}=\mathrm{F}=\mathrm{Mn}:$ IF $P<L-1$ THE N Rs $=$ RIGHT\＄（A），L－P－ 1）
55360 HTAB 7：PRINT L\％；：FLASH ：IF P＜L THEN PRINT MID ＊（ $A *, P+1,1$ ） $1:$ NORMAL： PRINT RE：
78 37＠PRINT＂$" ;$ ：NDRMAL
E6 $380 \mathrm{~K}=$ PEEK（49152）：IF K＜ 128 THEN 389
CI 390 PDKE 49168， $02 K=K-128$
58 4 øø IF K $=13$ THEN HTAB 7i PR INT A＊；＂＂；RETURN
9A 410 IF $K=32$ OR $K>47$ AND $K$ ＜ 5 E ORK $\mathrm{K}>64$ AND K＜ 7
1 THEN A＊$=$ L $\%$ CHR＊（K） $+R^{\prime \prime}: P=P+1$
C！ 420 IF $K=4$ THEN $A *=L \$+R$ 5F 430 IF $K=9$ THEN $A *=L \%+"$ ＂＋MID＊（AB，$P$＋ 1,1 ）＋ R\＄
th 440 IF $K=E$ THEN $P=P-(P$ $>$ ©

93450 IF $K=21$ THEN $P=P+(P$ （L）
90460 GOTO 336
$37470 \mathrm{~F}=1: \mathrm{D}=\boldsymbol{0}:$ FOR $\mathrm{P}=1 \mathrm{TO}$ LEN（ $A$ ）：：Cs＝MID ，1）：IF F＞N AND Cs 〈〉 ＂＂THEN RETURN
的 48 Cl IF C $\rangle$＂＂THEN GOSUB 529：$V(F)=J+16 *(D=$ 1）$V(F): D=D+1$
 $D=2$ THEN $D=0: F=F+$ 1
98 Søб NEXT ：IF $\mathrm{D}=$ THEN $F=$ F－1
17516 RETURN
85 $520 \mathrm{~J}=$ ASC（Cs）：J＝J－ 48 － 7 （J＞64）：RETURN
AB 536 A＝0：INPUT AS：A\＄＝LEFT －（ $A *, 4$ ）：IF LEN（ $A *$ ）＝ THEN RETURN
6F 548 FOR $P=1$ TO LEN（As）：Cs ＝MID＊（AB，P，1）：IF C＊＜ ＂む＂OR C＊＞＂9＂AND C\＄＜ ＂A＂OR Cs＞＂Z＂THEN A＝ Ø：RETURN
20 550 GOSUB 529：A $=A * 16+J$ ： NEXT ：RETURN
$28568 \mathrm{C}=$ INT（ $\mathrm{B} / 256$ ）： $\mathrm{C}=\mathrm{B}-$ 254 ＊C－255（（C） 127 ） $\mathrm{C}=\mathrm{C}-255$（ $\mathrm{C}>255$ ）
21570 FOR F $=1$ TO 日：C＝C 2
 $c=c-255$（ C ＞255）： NEXT ：RETURN
时500 I＝FRE（ 0 ）：A $=\mathrm{mN}$ ：FOR $I=1$ TD LzT＝INT（A／／ 1 6）$:$ A＊$=$ MID＊（＂ø123456789 ABCDEF＂，$A=16+T+1,1)$ ＋AS：A＝T：NEXT ：RETUR N
If 59® PRINT＂FROM ADDRESS＂；： OSUB 530：IF 9 ＞A ORE＜ $A$ OR $A=$ THEN $B=$ g：R ETURN
 （ B）：RETURN
B6 G16 PRINT＂DISK ERROR＂：GOTO 158

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    PRINT"Copyright 1987":PRINT"Comp utel publications, Inc."4
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    $\mathrm{X}=1$ TO 2000:NEXT X4
    CLS 4
    MainLine:4
    GOSUB HouseKeeping
    GOSUB ParameterEntry 4
    GOSUB DefineFieLds4
    IF NoErrars THEN 4
    GOSUB CreateZoofile4
    GOSUB FiLeMaintenance
    END IF4
    GOSUB EndJob4
    END 4
    Housekeeping: 4
    DEFINT a-z4
    WINDOW 1,"The Zookeeper", (9,56)-
    ( 500,186 ), 154
    TRUE $=-14$
    FALSE= 14
    HeaderBytes= 264
    CoLorMapBytes $=64$
    RETURN4
    4
    ParameterEntry: 4
    PRINT4
    INPUT "Enter name of AmigaBASIC object file: ", FiLename\$4
    INPUT "Enter maximum number of $d$ ata elements per statement: "،Ma xBytes 4
    PRINT 4
    RETURN4
    4
    DefineFields: 4
    PRINT "Input file: ";FiLename\$4 OPEN FiLenameS FOR INPUT AS 14 Image $\$=$ INPUTS(LOF (1) , 1) *
    CLOSE 14
    Depths $=$ CVL $($ MIDS $($ Image $\$, 9,4)) \leftarrow$

[^6]:    Log in new disk
    New block
    Rewrite block
    Move to next block
    Move to previous block
    Move to next track
    Move to previous track
    Change byte under cursor
    Text mode
    Double side select

[^7]:    ```
    7279 PIANO MAN V3
    477 NAMEGRAM/BR
    5 T30 PCFFLE REAK DOWMFOME WORD
    5,730 PC.FILE * an excellent dalabase
    manager for labeis. Inventory and form letters
    \square78.627 PC-WRITE VERSION 2.74 A DOwerful
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