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# COMPUTE <br> JULY 1987 <br> VOLUME 9 <br> NUMBER 7 <br> ISSUE 86 



[^0]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 Officen 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 Comodore's North American operations, and Alan Gauthier, vice president of finance. 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 resulted 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 Commodore, 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 potential 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 valwe 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' Exposition (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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COMPUTE! Books is bringing you a brand new line up of books for your Commodore 64 and 128. These recent releases offer you everything from programming hints to exciting games, from educational to home and business applications.


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## 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 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. Turn 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

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its own, custom-tailored 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 \$006C-\$006F) to point to an IRET instruction which it places at address \$0180, a normally unused location.

```
D DEF SEG=\varnothing
    SEGMENT
1g POKE &H18g,&HCF 'POKE 18\emptyset
    WITH MACHINE INSTRUCTION FO
R IRET
2\emptyset POKE &H6C,&HB\varnothing 'LOW BYTE
    OF 180
3\varnothing POKE &H6D, &H1 'HIGH BYTE
    OF 180
4\emptyset POKE &H6E,\emptyset 'g'S FOR
SEGMENT
5ø POKE &H6F,\emptyset
6\emptyset FOR I=1 TO 1ø\emptyset\emptyset: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, 5
MOV DS, AX
MOV BX, D18gh
MOV AX, 日CF
MOV [BX], AX
XCHG BX, DX
MOV AH, 225 h
MOV AL, $\varnothing 1 \mathrm{Bh}$
INT 21 h
INT 20
; SET DATA SEG READ-WRITE TO Ø
; CHANGE LOCATION 189 h
; TO OPCODE FOR IRET
DOS NEEDS LOCATION FOR IRET IN DX
SETUP FOR DOS INTERRUPT CHANGING SERVICE 25 h
INTERRUFT NUMBER TD BE CHANGED
; DOS INTERRUPT
; RETURN TO 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 $S A$, 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, $2 \uparrow$ 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 $53248+S N$

* 2 , where $S N$ 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, $2 \uparrow$ 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, $2 \uparrow \mid S N$, 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 1ø23:POKE $I$ , 170:NEXT
QH 30 REM PUT IN STRIPE
HJ $4 \emptyset$ FOR $I=\emptyset$ TO 5
XA 50 POKE $832+\mathrm{I}+12,255$ : POKE 8 $96+\mathrm{I}+36,255$ : POKE $960+\mathrm{I}+5$ 7,255
HH 60 NEXT I
JA $7 \varnothing$ REM PUT IN SECOND MULTIC OLOR STRIPE
CX $8 \emptyset$ FOR $I=\emptyset$ TO 8
PH $9 \varnothing$ POKE 832+I+18,85: POKE 89 $6+I+42,85$ : POKE $960+1,85$
AP $10 \emptyset$ NEXT I
KA $11 \varnothing$ REM $P()$ IS POINTER
SJ $12 \varnothing \mathrm{P}(1)=13: P(5)=14: P(6)=14$
CQ 130 REM $x()$ IS HORIZONTAL $P$ OSITION
FF $140 \times(1)=9 \varnothing: X(5)=2 \varnothing \varnothing: X(6)=2$ $8 \varnothing$
RX 150 REM $Y()$ IS VERTICAL POS ITION
$\mathrm{XC} 160 \mathrm{Y}(1)=99: Y(5)=88: Y(6)=77$
RE $17 \varnothing$ REM TURN ON SPRITES 98= $2 \uparrow 1+2 \uparrow 5+2 \uparrow 6$
HE 18Ø POKE 53269,98
SA 190 REM MAKE THEM ALL MULTI COLOR
DF $20 \emptyset$ POKE 53276,98
XP 210 REM SET MULTICOLORS TO \{SPACE \} YELLOW, BLACK
HM 22 Ø POKE 53285,7:POKE 53286 , $\varnothing$
DH 230 REM SET SPRITE PRIMARY \{SPACE \} COLOR
EQ 240 POKE 53288,1:POKE 53292 ,2:POKE 53293,3
DK 250 FOR SN=ø TO 7
GH 260 IF $\mathrm{P}(\mathrm{SN})=\varnothing$ THEN $36 \varnothing$
JE $27 \varnothing \mathrm{P}(\mathrm{SN})=\mathrm{P}(\mathrm{SN})+1: \operatorname{IF} \mathrm{P}(\mathrm{SN})=$ 16 THEN $\mathrm{P}(\mathrm{SN})=13$
CK 280 POKE $2 \varnothing 4 \varnothing+$ SN, P(SN)
CR $29 \varnothing \mathrm{Y}(\mathrm{SN})=\mathrm{Y}(\mathrm{SN})+2$
SS 3 Øø IF $\mathrm{Y}(\mathrm{SN})>255$ THEN $\mathrm{Y}(\mathrm{SN})$ $=32$
MR 310 IF $\mathrm{X}(\mathrm{SN})>256$ THEN $34 \varnothing$
AK $32 \varnothing$ POKE $53248+$ SN * $2, \mathrm{X}(\mathrm{S}$ N) : POKE $53264, \operatorname{PEEK}(5326$ 4) AND ( $255-2 \uparrow$ SN $)$ : GOTO 3 50
SP $33 \emptyset$ REM FAR RIGHT
FQ 340 T=X(SN)-256:POKE 53264, PEEK(53264) OR $2 \uparrow$ SN
SQ 350 POKE $53249+$ SN * 2,Y(S N)

MQ 360 NEXT SN:GOTO25ø

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Even if your contest entry doesn't win a prize, you will still earn purchase fees if we accept your program for publication.

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1. Entries must be your original work, previously unpublished in any form. All those whose programs are accepted will be required to affirm this in writing.
2. You can submit as many entries as you want, but we cannot consider programs which have been either entered in other contests or submitted for publication elsewhere at the same time.
3. The contest deadline is October 31, 1987. All entries must be received at our offices by this date. Programs submitted after this date will still be considered for publication, but will not be entered in the contest. If we purchase an entry for publication before the deadline, the entry is still eligible to win.
4. Entries are allowed (and encouraged) in virtually all software categories: home and business applications, education, recreation, telecommunications, graphics, sound and music, and utilities.
5. Entries may be written in any programming language-including BASIC, C , machine language, Pascal, and Modula-2-as long as they meet two requirements. First, if you're using a compiled language, the compiled object or runtime code must be a self-standing program that can be run by someone who doesn't own a copy of the language. (Interpreted BASIC is an exception. It can be assumed that nearly everyone owns a copy of BASICA or GWBASIC.) Second, we must be able to legally distribute the program without incurring licensing fees or other obligations to the maker of the language. If you're not sure whether a certain language qualifies, contact its maker for clarification.
6. Entries must be submitted on $51 / 4$-inch floppy disks. If your program is written in a compiled language, you must submit both the runtime code and all of the source code required to compile the program.
7. Entries must be accompanied by an article which explains how to use the program and what it does. If your program employs any new or unusual techniques that you think will be of interest to other programmers, you can also describe how the program works. (If you feel that writing is not your strong point, please do not hesitate to enter; this is a programming contest and the entries will be judged solely on the basis of the programs submitted.)
8. Submissions which do not win a prize and are not accepted for publication will be returned only if accompanied by a selfaddressed, stamped mailer.
9. The staff of COMPUTE! Publications, Inc., will judge the contest, and all decisions regarding contest entries and acceptances will be solely at the discretion of COMPUTE! Publications, Inc. All decisions are final. This includes decisions regarding creativity, similarity among entries, and general suitability
10. Winners will be announced by COMPUTE! Publications, Inc., in early 1988.
11. This contest is void where prohibited by law. Full-time, parttime, and previous employees of COMPUTE! Publications, Inc. and Capital Cities/American Broadcasting Corporation are ineligible for the contest, but may still submit work for publication at standard rates.

Every contest entry must include this signed form:
I warrant that the program presently entitled $\qquad$ is my own original work and that the work has not been submitted for consideration elsewhere, nor has it been previously published in any form. If my work is accepted by you, I understand that your decision as to the selection of winners and awarding of prizes is final and without recourse on my part. Should you select my submission, I understand that I will receive no payments until I sign your standard contract, which includes assignment of the copyright of the program to COMPUTE! Publications, Inc., and that you may use my name and image in promotional materials and other forms. (If you are under age 18, your parent or legal guardian must sign for you.)

## Signature:

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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, 512 K 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, 512K 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 $360 \mathrm{~K} 5^{1 ⁄ 2}$-inch disk drive, the Hyundai-built Blue Chip XT currently retails for $\$ 699$, with a green monochrome monitor available for
an additional $\$ 99$. The $X T$ 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 384K RAM (expandable to 640K), two 360K 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 256K RAM (expandable to 640 K through Tandy's Memory PLUS Expansion Adapter) and a single $360 \mathrm{~K} 5^{1 / 4}$-inch disk drive for $\$ 599$, and the SX, with two 360K 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 360K 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 $\$ 799.95$ 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 640K 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 Radin 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 20percent school discount offered by

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 $31 / 2$-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 $3^{11 / 2}$-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 $3^{1 / 2}$ inch drives, and is enthusiastic because the manufacturing cost of such drives is less than that for traditional $5 \frac{1}{4}$-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, $\mathrm{OS} / 2$ 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

c/o Vidco
1915 Harrison Rd.
Longview, TX 75604
Atari
1196 Borregas Ave.
Sunnyvale, CA 94086
Blue Chip Electronics
7305 West Boston Ave.
Chandler, AZ 85226
Commodore Business Machines

## 1200 Wilson Dr.

West Chester, PA 19380
Franklin Computer
Route 73 / Haddonfield Rd.
Pennsauken, NJ 08110
International Business Machines
Information Systems Group
900 King St.
Rye Brook, NY 10573
Leading Edge
21 Highland Cir.
Needham Heights, MA 02194
PC's Limited
1611 Headway Cir., Building 3 Austin, TX 78754
Tandy / Radio Shack
1800 One Tandy Center
Fort Worth, TX 76102
Vendex Pacific
40 Cutter Mill Rd., Suite 438
Great Neck, NY 11021
Victor Technologies
380 El Pueble Rd.
Scotts Valley, CA 95066

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$\$ 16.95$ ISBN 0-87455-047-5

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## C. Regena

Here's your introduction to the new and powerful BASIC on the Amiga personal computer. The Amiga's impressive graphics, animation, and sound can be unlocked with the right commands, and BASIC is the place to start. Complete descriptions of Amiga BASIC's commands, syntax, and organization take you from the beginner level to a full-fledged programmer. Plus, the book offers you ready-to-type-in programs and subroutines while showing you how to write your own programs. There is a disk available which includes the programs in the book, $\$ 12.95$. This title is also available as a book/disk combination for $\$ 29.95$ (057-2).
\$14.95 ISBN 0-87455-041-6


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## \$17.95 ISBN 0-87455-028-9

## Advanced Amiga BASIC

Tom R. Halfhill and Charles Brannon
This guide to applications programming on Commodore's new Amiga contains everything an intermediate programmer requires to begin creating sophisticated software on this powerful machine, including several ready-to-type-in programs. Clear, yet comprehensive documentation and examples cover advanced BASIC commands, designing graphic applications, generating sound and music, using the Amiga's built-in speech synthesizer, creating a user interface, and programming the computer's peripherals. There is a disk available which includes the programs in the book, $\$ 15.95$. (June release)
\$17.95 ISBN 0-87455-045-9

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the Amiga the Amiga
Dan McNeill
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Sheldon Leemon
The Amiga, Commodore's powerful new computer, is an extraordinarily impressive graphics machine. Easy to use, the Amiga can produce color graphics and excellent animation. You'll find thorough descriptions of the computer's abilities and the hardware required to create a complete graphics system. Software. too, is central to the Amiga's power, and complete tutorials show you how to get the most from the machine. (June release)
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Edward H. Carlson
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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 Bit 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 MCI 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

## QuanfumLink

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 II-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


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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 IIGS, 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 I 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

## Partner

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 IIGs'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 love.
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, 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 36hour 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．

1 1ヵ REM Copyright 1987 COMPUTE！ Publications，Inc．All righ ts remarved
29 GOSUB 152ø
$3 \emptyset$ PRINT＂The Weather Wizard＂ $4 \varnothing$ PRINT
5ø PRINT＂Copyright 1987 COMPUT E！Publications＂：PRINT＂All R ights Reserved
6Ø FOR J＝1 TO 3øøø：NEXT J
7ø GOSUB 152の
8ø PRINT＂Enter month（use numb
er）＂；：MIN＝1：MAX＝12：GOBUB 139
ø：$M=E$
9\％PRINT＂Enter Day＂；：MIN＝1：MAX ＝31：GOSUB 139ø：D $=E$
1 1øø PRINT＂Enter the Year＂；aMIN

E
11ヵ GOSUB 152ø
126 PRINT＂Pleame input numbers when prompted by ？＂
130 PRINT
$14 \varnothing$ PRINT＂From the menu enter the number corres－＂
$15 ø$ PRINT＂ponding to the wind
direction
160 PRINT
$17 \emptyset$ PRINT＂N＝North，S＝South， Em Eagt，W＝West＂
18ø PRINT＂（Note：The direction ＂are where the＂
$19 \emptyset$ PRINT＂wind comes from，not where it in going．＂
2 2gø PRINT＂So，＇NE＇means a win d blowing out of＂
$21 \varnothing$ PRINT＂the northeast．）＂
220 PRINT
$23 \varnothing$ PRINT
$\qquad$ WIND DIREC

TION MENU
24ø PRINT
$25 \varnothing$ PRINT＂1．N＂SPC（4）＂2．NE＂SP C（3）＂3．E＂
$26 \emptyset$ PRINT
27ø PRINT＂4．SE＂SPC（3）＂5．S＂SP C（4）＂6．SW＂
28ø PRINT
29ø PRINT＂7．W＂SPC（4）＂日．NW＂SP C（3）＂9．NO WIND＂
$36 \square$ PRINT
$31 \varnothing$ PRINT
320 MIN＝1：MAX＝9：GOSUB 1390：W＝
E
33ø GOSUB 152ø
$34 \varnothing$ PRINT＂Enter barometric pre seure＂：PRINT＂in inches of $H$
g（ax．29．95）＂；
35ø MIN＝27：MAX＝33：GOSUB 148．：BP $=E$
उ6ø EOSUB $152 \varnothing$
$37 \emptyset$ PRINT＂Plaase enter the num
ber that demeribeg＂
38g PRINT＂currant barometric a ctivity．＂
39ø PRINT＂Barometer im：1．mte ady＂
4øø PRINT SPC（14）＂2．rising fas t＂
410 PRINT SPC（14）＂3．slowly ris ing＂
42ø PRINT SPC（14）＂4．falling fa st＂
43』 PRINT SPC（14）＂5．slowly fal ling＂
44ஜ PRINT
45ø $M I N=1: M A X=5$ ：GOSUB 139ø：BD $=$ E
46 G GOSUB 1520
$47 \varnothing$ PRINT＂Pleame enter the num
ber for the main＂
$48 \emptyset$ PRINT＂cloud type for your location．＂
$49 \varnothing$ PRINT
5øø PRINT＂1．Cirrus＂：PRINT＂2． Cumulonimbus＂：PRINT＂3．Stra
tus＂
51ø PRINT＂4．Nimbostratus＂：PRI NT＂5．Altostratus＂：PRINT＂6． Al tocumulus＂
$52 \emptyset$ PRINT＂7．Cirrogtratus＂：PRI NT＂8．Cumulus＂：PRINT＂9．No clouds＂：PRINT
530 MIN＝1：MAX＝9：GOSUB 139Ø：C＝

## E

540 GOSUB 1520
55ø PRINT＂Input Humidity＂：PRIN

T＂（ax．input 5ø for 5ø\％hum
idity）＂；
56ø MIN＝ø：MAX＝190：GOSUB 148ø：H
$=E$
57ø GOSUB 152ø
5日ø PRINT＂Input Tmmperature in
Fahrenheit＂：PRINT＂（ex． 63
$=63$ dag．F）＂；
59ø MIN＝－13ø：MAX＝13ஜ：GOSUB 148ø $: T=E$
6ஜロ BOSUB 152g
61ø REM FORECASTS
620 IF BP $>29.9$ THEN 71.
63ø IF（ $W>=1$ AND $W<=5$ ）AND $B D=4$
AND BP＞29．7 THEN $86 \Xi$
640 IF $(W\rangle=6$ AND $W\langle=8$ ）AND（BD）
$=1$ AND $B D<=3$ ）AND $T>75$ AND
H $>68$ THEN 910
65 I IF $(W)=6$ AND $W<=8)$ AND（ $B D=$
2 OR BD＝3）THEN 930
$66 \varnothing$ IF BP $>29.7$ THEN $81 \varnothing$
$67 \varnothing$ IF（ $\mathrm{BD}=2$ OR $\mathrm{BD}=3$ ）THEN $194 \varnothing$
68ø IF（ $W>=1$ AND $W<=5$ ）AND $B D=4$ THEN 111ø
690 IF（ $W=2$ OR $W=3$ ）AND $B D=5 \mathrm{TH}$
EN $112 \sigma$
7øஜ BOTO 81ø
$71 \emptyset$ IF $(W)=6$ AND $W<=8)$ AND（ $\mathrm{BD}=$
1 OR BD＝3）AND $T>75$ AND $H>7$
ๆ THEN 95ø
729 IF（W）＝6 AND $W<=8$ ）AND（ $\mathrm{BD}=$ 1 OR $\mathrm{BD}=3$ ）THEN 970
$73 \emptyset$ IF $W=4$ AND $B D=5$ THEN 1 1øø
$74 \emptyset$ IF $W=4$ AND $B P>30.5$ AND（ $\mathrm{BD}=$
4 OR BD＝5）THEN 1 102
$75 \emptyset$ IF（ $W=4$ OR $W=5$ ）AND $B D=4 \mathrm{TH}$ EN 1．66g
76ø IF（ $W=4$ OR $W=5$ ）AND $B D=5 \mathrm{TH}$ EN 188
779 IF（ $W=3$ OR $W=4$ ）AND $B D=4 \mathrm{TH}$ EN 1990
$78 \emptyset$ IF $W=5$ AND（ $\mathrm{BD}=4$ OR $\mathrm{BD}=5$ ）$T$ HEN BGஜ
$79 \emptyset$ IF $(W=1$ QR $W=2)$ AND $B D=4 \mathrm{TH}$ EN $114 \%$
Bøஜ IF（ $W=1$ OR $W=2$ ）AND $B D=5 \mathrm{TH}$ EN 116 g
81ø ON C GOTO 118币，121ø，126ø， 128ø，13øø，82ø，131ø，84ø
，84ஏ
B2ø IF $T>75$ AND $H>68$ THEN $95 \emptyset$
日3ø GOTO 131g
840 IF T＞75 AND H＞68 THEN $133 \emptyset$
85g GOTO 134
BGø PRINT＂FORECAST：STRONG WIN
DS and HEAVY＂
87ø PRINT＂PRECIPITATION CAN BE EXPECTED within＂
B日ø PRINT＂the nixt 6－24 hours．
Lower tempara－＂
89ø PRINT＂tures are also forec ast．＂
9øø GOTO 1530
919 PRINT＂［SMALL CHANCE OF THU NDERSTORMS TODAYJ＂
926 PRINT
930 PRINT＂FORECAST：FAIR weath er can be expected＂
940 PRINT＂for the next 24 to 3 6 hours＂：GOTO 1530
95ø PRINT＂［SLIGHT CHANCE OF TH UNDERSTORMS TODAYJ＂
$96 \boxed{0}$ PRINT
970 PRINT＂FORECAST：Continued
FAIR weather for＂
98ø PRINT＂the next 24 hours．
Temperatures will＂
99® PRINT＂remain nearly consta nt．＂：GOTO 1530
1øøø PRINT＂FORECAST：PRECIPITA
TION can be expected＂
1ø1ø PRINT＂in 24－4日 hrg．＂：E0 TO 153ஜ
1ヵ2ø PRINT＂FORECAST：WARMER te

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mparatures for the＂
1øアø PRINT＂next 24 hourg．＂：BOT 01536
1ø4ø PRINT＂FORECAST：Clear wea ther ahead with＂
1 1ø5ø PRINT＂cooler temperatures －＂：BDTO 153』
1 1ø6 PRINT＂FORECAST：HIGH WIND 3 and PRECIPITATION＂
1ø7ø PRINT＂within 12 hours．＂： OTO 153
I $\sigma$ EG PRINT＂FORECAST：PRECIPITA TION within 24 hours．＂：GOT
01530
1ø9ø PRINT＂FORECAST：HIEH WIND 5 and PRECIPITATION＂
11øø PRINT＂within 24 hourm．＂： OTO 153Ø
111ø PRINT＂FORECAST：SEVERE we ather：stormy with＂：PRINT＂
high winds．＂：GOTO 153g
$112 \emptyset$ PRINT＂FORECAST：Continuin g precipitation can＂
$113 \varnothing$ PRINT＂be expected for the next 12 to 24 hours．＂：GOT
0 1535
114ø PRINT＂FORECAST：STORMS wi th HIGH WINDS within＂
$115 \emptyset$ PRINT＂ 24 hours．Cooler $t$ emperatures as well．＂：GOTO 1539
1165 PRINT＂FORECAST：Precipita tion within 24－36＂
$117 \emptyset$ PRINT＂hours，slightly coo ler temperatures．＂：GOTO 15
$3 \varnothing$
118ø PRINT＂FORECAST：If cirrus clouds are＂
1190 PRINT＂increasing and beco ming more dominant＂
12øø PRINT＂we can expect warme $r$ weather．＂：GOTO 153\％
121ø PRINT＂FORECAST：5ø－8ø\％ch ance of preci－＂
1220 PRINT＂pitation within the next 24－36 hours．＂
1230 PRINT＂Chance of precipita tion will incraase＂
$124 \varnothing$ PRINT＂with the accumulati on of more cumulo－＂
$125 \varnothing$ PRINT＂nimbus type clouds． ＂：BOTO 153g
126छ PRINT＂FORECAST： $10-26 \%$ ch ance of＂；：IF T＞35 THEN PR
INT＂showerg＂：日OTO 153ø
$127 \emptyset$ PRINT＂gnow flurries＂：GOTO 1539
128ø PRINT＂FORECABT：96\％chanc －of HEAVY precipi－＂
1290 PRINT＂tation within 12－24 hours．＂：BOTO 1530
13øø PRINT＂FORECAST：Chance of light precipitation＂：GOTO 1530
131ø PRINT＂FORECAST：PRECIPITA TION with HEAVY＂
1326 PRINT＂winds in 24－48 hour g．＂：GOTO 153Ø
133ः PRINT＂［POSSIBILITY OF THU NDERSTORMS TODAYI＂
$134 \%$ PRINT＂FORECAST：FAIR wat her today with light＂
$135 \varnothing$ PRINT＂to moderate winde．＂ ：BOTO 153
$136 \varnothing$ REM integer input routine
1379 PRINT＂enter an integar be
twean＂；MIN；＂and＂；MAX
138ほ PRINT＂，try again＂

 ＂THEN 137
1419 IF $E<>$ INT（E）THEN PRINT＂$p$ lease enter an integer＂；：
OTO 1386

142ø IF MIN＞E THEN PRINT＂too 1
OW＂；：GOTO 138の
143 IF EPMAX THEN PRINT＂too $h$ 1gh＂；：GOTO 1389
144\％RETURN
$145 \varnothing$ REM real number input rout ine
$146 \%$ PRINT＂enter a number betw emn＂；MIN；＂and＂；MAX
1479 PRINT＂，try again＂
148ø INPUT E
छ AND LEFT $(E \neq 1)<>" \emptyset "$ THE
N $146 \emptyset$
$149 \varnothing$ IF MIN＞E THEN PRINT＂too 1 OW＂；：GOTO 147
15øø IF EPMAX THEN PRINT＂too h
igh＂；：GOTO 1470
1516 RETURN
1529 CLS：RETURN
153ø PRINT：PRINT M；＂／＂；D；＂／＂；Y； PRINT
$154!$ PRINT＂Temperature i ：：＂； ；＂deg．F＂：PRINT
155ø PRINT＂Humidity is：＂；H；＂\％ ＂：PRINT
156ø PRINT＂Barometric Pressure
im：＂；BP；＂in．Hg＂
157ø FOR J＝1 TO 35øø：NEXT J
158ø PRINT ：PRINT ：PRINT：PRINT ：PRINT
1590 PRINT＂PRESS＜RETURN＞to m ake another forecast
$16 \emptyset \emptyset$ INPUT P\＄
$161 \emptyset$ GOSUB $152 \emptyset$
1620 GOTO 120
Program 2：IBM PC／PCjr Line Changes

5 KEY OFF：DEF SEG＝ø：PDKE 1ø47，P EEK（1ø47）OR 64：WIDTH 4ø：LOCA TE ，，

## Program 3：Commodore 64 Line Changes

$1390 \mathrm{E} \$=" \mathrm{"}:$ INPUT $\mathrm{E} \$: \mathrm{E}=\mathrm{VAL}(\mathrm{E} \$$
$148 \emptyset \mathrm{ES}=\mathrm{"}$＂：INPUT E ：$: \mathrm{E}=\mathrm{VAL}(\mathrm{E} \$$ ）：$I F E=\varnothing$ AND $\operatorname{LEFT} \$(E S, 1)<>"$ Ø＂THEN $146 \emptyset$
$152 \emptyset$ PRINT CHR\＄（147）；：RETURN

## Program 4：Atari 400，800， XL，and XE Line Changes

 ：POKE 82，$\ddagger$ ：POKE 83，39
B6 6 FOR J＝1 TO 999：NEXT J
KO 25ø PRINT＂1．N
\｛4 SPACE 3）2．NE
〔3 SPACES\}3. E"
CI 27 PRINT＂4．SE ［3 SPACES\}5. 5 \｛4 SPACES\}6. SW"
6J 29 D PRINT＂7．W〔4 SPACES\}日. NW （3 SPACES\}9. NO WIND"
N 3 395 T\＄＝＂\｛14 SPACES\}": REM 1 4 SPACES
HC 4øø PRINT T\＆；＂2．RISING F AST＂
DA 41 PRINT T\＄；＂3．SLOWLY R ISING＂
KH 420 PRINT T\＆；＂4．FALLING FAST＂
日F 436 PRINT T\＄；＂5．SLOWLY F ALLINE＂
 ＞＂9＂OR E象く＂g＂THEN 1370
$0 E 140 \varnothing$ E＝VAL（E ）
IL 148 E E\＄＂＂：INPUT E\＄：IF E\＄ ＞＂9＂OR E\＄く＂ø＂THEN 146 g
PB 1485 E＝VAL（E\＄）
AL 1520 ？CHR（ 125 ）：RETURN
HN 157 FOR $J=1$ TO 999：NEXT $J$

## Program 5：Apple II Line Changes

1529 HDME ：RETURN

## Program 6：Atari ST Line Changes

| 1 | $\begin{aligned} & \text { rem delete } 16 \varnothing, 24 \varnothing, 26 \varnothing, 28 \\ & \varnothing, 3 \varnothing \varnothing \end{aligned}$ |
| :---: | :---: |
| 5 | fullw 2 |
| 120 | ？＂Input numbers when prom pted by ？＂ |
| 130 | ？ |
| 1520 | clearw 2：gotoxy 6， $0:$ retur |
| 158g | ？：？：？ |

## Program 7：Amiga Line Changes

5 SCREEN 1，32ø，2øø，4，1：WINDOW 3， ＂＂，$(\varnothing, \varnothing)-(311,186), 16,1:$ WINDOW 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 COMPUTE!, 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 $3^{1 / 2}$ 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 \$800version 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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## Sandbox Fred Rides The Wild Electrons

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It gives you goose bumps seeing yourself captured on a video image and watching the computer digitize it and transmit it over the telephone line to another person far away. You feel the same sense of awe and wonder that an isolated tribesman in the bush must feel when he first sees himself in a photograph.

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" Newsletłer

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 IIc 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, so 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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Maxell:
SSDD ......................... $\$ 15.95$
DSDD …........................... \$21.95
Verbatim:
SSDD .......................... \$16.95
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## ^ATARIST

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GFL Football Game Maker Hacker Hacker 2 Leather Godd Little People Moonmist Music Studio Paint Works Shanghai Tass Times Bureaucracy Data Soft: Mercenary Mercenary - 2 Alt. Reality - T Alt. Reality-Du Microprose: Silent Service F-15 Strike Ea Optimized Sy Personal Pasc Personal Prolo Strategic Sim Phantasie Phantasie II .. Road War 200 Colonial Conq Epyx: Apshai Trilogy Sub Battle Sin Super Cycle. World Games Wrestling Karate Champ Firebird: Pawn Starglider Golden Path Guild of Thiev Tracker
VIP:
Accounts ...... VIP Profession Unison World Art Gallery 10 Print Master.
Zoom:
Zoomracks ...
Zoomracks II
Microleague:
Microleague B General Mana
com

Broderbund:
Bank St. Write Carmen San D Champ. Lode Graphic Lib. I, Karateka ....... Print Shop .... Print Shop Con Print Shop Pap Science Kit ... Lode Runner Bank St. Filer Bank St. Maile Access: Leader Board Mach 5 ......... Mach - 128 . 10th Frame ... Exec. Tournam Tournament \#

VISA ${ }^{\circ}$

## 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 XL/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
- ABC'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 lan－ guage 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 opera－ tions．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 capa－ ble of．But nobody seems to have written a book that shows，in a simple direct manner，how to con－ vert the most common and useful operations of Atari BASIC into as－ sembly language．

In particular，the topic of Atari graphics is poorly covered．There have been volumes written on display－list interrupts，player－ missile 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 well－ designed the Atari Operating Sys－ tem（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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## 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 20020－ 21060 on page 48.

## Applesoft Memory Management

The＂Readers＇Feedback＂column from the June issue included a question about moving an Apple－ soft 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 com－ plete line should read as follows：
5 IF PEEK（104）＜＞64 THEN POKE 104，64： POKE 16384，0：PRINT CHR\＄（4）＂RUN PROGRAM ${ }^{\prime \prime}$

## 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（ $\mathrm{A}:, \mathrm{B}:$ ，and so forth） should always be entered in upper－ case．Although the computer un－ derstands 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 doc－ ument 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 $\mathrm{N} / 2$, 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 $I, J, K$, $L, M$, 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 $300 / 1200 \mathrm{bps}$ 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 Amiga'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 $[4 \mathrm{~m}$ 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.

[^3]Toshiba printer 4
OPEN "PAR:" FOR OUTPUT AS \#14 $\mathrm{FS}=\operatorname{CHRS}(27)+"["+\mathrm{A} \$$
$\mathrm{G} \$=\operatorname{CHR}(27)+"] "+\mathrm{B} \$+\operatorname{CHR} \$($ 13) 4

GOSUB DoPrint 4
4
PRT: device - works with ANY $p$
rinter 4
OPEN "PRT:" FOR OUTPUT AS \#1 4
$\mathrm{F} \$=\operatorname{CHR}(27)+"[4 \mathrm{w} "+\mathrm{AS4}$ $\mathrm{G} \$=\operatorname{CHRS}(27)+"\left[3 w^{\prime}+\mathrm{BS} 4\right.$ GOSUB DOPrint: END 4

DoPrint: 4
PRINT \#1,: PRINT \#1, F\$;G\$4 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[24m |
| 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 CP/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 detail $=$ 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: fish\$
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 | 3816 DOC |
| :--- | ---: |
| FISH.FROM | 1 DOC |
| FISH.IN | 2 DOC |
| FISH- | 1 DOC |
| FISH-AND-CHIPS | 1 DOC |
| FISH-AND-LEMON-GRASS | 1 DOC |
| FISH-AND-VEGETABLE | 1 DOC |
| FISH-BELYY | 1 DOC |
| FISH-BONING | 1 DOC |
| FISH-BOWL | 1 DOC |
| FIIH-BUYING | 1 DOC |
| FISH-CLEANING | 3 DOC |
| FISH-COUNTER | 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 |

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
143 DOC
RESULT
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 /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 ( $P / M$ ) 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, P/M Magic is invisible to BASIC, doing its work without slowing down BASIC operations. Here are some of the features that $\mathrm{P} / \mathrm{M}$ 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" 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 P/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, $\operatorname{PEEK}(106)-16$ 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 $\mathrm{P} / \mathrm{M}$ 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 M1 to PF 2
1691 M1 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 P/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,P0X,P0Y,P1X,P1Y, HEIGHT,FLAG,RESOLUTION)

Here is an explanation of the values you must supply in the USR statement:

| RAMTOP | start address of $\mathrm{P} / \mathrm{M}$ <br> Magic |
| :--- | :--- |
|  | X position of player 0 |
| P0Y | $Y$ position of player 0 |
| P1X | X position of player 1 |
| P1Y | $Y$ position of player 1 |
| HEIGHT | height of taller player; add <br> zeroes to bring the shorter <br> player up to this height |
|  | set flag to allow one joy- <br> stick to control two |
| FLAG | players |

RESOLUTION 1 for one-line, 2 for twoline
Once P/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 $\mathrm{P} / \mathrm{M}$ 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＂COMPUTEI＇s Guide to Typing In Programs＂elsewhere in this issue．
Program 1：P／M Magic Loader


HC 2פøø1 REM COPYRIEHT 1987 CDMPUTE！PUBLICATID NS，INC ALL RIEHTS RESERVED．
AH 2 ．6®1\％FOR A＝RAMTOP TO RAM

TOP＋1358：READ B：POK E A，B：NEXT A
 $4,141,51,6,169,6,6$ ， $141,55,6,164,164,14$ $1,52,6,199,7,6,141$ ，
$56,6,154$
 09， $8,6,141,57,6,104$ ，104，141，54，6，199，9
$, 6,141,58,6,194,194$ ，141，59
PK 2øø4ø DATA 6，104，104，141， $61,6,104,1$ © $4,201,2$ ， 298，31，165，196，24，1 65，14，133，294，133，2 66， $133,223,133,221$
明20ஜ5® DATA $198,223,198,22$ $1,169,128,133,265,1$ 33，222，133，229，169，
6，133， $263,246,33,16$
$5,106,24,165,13,133$ ， 266
LP 29ø6ஏ DATA $133,294,133,22$ 3，133，221，198，223， 1 $98,223,198,221,198$ ， 221，198，204，169， 6,1 33，2ø3，133，205，133， 222，133
AI 26ø7ø DATA 220，169， 0,185 ， 22ø， $5,153,264,6,206$ ，192，4，298，245
PC 2ตซ日ø DATA 166,1 66，169， 15 $4,169,7,32,92,228,1$ $69,64,141,14,212,96$ ． 216
KH 2øø9ø DATA $16 \varnothing, \varnothing, 185,22 \emptyset$ ， 6，153，20ø，6，29ø， 192 ，4，26日，245，160， 5,1 日
$5,294,6,153,220,9,2$
65，192，4，29日， 245
EI 201 Dø DATA $173,2 \varnothing 8,6,24 \varnothing$ ， $13,169,233,141,37,2$ ，169，5，141，36，2，76， 98，22日
OE 2ø11ø DATA $174,120,2,189$ ， $74,6,141,62$

IE 25120 DATA 6，189，90，6，141 ，63，6，173，34，6，268，
$38,173,61,6,261,1,2$ $68,16,173,62,6,141$ ， 64，6
MA 25130 DATA $173,63,6,141,6$ $5,6,169,5,246,15,17$ $4,121,2,189,74,6,14$
$1,64,6,189,96,6,141$ ，65，6
H 2 月14 4 DATA $173,49,6,24 \%, 2$ 9，173，120，2，261，15， $298,61,173,2,6,248$ ， $56,169,5,141,49,6,1$ 41，2，6
HE $2 \boxed{15}$ DATA $173,132,2,268$ ， 31，173，12 $6,2,261,15$ ，246，24，169，1，141，4 9，6，174，12ø，2，189， 1 66，6， 141,66
BH 2916 DATA 6， 189
OC 2517 DATA $122,6,141,67,6$ ，169， $5,245,12,173,6$ $2,6,141,66,6,173,63$ $, 6,141,67,6,173,132$ ，2，208
HK 2018ø DATA 26，173，4，6，2月8 ，21，169， $6,141,62,6$ ， $141,63,6,173,61,6,2$ $45,8,169,5,141,64,6$ ， 141
P月 26190 DATA $65,6,173,56,6$ ， $240,26,173,121,2,2 \varnothing$ $1,15,208,61,173,3,6$ ，248，56，169，5，141，5 $0,6,141$

CC 252øø DATA $3,6,173,133,2$ ， $208,31,173,121,2,26$ $1,15,249,24,169,1,1$ $41,56,6,174,121,2,1$ 89，106，6
ME 2ø21ø DATA $141,68,6,189,1$ $22,6,141,69,6,169,6$ ，24ø，12，173，64，6， 14 $1,68,6,173,65,6,141$ ，69，6
HH 2ø22の DATA $173,133,2,2$ 2月， $13,173,5,6,298,8,16$ 9， $5,141,64,6,141,65$ ，6，173，51，6，24，199， 62，6
CI 2023 DATA $141,6 \varnothing, 6,166,6$ ，185，1ø，6，2ø5，6ø，6， $24 \emptyset, 15,20 \emptyset, 192,4,2 \emptyset$ $8,243,173,65,6,141$ ， 51，6，192
EC 2924 DATA 4，24 $, 16,173,4$ 9，6，298，5，169， 5,141 $, 66,6,173,52,6,24,1$ $69,63,6,141,66,6,16$ 0． 5
时 2525 DATA $185,14,6,265,6$ 6，6，245，15，259，192， $4,298,243,173,65,6$ ， $141,52,6,192,4,24 \%$ ， $16,173,49$
 $141,67,6,173,53,6,2$ $4,159,64,6,141,65,6$ ，165， $5,185,18,6,265$ ， 6 ©
AN 2 Ø27 5 DATA 6，24．
DH 2 Ø286 DATA $15,206,192,4,2$ 68，243，173，66，6，141 ，53，6，192，4，246，10， $173,56,6,298,5,169$ ， 6，141，6B
KE 20296 DATA 6，173，54，6，24， $169,65,6,141,66,6,1$ 6． $5,185,22,6,265,6$ 6，6，245，15，2\％\％，192， 4，268
KH 2935\％DATA 243，173，66，6， 1 $41,54,6,192,4,240,1$ ஏ，173，5の，6，258，5，16 $9,6,141,69,6,173,55$ ，6，24
DB 2931．DATA 109，66，6，141，6 5，6，16\％， $5,185,26,6$ ，
 ，192，4，268，243，173， $6 \Phi, 6,141$
OD 20320 DATA 55，6，24，144，5， $169,1,141,2,6,173,5$ $6,6,24,159,67,6,141$ ，60，6，16月， $6,185,39$ ， 6
AB 2933 DATA 2g5， 6 D，6，249， 1 4，2øø，192，4，26日，243 ，173，66，6，141，56，6， $24,144,5,169,1,141$ ， 2，6，173
A月 20346 DATA $57,6,24,109,68$ $, 6,141,60,6,160_{6}^{6}, 1$ $85,26,6,295,65,6,24$ 6，14，265，192，4，2月8， 243，173
012935 DATA 6 ． $2,6,141,57,6$ ， $24,144,5,169,1,141$ ， $3,6,173,58,6,24,159$ ，69，6，141，65，6，166，
DK 2936』 DATA 185，36，6，295， 6
 $4,268,243,173,66,6$ ， $141,58,6,24,144,5,1$ 69，1，141
HK 2837 DATA $3,6,162,9,173$ ， 5，25日，16B，41，1，240，

18，189，148，6，249， 13 ，205，49，6，2ø8，8，141 ，2， 6
BD 2938 DATA 169,6
EH 2פ39ø DATA $157,148,6,152$ ， 74，232，224，4，26B，22 $6,173,1,268,168,41$ ， $1,249,18,189,148,6$ ， 24．，13，2ø5， $5 \varnothing$
EN 294 の曰 DATA $6,208,8,141,3$ ， $6,169,5,157,148,6,1$ $52,74,232,224,8,298$ ，226，173，日，268，168， 41，1， 24 ■
IC 2 Ø41ø DATA 18，189，148，6， 2 4 \％，13，255，49，6，2\％8，日，141，2，6，169，6，157 ，148，6，152，74，232，2 24，12，268
EN 2642 DATA 226，173，9，268， $168,41,1,246,18,189$ ，148，6，248，13，2ø5，5 $9,6,208,8,141,3,6,1$ 69， 6,157
K6 2043 DATA $148,6,152,74,2$ $32,224,16,258,226,1$ $69,1,141,36,298,173$ $, 2,6,245,8,169,6,14$ $1,39,6,141$
OF 2ø44ø DATA $4 \varnothing, 6,173,72,6$ ， $246,8,169,0,141,39$ ， $6,141,40,6,173,3,6$ ， $24 \varnothing, 8,169,5,141,45$ ， 6
HP 2045 D DATA $141,46,6,173,7$ $3,6,249,8,169,0,141$ $, 45,6,141,46,6,173$ ， $51,6,141,9,298,173$ ， 53，6
KF 2046 DATA $141,1,298,173$ ， $55,6,141,4,208,173$ ， $57,6,141,5,208,174$ ， ø，6，169， $0,133,2 \boxed{20,1}$ 33，209， 224
GE 2647 DATA $\%, 24 \emptyset, 17,165,2$ 68，24，199，59，6，133， 208，144，2，230，299， 2 62，224， $5,298,239,16$ 5，106，24，1ø5，6
JK 2ø48ø DATA 27，1ø1，209，133 ，209，165，2ø8，24，109 ，59，6，141，79，6，172， $52,6,162,9,161,208$ ， 145，263，239，298
BB 2949 DATA 268， 2
 5，2ø8，2ø5， $76,6,268$ ， $238,174,1,6,169,6,1$ 33，258，133，209，224， 6，24 $1,17,165,268$
朋 2051 DATA $24,169,59,6,13$ 3，26日，144，2，236，299 ，262，224， $6,268,239$, $165,156,24,105,6,24$ ，1月1，269，133，209
时26520 DATA 165，268，24，169 ，59，6，141，71，6，172， $54,6,162,0,161,268$ ， $145,265,235,26 日, 268$ ，2，23 $5,269,266$
DP 2653 DATA 165，26日，265， 71 ，6，268，238， $172,56,6$ ，162， $9,177,222,41,2$ $52,29,37,6,145,222$, 295，232，224，6
PO 26549 DATA 26B，241，172，5日 ，6，162， $6,177,226,41$ ，243，29，43，6，145， 22 6，269，232，224，6，298 ，241，173，2，6
FA 2 255ø DATA 2 ．6日， $7,173,72,6$ ，258，2，249，32，173，5 $1,6,24,159,6,6,141$ ，
$55,6,173,52,6,24,16$ 9，7
F0 2856．DATA 6，141，56，6， 173 ，62，6，141，66，6，173， $63,6,141,67,6,169,3$ ，141，39，6，141，4 4,6 ， 173
PD 2657ø DATA $3,6,2$ ， $2,7,173$ ， $73,6,298,2,246,32,1$ $73,53,6,24,199,8,6$ ， $141,57,6,173,54,6,2$ 4

JP 2658 DATA $199,9,6,141,58$ ， $6,173,64,6,141,68$ ， $6,173,65,6,141,69,6$ ，169，12， $141,45,6,14$ 1，46
E1 2．559 DATA 6，173，4，6，249， $5,169,6,141,4,258,1$ $73,5,6,245,5,169, \varnothing$, $141,5,298,173,61,6$ ， $24 \varnothing$
BD 206 D DATA 5,169
JB 29619 DATA $0,141,5,298,16$ $9,0,141,72,6,141,73$ ，6，248
KE 2562 DATA $165,6,185,220$ ， 6，153，264，6，25ø，192 ，4，26日，245， $165,6,18$ 5，269，6，153，225， 6,2 ø6，192，4，298，245， 76 ，98，228
NL 25630 RETURN

## Program 2：Helicopter Demo

EC 5 PRINT＂©CLEAR\}COPYRIGHT 1987＂：PRINT＂COMPUTE！ PUBLICATIONS，INC．＂：PRI NT＂ALL RIGHTS RESERVED

BKB FQR $X=1$ TO 1 פø円：NEXT $X$

E6 2 ．RAMTOP＝PEEK（ 1 ©6）$\$ 256$
FB $36 \mathrm{~A}=\mathrm{PEEK}(166)+\mathrm{B}$
AL 4 © POKE $54279, A$
6C 59 PMBASE＝A\＄256
FC 6 $\sigma$ A＝PEEK（ 1 פ6）+6
$6 L 62$ FRAMES $=$ A $\$ 256$
017 GRAPHICS $\varnothing$
JK 75 POKE 559， 6
LB $8 \varnothing$ EOSUB 9 øøの
NK 9 g GOSUB 1 øøøஜ
AD 1 Ø历 EOSUB 265 20
KE $12 \boldsymbol{6}$ POKE 1545，1：POKE 1541 ，1：POKE 754，148：PQKE

MA 122 POKE 53277，3：PQKE 174 4，${ }^{\text {D }}$
JJ 123 FOR R＝PMBASE TO PMBAS E＋2．947：POKE R，$\sigma: N E X T$ R：POKE 559，62
 Ф，$\varnothing, 14, \varnothing, 1)$
PF 127 POKE 1536，1
6L 130 END


明 9 Øøø FOR I＝FRAMES TU FRAM ES＋69：READ A：POKE I， A：NEXT I
MA $9 \varnothing 1 \varnothing$ DATA $\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing$ ，Б，ஜ，ஏ，ஏ，ぁ，б
FL 9．025 DATA $\varnothing, 6,31,4,78,189$ $, 79,6,16,3.7,6, \varnothing, 6$
HC 963 DATA $9,5,4,4,142,125$ $, 143,6,1 \varnothing, 3 \varnothing, 7,9,9,6$
019 94\％DATA $9,6,248,32,114$ ， $189,242,96,86,126,22$ $4, \varnothing, \square, \emptyset$
 90，241，96，80，120， 224 ，$\varnothing, \varnothing, \varnothing$

LA 9 g7 7 RETURN

USAEE 部高高章
AE 1 פூgந FOR $A=1546$ TO 1673： READ B：POKE $A$ ，B：NEX $T A$
PA 1øø1ø DATA 46，47，2ø4，2ø5， 39，31，212，213，48，49 ，2ø6，207，3日，39，22ø，
221，4 4 ，41，210，211，2 5，26，225， 226
AK $1 \varnothing \varnothing 2 \varnothing$ DATA $\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, 3,3$ ，
Б， $5, \varnothing, \varnothing, 12,12, \varnothing, \varnothing, \varnothing$
IC $1 \varnothing \varnothing$ Dø DATA $\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing$ ， $\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing$ ，ஜ，ஜ，ஜ，ஜ，ஜ，ஜ，ஜ
BL 10035 REM PLAYER SPEED
PB $1 \Phi \varnothing 4$ DATA $\varnothing, \emptyset, \varnothing, \varnothing, \varnothing, 1,1$ ， $1, \varnothing, 255,255,255$, ，,$~ \emptyset$ 4，Ø，Ф，ஜ， $2, \varnothing, \varnothing, \varnothing, 2,25$
011 øø45 DATA 254， $0, \varnothing, 2,254$ ， Ø
㫙 10947 REM MISSILE SPEED
 $2, ஜ, 254,254,254,6,6$ ，Ф，Б，Ф，ஏ，ந
 $2,254, \emptyset, \emptyset, 2,254$, ，
NI $19 \boxed{6} 9$ RETURN

## Program 3：Street Scene Demo

6C 5 PRINT＂\｛CLEAR\}COPYRIGHT 1987＂：PRINT＂COMPUTE！ PUBLICATIUNS，INC．＂：PRI NT＂ALL RIGHTS RESERVED

BK 8 FQR $X=1$ TO $1 \varnothing \varnothing \varnothing: N E X T \quad X$


FB 3 § $\quad A=\operatorname{PEEK}(1.56)+8$
AL $4 \varnothing$ POKE 54279 ，A

FC G D $A=P E E K(1$ Ø6）+6
$6 L 62$ FRAMES $=A \% 256$
IH 63 GRAPHICS 23：POKE 559，$\emptyset$
N6 64 POKE 5325ø，126：POKE 53 251，126：POKE 53254， 1 Øø ：POKE 53255，14の
JO 9 Ø POKE 623，17：POKE 53277 ，3：POKE 5326ø，96：POKE 54286， 32
DE 1 Øø FOR I＝PMBASE $+\varnothing$ TO PMB ASE＋2ø47：POKE I，6：NEX T I
BA $12 \boldsymbol{\sigma}$ FQR $\mathrm{Y}=\mathrm{PMBASE}+8$ Ø $\quad$ TO $P$ MBASE＋889：POKE Y，24历： NEXT Y
AF 130 FOR R＝PMBASE $+89 \emptyset$ TO $P$ MBASE＋946：POKE R，192： NEXT R
$K M 150$ FOR T＝PMBASE +1698 TO PMBASE＋1797：READ A：PO KE $T, A$ ：NEXT $T$
NH 16 G FOR $X=P M B A S E+196 \varnothing T 0$ PMBASE＋1979：READ S：PO KE $X, S$ ：NEXT $X$
60170 DATA $16,56,124,124,25$ $4,124,16,2,3,2$
FL 180 DATA $168,124,124,124$ ， $124,124,124,124,254,5$ 6，$\square$
F6 190 FQR I＝7．64 TO $711:$ READ A：POKE I，A：NEXT I
IB 2פø DATA $84,84,14,236,22$ ， 146，152，2

 （561）

FC 224 POKE DL＋81，77：POKE DL ＋82，49：POKE DL＋83，PEE

226 $k(D L+5)+12$

A6 23 g GOSUB 1 ตgøg
AJ 232 GOSUB 2øøøø
LC 24ø POKE 1744，ø：POKE 154ø ，1：POKE 1541，1：POKE 5 59，62
KJ $26 \emptyset \mathrm{X}=\mathrm{USR}$（RAMTOP， $12 \boldsymbol{1}$ ，18ø， 128，188，26，1，1）


H1 3øø T＝6：SPEED＝6
KE 310 FOR I＝1 TO 5：POKE 153 6，I：POKE 1537，T：T＝T＋1 $:$ IF PEEK $(632)=11$ THEN SPEED＝12
L6 320 IF PEEK $(632)=7$ THEN $S$ PEED＝ø
쌔 33 の $K=K-1: I F K=44$ THEN $K=$ 212
6J 34ø L＝L－ø．75：IF L＜44 THEN $\mathrm{L}=212$
MK 35ø $\mathrm{J}=\mathrm{J}-1: I F \mathrm{~J}=44$ THEN $\mathrm{J}=$ 212
BK $36 \varnothing$ FOR $P=\varnothing$ TO SPEED：NEXT POKE 5325ø，J：POKE 532 51，J
CJ 3日ø POKE 53255，K：POKE 532 54，L
AB 39ø LBYTE＝LBYTE＋ø．25：IF L BYTE＝59 THEN LBYTE＝1\％
BJ 4øø POKE DLB2，LBYTE
NB 410 IF PEEK $(1588)<181$ THE N POKE 623， 24
NK $415 \operatorname{IF} \operatorname{PEEK}(1588)>181$ THE N POKE 623，17
BO 42』 NEXT I

EB 7 ØDD REM \＆

HB Bøøø COLOR 1：PLOT 159，39： DRAWTO 159，$ஜ: D R A W T O$
 KE 765，1：XIO 18，\＃6， ， 0, ＂S：＂
WH 8ø1ø COLOR 3：PLOT 159，47： DRAWTO 159，4』：DRAWTO Ф，4历：POSITION Ø，47： POKE 765，3：XIO 18，\＃6 ，$\varnothing, \varnothing, " S: " ~$
KB 日ø2ø PLOT 159，95：DRAWTO 1 59，68：DRAWTO ©，68：PO SITION 6，95：XIO 18，\＃ 6， $5, \varnothing, " 5: "$
OC 8øアø COLOR 2：PLOT 159，51： DRAWTO 159，4日：DRAWTO Ø，4B：POSITION $\operatorname{D}, 51:$ POKE 765，2：XIO 18，\＃6 ，ロ，ロ，＂З：＂
HN Bø6も COLOR 1：W＝1
JF 日ø日ø FOR I＝1 TO 6：PLOT 99 ，79＋I：DRAWTO 99＋W，79 ＋I：W＝W＋2：NEXT I
IC 日ø9ø COLOR 2
H0 日1øø FOR $I=\emptyset$ TO 6：PLOT 73 ，78＋1：DRAWTO 98，78＋1 ：NEXT I
HK B11ø COLOR 1
BD B12 FOR I＝g TO 24 STEP 4 ：PLOT 75＋I，89：DRAWTO 75＋I，84：NEXT I
PB日13ø FOR I＝g TO 13：READ A ；B：PLOT A，B＋25：NEXT I
PF 日14』 FOR $I=\varnothing$ TO B：READ $A$ ， B，C，D：PLOT A，B＋25：DR AWTO C，D＋25：NEXT I
HH 8159 DATA $77,58,77,56,76$ ， $58,78,56,85,56,85,58$ ，86，57，86，55，86，59，8 9，59， $93,56,93,58,93$ ，

59，97，55
PP 816 DATA 74，54，74，65， 81 ， $55,81,58,89,55,89,57$ ，96，57，96，59，98，57，9 8，59，75，60，112，60， 11 2，60，99，54，75，66，75， 54
Bо $817 \emptyset$ DATA $75,54,99,54$
LB 818ø RETURN
FP9øD．REM \＃\＃\＃\＆ANIMATION

JI 901 g FOR I＝FRAMES TO FRAM ES＋285：READ A：POKE I ，A：NEXT I
BB9ø2ø DATA $\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing$ $, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing$ ，$, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing$
KP 9ø3ø DATA ø，$\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing$ ，$\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, 3,15,29,5$ 9，51，7，7，15，252，224， 112，48，$\varnothing$
OA 9ø4ø DATA ø，$, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing$ ， $0, \varnothing, \varnothing, \varnothing, 0,1,7,15,31$ ，55，55，7，111，125，248 ，192，65， 1
в $9 \varnothing 5 \varnothing$ DATA $\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing$ ，\％，\％，\％，3，7，15，31，3 1，31，31，222，254，251， 231，206，15，
NH 9ø6ø DATA $\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, 1,3$ ，3，3，1，7，15，31，3ø，62 ，62，63，63，60，124，120 ，112，112，252， 0
 ，1，1，1， $0,7,31,31,31$ ， $31,31,15,15,13,31,12$ 3，112，124，$\varnothing$
旷 $9 \varnothing 8$ D DATA $\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, 2$ 8，62，62，62，28，246，24 Ф，24ø，24ø，251，255，22 ஏ，192，192，227，118，6ø ，24， 1
แ 9ø9ø DATA ø，ø，ø，ø，ø，ø，ø，ø ，56，124，124，124，56，2 24，224，224，224，246，2 54，192，128，192，224，2 24，24日， 0
 12，248，248，248，112， 1 92，192，12日，128，128，2 24，224，ம，ம，ம，ம，ம，12 －$\varnothing$
CB $911 \varnothing$ DATA $\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, 192$ ，224，224，224，192，ø， ，Ф，$, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing ~$ ，ஜ，ஜ，ø
KN $912 \varnothing$ DATA $\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, 2$ 24，24ø，24ø，24ø，224，1
28，128，128，128，176， 2 4の， $5,128,192,128,192$ ，128，ø，$\varnothing$
KN $913 \varnothing$ RETURN
 －USAGE＊部
 READ B：POKE A，B：NEX T A
M 1 IDg 5 REM PLAYERS LIMITS
JG 1 פֿ1ஏ DATA 46，47，194，195， $154,155,195,196,54$ ， 55，2ø2，2ø3，154，155， 195， 196
HO 1 ø® 15 REM MEMORY USED BY PMMAEIC
OW 1 ■ø2ø DATA $\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing$, $\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, З, З, \varnothing, \varnothing$ ， $0, \sigma, 12,12, \sigma, \sigma, \sigma$
IC 1 øø 1 DATA $\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing$ ， Ф，$, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing ன$

JF 1 פøO 35 REM PLAYERS＇SPEED
 $1,6,255,255,255, \mathscr{6}, \varnothing 1$
；$\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, 1,25$ 5，$\varnothing, \varnothing, 1$
OF 1 øø5 DATA 255，$\varnothing, \varnothing, 1,255$ ， ■

## HI 1 øø7ø RETURN

## Program 4：Arcade Game Demo

AC 5 PRINT＂CCLEARJCOPYRIBHT 1987＂：PRINT＂COMPUTE！
PUBLICATIONS，INC．＂：PRI
NT＂ALL RIBHTS RESERVED
BK B FOR X＝1 TO 1 صøø：NEXT $X$
PE 10 POKE 1ø6，PEEK（106）－16
EG 2 2 RAMTOP＝PEEK（1ø6）\＄ 256
FB 3g A＝PEEK（1ø6）＋
AL 4 © POKE 54279，A
BC 5 g PMBASE＝A $\mathbf{~ 2 5 6}$
FC 6ø $\operatorname{A=PEEK}(1$ © 6$)+6$
6L 62 FRAMES＝A\＄256
BA 64 BRAPHICS 1：POKE 53248， D：POKE 53249，D：POKE 53 252，$:$ POKE 53253，$\emptyset$
KB 65 ？；＂$\{7$ SPACES\}HOW MANY TAREETS＂；
FL 66 INPUT $B: I F$ B＜1 THEN 66
HC 67 ？＂＂（G SPACES）TAREET $S$ PEED（1 OR 2）＂；：INPUT
F：IF F＞2 OR F＜1 THEN 6 7
0068 ？；＂ $\mathbf{~ C 5 ~ S P A C E S \} ~} 1=$ EASY ； 2＝DIFFICULT＂；：INPUT N ：IF $N>2$ QR $N<1$ THEN $6 B$
 ILL BLANK＂：？；＂
\｛11 SPACES\}TEMPORARILY" ；
EH 82 FOR $T=1$ TO 13פø：NEXT T
IH 84 GRAPHICS $1+16$ ：SOUND $\varnothing$ ， Ø，$\varnothing$ ，
619ø POKE 559， $9:$ POKE 623，49 ：POKE 53277，3：POKE 532 56，1：POKE 5325日，ø：POKE 53259，
DE 1 øø FOR I＝PMBASE $+\varnothing$ TO PMB ASE＋2ø47：POKE I，D：NEX T I
MI 19ø POKE 704，148：POKE 705 ，68：POKE 797，232：POKE 766，66：POKE 768，152： POKE 719,146
CB 24ø POKE 1542，7：POKE 1543 ，6：POKE 1744，$\varnothing$
DK 241 FOR I＝1 TO 22 STEP 3： X＝RND（ $\varnothing$ ） 6 ：POSITION $X$ ，I：？\＃ 6 ；＂．＂
HE $242 \mathrm{Z}=$ RND（ 0 ）\＃ $6:$ POSITION 6 $+Z, I: ?$＂6；＂．＂：$Z=R N D(D$ ）\＃：POSITION $12+Z$ ，I：？ \＃6；＂．＂
HP 243 NEXT I：RESTORE
DF 244 FOR T＝g TO 511：POKE 3 $2768+$ T，PEEK $(57344+T)$ ： NEXT T：POKE 756，128
IB 245 FOR $T=32768+24$ TO 327 68＋47：READ B：POKE T，B ：NEXT T
LC 246 DATA $\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, 112$ ， $248,124,126,127,255,2$ 55，255，255，255，255，25 5，255，255，255，255，255 ， 255
JE 247 FOR T＝g TO 19：POSITIO N T，21：？＂6；＂整＂：NEXT T：POSITION $\quad, 22$
 ＂：$:$ NEXT T：POSITION $\varnothing$ ， 23
FC 249 FOR $T=9$ TO 19：？\＃6；＂四 ＂；：NEXT T
OC 252 BOSUB 9 ฮฮฮ

AN 254 GOSUB 1 øøøø
AP 256 GOSUB 2øøøø
PF 26 © POKE 1585，$\varnothing$ ：$X=$ USR（RAM TOP，118，12ø，1ø，1øø， 14 ，$\varnothing, 1)$
PP 280 POKE 559，62：T＝1：M＝2：A B＝ø：MISS＝ø
$0029 \varnothing$ POKE 154ø，ø：POKE 157ø ，1：POKE 1537，1：POKE 1 536，3：POKE 77，ø
06295 IF PEEK $(53279)=6$ THEN 302
BB 3øø IF PEEK（53279）$=3$ THEN POKE 1744，1：POKE 532 48，$:$ POKE 53249，$:$ BOT 064
PJ $3 \varnothing 1$ POKE 16øの，$:$ ：
CL 3ø2 POKE 16øø，F：POKE 16』1 ，1：POKE 1693，1：IF N＝1 THEN POKE 16ø1，


KF 3 ø4 E＝STICK（D）：IF E＜B THE N POKE 1536，T＋4：M＝4： वTO $31 \varnothing$
BD 306 IF E＜12 THEN POKE 153 6，T＋2：M＝2：GOTO 31 ø
JB 3ø日 POKE 1536，T＋M
KD 310 POKE 1537，T：IF PEEK（1 693）$=\varnothing$ THEN POKE 1693 ，1：©0SUB 8ø1ø
M0 32 IF $\operatorname{PEEK}(5326 \varnothing)=2$ THEN POKE 154た，i：EOTO 日50 ø
DC 35 Ø IF $\operatorname{PEEK}(159 \varnothing)>19 \varnothing$ THE N POKE 1601，255
IP 36ø IF PEEK（159ø）＜3ø THEN POKE 1601，1
FL 39ø $T=T+1: I F T=3$ THEN $T=1$
CA 4øø IF PEEK（1589）＞24のTHE N MISS＝MISS $+1: A B=A B+1$
：POKE 1589，10：IF AB＝日 THEN POP ：BOTO 5øø
6H 43 曰 воTO $3 ø 4$


PO 5øD POKE 1537，1：POKE 1536 ，M＋1
OE 5 פ5 POSITION 5，$\curvearrowleft: Z X=($（G－M ISS）／日）\＃1øø：？\＃6；INT（ 2X）；：？\＃b；＂PERCENT＂
PC 51 （ POKE 1744， 1
OB 520 IF PEEK $(53279)=6$ THEN 540
B8 530 IF PEEK（53279）$=3$ THEN POKE 1744，1：POKE 532 48， $\operatorname{D:POKE} 53249$, ஏ：GOT 064
6N 535 вотס 520
KJ 54ø POKE 53248， $9:$ POKE 532 49，$:$ POKE 53252，D：POK E 53253，ø：POKE 1744， ：POSITION 5，ø：？\＃6；＂ \｛14 SPACES\}"
NP 55ø FOR T＝PMBASE +768 TO P MBASE＋1535：POKE T， $\mathscr{D}: \mathrm{N}$ EXT T：BOTO 260
KO 日øøø REM \＃TAREET EXPLOS

JM $8 ø 1 \varnothing$ POKE 1536， $1+\mathrm{M}$
EA Bø 15 FOR $Z=7$ TO 11：POKE 1 537，z：SOUND ø，2øø，в， 22－Z＊2：FOR I＝1 TO 1ø ：NEXT I：NEXT Z
68 日ø2ø SOUND ø，ஜ，ø，ஜ：$A B=A B+$ 1：IF AB＝O THEN POP ： ВロTO 5øø
KH 日ø3ロ POKE 1537，ø：IF N＝2 T HEN $8 ø 4 \varnothing$
EH $\mathbf{\theta}$ Ø32 L＝PEEK（5377ø）：IF L＜3 © OR L＞19ø THEN 8932 EF 8ø34 POKE 159ø，L

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Dressellhaus
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HJ 日ø $4 \varnothing$ PQKE 1589， $1 \varnothing:$ RETURN DB 日4øの REM 事 COLLISION WIT H TARGET \＃\＃
A6 85øø FOR $Z=7$ TO 14：POKE 1 537，Z：SQUND ஏ，2øø，8， 2日－Z～2：POKE 1536，Z：F OR I＝1 TO 1ø：NEXT I： NEXT $Z$
6H 8502 POKE 1536， $9:$ POKE 153 7，D：POKE 1744，1：SUUN D $\varnothing, \varnothing, \varnothing, \varnothing:$ GOTO 54ø


JB 9øøø FOR I＝FRAMES TO FRAM ES＋153：READ A：POKE I ，A：NEXT I
MA $9 \varnothing 1 \varnothing$ DATA $\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing$ ，$, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing$
FL 9ø2פ DATA $\varnothing, \varnothing, 31,4,78,189$ ，79，6，1Ф，3ø，7， $9, \emptyset, \varnothing$
HC $9 \varnothing 3 \varnothing$ DATA $\emptyset, \emptyset, 4,4,142,125$ $, 143,6,1 \varnothing, 3 \varnothing, 7, \varnothing, \varnothing, \varnothing$
FE 9 פ6 DATA $\varnothing, \varnothing, 31,4,252,3 日$ ，46，62，124，92，120，48 ，$\varnothing$ ，
PG 9962 DATA $9,9,4,4,36,38,4$ $6,62,124,92,120,48,6$ ，$\varnothing$
LA 9 פ64 DATA $\varnothing, \varnothing, 248,32,63,1$ Ø0，116， $124,62,58,3 \varnothing$ ， $12, \varnothing, \varnothing$
HI 9 פ65 DATA $\varnothing, \varnothing, 32,32,36,1 \emptyset$ D，116，124，62，58，30， 1 2，, ，
GC 9 פ66 DATA $\varnothing, \varnothing, 16,4,89,28$ ，
$58,28,8 \varnothing, 4,16,9, \emptyset, \emptyset$
HE 9 פ67 DATA $\emptyset, 9,16,36,89,28$ ，186，61，158，56，82，4ø ，$\varnothing$ ，
$019 \emptyset 68$ DATA $\varnothing, \varnothing, 2 \emptyset, 42,189,1$ ஏ2，2ø2，83，239，161，86 ，4ø，ø，
019 Ф69 DATA $\varnothing, \varnothing, 4 \varnothing, 84,13 \varnothing, 1$ ，129，$, 129,2,72,2 \emptyset, \emptyset$ ，$\varnothing$
LA 9070 RETURN
 USAGE 高高高高音
AE 1 Øøøø FOR $A=1546$ TO 1673： READ B：POKE A，B：NEX TA
DH 1 Øø1ø DATA $46,47,194,195$ ， 21，22，193，194， $6, \varnothing 2$ $55,255, \varnothing, \emptyset, 21 \varnothing, 211$ ， $45,46,215,216,25,26$ ，215，216
AN 1 Øø2ø DATA $\emptyset, \varnothing, \varnothing, \varnothing, \varnothing, З, ~ З, ~$ Ø，ஜ，ø，$, 12,12, \varnothing, \varnothing, \varnothing$
IC 1 øøЗø DATA $\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing$ ， $\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing$ ，$, \varnothing, \emptyset, \emptyset, \emptyset, \varnothing, \varnothing$
BL $19 \varnothing 35$ REM PLAYER SPEED
PB1øø4ø DATA $\varnothing, \varnothing, \emptyset, \varnothing, \emptyset, 1,1$ ， $1,0,255,255,255, \varnothing, \varnothing$
 4，ஜ，Ø，2
01 1 Фø45 DATA 254，$, ~ ஏ, 2,254, ~$ ■
6H $19 \emptyset 47$ REM MISSILE SPEED
PP 1 Øø5ø DATA $\emptyset, \emptyset, \emptyset, \emptyset, \emptyset, 2,2, ~$ $2, \varnothing, 254,254,254, \varnothing, \emptyset$ ，$, \varnothing, \varnothing, \varnothing, \varnothing$
N1 1 øøGの DATA $\varnothing, \varnothing, 2,254, \varnothing, \varnothing$ ， $2,254, \emptyset, \emptyset, 2,254, \emptyset$
N1 1 øø7ø RETURN

# 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 '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:

## Starting address: BF40 <br> Ending address: CFFF

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, command\$

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 f1 to execute these commands each time you press it:

## PRINT CHR\$(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 f1 key:
A $\$=$ "PRINT CHR $\$(147): L I S T " ~+~ C H R \$ ~$ (13)

KEY 1, A\$
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

[^4]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 $O K$, 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 $00 F F$. Note that the result is returned as a string four characters long; after you execute $\mathrm{X} \$=$ 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 $X=\mathrm{DEC}$ ("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$=$ POINTER $(X)$ assigns to the variable ADDR the address of the variable $X^{\prime}$ '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 A\$

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 new 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 shiff-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.

|  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 55 | 54 | 45 | 21 | 15 | Cl |  |  |
|  |  | C | 59 | C5 | ØF | C2 |  |  |
|  |  | A | 01 | 48 | 2 | 45 |  |  |
|  |  |  |  |  |  |  |  |  |
|  | øø | B1 | 14 | A8 |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| 8:85 | 47 | 20 | FA | A | 20 | 28 |  |  |
|  | øø | 8 |  | A | 48 |  |  |  |
|  | 47 | 4 | 03 | CE | 4 |  |  |  |
|  | 9E | B7 | 8 | F |  |  |  |  |
|  | F3 | 49 |  | 30 |  |  |  |  |
|  | Ø2 | CF | 9 | FF | 9 D | 8 |  |  |
| 8 | 78 |  | ØB | B9 | 00 |  |  |  |
|  | 9 E | B9 | 4D | B | 99 | Øロ | 0 |  |
|  | 10 |  |  | 15 | 63 |  |  |  |
|  | AD | 14 | g | 8 | DF | C3 |  |  |
|  | $\square 2$ | 8D |  |  |  |  |  |  |
|  | F7 | 9 F | A | 32 | B9 |  |  |  |
|  | F | 9E | 88 | 11 | F |  |  |  |
|  | B9 | 59 | B | 99 | g |  |  |  |
|  | F7 | A | Ø2 | B | C |  |  |  |
|  | CF | 88 | 10 | F7 |  | $\square$ |  |  |
|  | 9E | 9 | 3A |  | 8 |  |  |  |
|  | 38 | 8 C | 8 | C4 |  |  |  |  |
| 8 | A |  | 20 | - |  |  |  |  |
| cø10:C4 | $9 \varnothing$ | Ø6 | $2 \varnothing$ | 82 | C4 |  |  |  |
|  | A | 6 |  | 29 |  |  |  |  |
|  | 9E | BF | 86 | $\emptyset$ | Aø | 97 |  |  |
| 928:7B | A | 99 | 53 |  |  |  |  |  |

Сø30：АØ 5ø B9 C9 A6 99 ø3 CF 5B Cø38：88 10 F7 A5 01 AA 29 FE 5F Cø46：85 Ø1 $2 \varnothing$ DF BF 86 Ø1 7859 C648：A9 4D 8D 8F 62 A9 C3 8D 68 Cø50：9ø ø2 A9 D6 8D 14 ø3 A9 A9 C658：C3 8D 15 ø3 A9 ø0 8D 459 F C660：C0 $58602047 \mathrm{C} \varnothing 2 \mathrm{C} 9995$ Cø68：9E 1011 EE 99 9E $2 \varnothing$ BD 93 Cø7ロ：C4 9ø ø9 2ø F8 C3 $2 \varnothing 6013$ Cø78：A6 4C Aø C4 AD 92 9E 10 C5 Cø80：27 CD 8F 9E FD 22 AD 8 F DF Cø88：9E 8562 AD 8 E 9 E 8563 FF Cø9ø： $2 \varnothing$ 6F CA A2 øø BD Øø Ø1 79 Cø98：Fの Ø6 9D 77 ø2 E8 Dø F5 8A CøAØ：A9 2ø 9D 77 ø2 E8 86 C6 Bl CøA8：2Ø 60 A5 $867 A 847 B 86$ D2 CøB6：3A 8E 8F 9E $2 \varnothing 73$ øб Fø 8E CøB8：AD $9 \varnothing 062 \varnothing 79$ A5 4C El D4 CøCø：A7 CE 99 9E $2 \varnothing$ 6B A9 C9 B2 CøC8：øø Fø 16 2C 92 9E 10114 C CøDØ：A5 1418 6D 9ø 9E 8D 8E AC CøD8：9E A5 156 D 919 E 8D 8F 3E CøEØ：9E 4C 9F A4 $2 \varnothing$ 8C C4 FØ BØ CøE8：12 $2 \varnothing 6$ B A9 A5 15 8D 91 Bl CøFø：9E A5 14 Fø ØF 8D 9ø 9E 2B CøF8：A9 FF 2C A9 90 8D 92 9E 69 Cløø：8D 8F 9E 6ø 4C 6E CB $2 \varnothing$ DB C1ø8：E1 FF Fø Ø3 4C B1 A7 A5 E8 C110：91 10 FC A2 1E A4 3A C8 EA C118： 68 Fø 65 A9 FF 8D 9E 9E 29 C12ø：8A $3 \varnothing 45$ 8E 9E 9E A8 $2 \varnothing 67$ C128：A2 B3 A9 17 2ø D3 9E $28 \quad 46$ C130： 88 FØ 1F Aø Ø1 B9 39 øø 43 C138：99 Cø 9E B9 3D øø 99 C2 ø8 C14ø：9E 88 1ø F1 AD Cl 9E AC B4 C148：Cø 9E $2 \varnothing 91$ B3 A9 1ø $2 \varnothing 75$ C150：D3 9E AE 9E 9E AD 9B 9E A6 C158：3ø 26 EØ 1E FØ ØD EØ 1F 18 C16ø：9ø $96 \quad 2 \varnothing 6 \mathrm{E}$ Cl 4 C 47 A 4 ØB C168：4C 8B E3 $4 \mathrm{C} \quad 32$ A8 FØ 034 F C170：A2 $\mathrm{CL}_{2}$ 2C A2 øø BD CA 9E Aø C178：85 22 BD CB 9E $85 \quad 23 \quad 606 D$ C180：28 Fø D7 AD BE 9E 85 7A 20 C188：AD BF 9E 857 B AD BC 9E A9 C190：85 39 AD BD 9E 85 4ø $2 \varnothing 62$ C198：A7 C1 A5 7A Dø 02 C6 7B 54 C1A0：C6 7A A9 894 C 34 C2 AD 5A C1A8：9B 9E 8D 9C 9E 49 FF 8D C4 C1B0：9B 9E 68 A8 68 A2 øø 9A A9
 C1Cø：ø3 2ø A6 B3 2C 9B 9E $3 \varnothing 1 \mathrm{~B}$ ClC8：F3 2C 9C 9E 10 EE C9 8221 C1DØ：DØ C5 Aø Ø1 B9 CØ 9E 99 F9 C1D8：3B øø B9 C2 9 E 99 7A 96 AD C1Eの：88 10 Fl $2 \varnothing$ A7 Cl $2 \varnothing 73$ E4 C1E8：$\varnothing$ Ø $2 \varnothing$ F8 A8 4 C B1 A7 $2 \varnothing$ B6 ClFø：9E AD $2 \varnothing 79$ Øø C9 89 FØ F5 ClFB： 65 A9 A7 20 FF AE A5 $61 \mathrm{C7}$ C2øø：DØ Ø3 4 C 3B A9 $68 \quad 68 \quad 2 \varnothing \mathrm{CB}$ C2ø日：79 øø Bø 24 4C 9A Cl 2C 1F C210：9A 9E 1019 A6 3A E8 FØ FE C218：14 A9 5B $2 \varnothing$ FF C4 CA 8A B2 C220：A6 392034 C5 $2 \varnothing$ CD BD 96 C228：A9 5D 2ø FF C4 $2 \varnothing 73$ øø 6B C230：C9 FE F6 F9 BA 8E B6 C1 57 C238：AA C9 8A Dø ø3 $2 \varnothing$ FB Cø 35 C246：A5 3ø C5 2E Dø ø9 A5 2F 65 C248：C5 2D D $\varnothing$ Ø3 $2 \varnothing$ 8A CE A9 B8 C250：øø 8D 96 9E 8D 98 9E 8D 8F C258：9D 9E A9 C1 48 A9 ø6 48 E2
 C268：9E Fの 65 CA 10 F8 30 Ø8 93 C27ø：2ø EE C2 Fø Ø3 4C A3 C4 7 E C278：68 A2 16 DD 38 CC Fø 1A 6C C280：CA 10 F8 A2 03 DD 65 9E B1 C288：Fの $05 \mathrm{CA} 10 \mathrm{FB} 3 \varnothing 65 \mathrm{~A} 257$ C29ø： $0 \varnothing$ 8E 9F 9E 2ø 7C øø 4C D6 C298：ED A7 8A 85 ØF ØA AA BD 5C C2Aの：D4 CC 48 BD D5 CC 48 4C 67 C2A8：73 Øの AA $2 \varnothing 73$ øØ $2 \varnothing 132 \mathrm{E}$
 C2B8：45 Dø ø8 C9 4C FØ 1C C9 DA
 C2C8：2の 13 B1 Bø F6 4C 7C øø 46 C2DØ：C9 53 D $\varnothing$ EF $2 \varnothing$ C3 C2 C9 88

C2D8：24 D6 ø3 2 Ø C3 C2 C9 24 E7 C2EØ：FØ EB C9 25 FØ E7 C9 28 48 C2E8：F0 E3 6868 Dø 2B AA A5 Al C2F6：7A 48 A5 7B 48 8A DØ 9343 C2F8：2ø 73 øø $2 \varnothing 21 \mathrm{CD}$ FØ 16 A5 C3ø0：24 ØF 30 F4 C9 B2 Fø ØE BB C3ø8：C9 3A FØ ØA $2 \varnothing 13$ Bl $9 \varnothing 63$ C310：E7 2ø AA C2 Dø E5 A9 øø 86 C318：2C A9 FF 85 日B $68857 B$ F8 C320：68 85 7A A5 øB 60 ø8 $2 \emptyset$ FØ C328：A6 B3 28 Fø 1A A5 39 8D 6B C $33 \varnothing$ ：BC 9 E A5 $4 \varnothing$ 8D BD 9E A5 BC C338：7A 8D BE 9E A5 7B 8D BF 18 C340：9E $2 \varnothing$ F8 A8 A9 FF 2C A9 18 C348：øø 8D 9B 9E 6ø AD 8D ø2 67 C350：C9 ø3 D6 ø3 4C 4F EB ØA 49 C358：C9 ø8 9ø ø2 A9 ø6 AA BD 71 C360：79 EB 85 F5 BD 7A EB 85 E4 C368：F6 A4 CB C4 C5 F6 1D B1 38 C37Ø：F5 C9 2Ø Dø Ø8 AD 96 9E 39 C378：49 FF 8 D 96 9E 2C 93 9E 2B C380：10 2D A2 ø8 DD 1B 9E Fø B9 C388：Ø6 CA D6 F8 4C Eø EA 8A B5 C390：A8 A9 øø 18 7D F8 9E CA $3 \varnothing$ C398：DØ F9 8D 94 9E 38 F9 F8 C4 C3AØ：9E CD 94 9E F 0 E6 8D BF 65 C3A8：C3 8D 95 9E EE 93 9E $2 \varnothing 35$ C3B ： B 7 C 3 A 2 FF 4 C 26 EB A6 D2 C3B8：C6 EC 89 Ø2 Fø 15 Aø øø 4D C3C 0 ： 89 Ø1 9F 9D 77 Ø2 E8 C8 91 C3C8：8C BF C3 CC 94 9E Dø E9 76 C3DØ：CE 93 9E 86 C6 60 2C 9384 C3D8：9E $3 \varnothing$ ØЗ $2 \varnothing$ В7 С3 4 C 31 В4 C3EØ：EA 4C 94 C4 4C A3 C4 $2 \varnothing$ 6A C3E8：8C C4 Fø F8 20 6B A9 $2 \varnothing$ B7 C3F0：F8 C3 4C 6E C9 4C 6E CB 7E C3F8： 2013 A6 90 E4 A5 144861
 C408：A9 AB $2 \varnothing$ FF AE 206 B A9 CB C41ø：D D D2 68 AA 68 E4 15 9ø FF C418：Ø8 DØ DA C5 $1490 \quad$ Ø2 Dø 49 C420：D4 A5 5F $85 \quad 22$ A5 6085 AF C428：23 2ø 13 A6 9ø B3 AØ øø AC C430：B1 5F AA C8 B1 5F 8560 C2 C438：86 5F AØ ø日 B1 5 F 91 2241 C440：E6 22 Dø 02 E6 23 A6 6071 C448：A4 5F C8 Dø Ø1 E8 $86 \quad 60$ 3B C45ø：84 5F C4 2D Dø E4 E4 2E 71 C458：DØ EØ 4C A8 C4 78 AØ ØB EA C460：B9 EB 9E 99 ø0 ø3 88 10 5C C468：F7 AD F7 9E 8D 8F ø2 AD 9E C47ø：F8 9E 8D 90 Ø2 AD EØ C3 25 C478：8D 15 日3 AD DF C3 8D 1486
 C488：FE 4C 62 E4 A4 3A C8 Dø A3 C49ø： 09 4C 79 ø日 A2 11 2C A2 35 C498：80 2 C A2 22 2C A2 16 2C 28 C4AD：A2 1ø 2C A2 ØB 6C øø ø3 3C C4A8：2ø 33 A5 A4 23 A5 22 18 1A C4BØ： 69 Ø2 $9 \varnothing$ Ø1 C8 842 EE 85 CB C4B8：2D 843085 2F A5 2D A4 67 C4C $\begin{array}{llllllll}2 E & 18 & 69 & 1 C & 9 \varnothing & \text { O1 C8 C4 } & 35\end{array}$
 C4DØ：A9 FF 2C A9 Øø 8D 9A 9E 59 C4D8：6Ø AE 9E 9E E8 Fø 19 AD E6 C4EØ：Cø 9 E AC Cl 9 E 851484 DB C4E8：15 $2 \varnothing 13$ A6 $9 \varnothing$ ØA A9 $8 \emptyset 52$ C4FØ：8D 97 9E 4C 93 CF $68 \quad 68$ 5 C4F8：A9 øø 8D 97 9E A9 ØD $2 \varnothing 58$ C5øø：34 C5 4C D2 FF C8 DØ 6395 C508：4C 4E CF AD 97 9E FØ 23 5E C510：10 1D A6 609818655 F 15 C518：9Ø Ø1 E8 EC C3 9E Dø 1365 C520：CD C2 9E 9ø ØE FØ ØC A9 16 C528：12 4E 97 9E $2 \varnothing$ D2 FF B1 2B C530：5F Fø C3 6048 AD 95 9E E8 C538：38 65 C8 8D BF C3 AD 96 2A C540：9E 30 FB 85 C6 686029 C 6 C548：7F A4 49 2ø D2 FF $2 \varnothing 14$ F2 C55ø：C5 2C 98 9E 3ø Fø 4C $3 \varnothing$ D4 C558：CF 10 FØ C9 FF FØ EC 24 4C C560：øF 30 E8 C9 CE Fø Ø4 C9 45 C568：FE Dø øD 2C 98 9E $3 \varnothing \quad 05$ Bø C57ø：C8 B1 5F Dø ø3 $2 \varnothing$ CF FF FD C578：84 49 A2 19 DD 3A CC FØ EØ

C580：11 CA D6 F8 38 E9 7F AA 04 C588：A9 Aø 8523 A9 9E 8522 E8 C590：30 ø8 A9 CC 8523 A9 5599 C598：85 22 AØ FF CA FØ 67 C8 74 C5Aの：B1 22 1ø FB $3 \varnothing$ F6 C8 Bl EF C5A8：22 3ø 9C $2 \varnothing$ D2 FF Dø F6 16 C5BD：4C 6E CB $2 \varnothing$ EB B7 A5 1518 C5B8：AC 45 C $\varnothing$ C $\varnothing$ FC Fø $1 \varnothing$ C9 A5 C5Cø：DØ Вø øС С9 Сø ВØ Е9 C9 65 C5C8：Aø B $\varnothing 64$ C5 38 Bø El C9 BF C5D ：Ø2 Dø Ø3 2ø 2B CC 4C 2740 C5D8：B8 2ø 1B CD Aø øø $2 \varnothing 79$ C7 C5EØ：øØ FØ 1384 ØB $2 \varnothing$ FD AE D6 C5E8：2ø 9E B7 8A A4 ØB 99 øC 5C C5Fø：Ø3 C8 Cø 04 Dø E8 4 C 307 B C5F8：E1 A8 24 ØD $3 \varnothing$ Ø8 $2 \emptyset$ A2 79 C600：B3 A5 0E 4C C2 A9 4C 9D 4A C6ø8：C4 Aø øø 84 ØB FØ 69 A4 3B
 C618：2Ø 8B Bø 8549844 A A4 9 C C620：ØВ B9 øС Ø3 Е6 ØВ $2 \varnothing$ F9 FØ C628：C5 $2 \varnothing 79$ øø Dø E1 $6 \varnothing 2 \varnothing \mathrm{BE}$ C630：34 C5 2ø El FF Fø 112475 C638：90 7ø Ø1 60 A9 $02249 \varnothing 7 \mathrm{E}$ C640：F0 Ø3 A9 Ø4 2C A9 8ø 2C Bl C648：A9 1E 2C A9 654820 DD B9 C650：C6 $6810 \quad 10386860$ AA DD C658：6C Øø Ø3 АØ øø 2C AØ ØF 87 C660：A9 øF 85 B8 84 B9 A9 0223 C668：85 BC A9 A7 85 BB $2 \varnothing 796 C$ C670：Øø FØ øD 20 FD AE A9 5531 C678：20 FF AE 20 9E B7 86 BA 89 C680：2C 9D 9E 10 Ø3 $2 \varnothing$ FE C7 BE C688：20 2B CC A5 BA C9 ø8 9ø 82 C690： 04 C 9 1F $9 \varnothing$ Ø2 A9 0885 CB C698：BA 2 C 98 9E 10 Ø6 20 AD 12 C6A日：F5 2ø FD C4 $2 \varnothing$ DD C6 2063 C6A8：CØ FF A6 B8 20 C9 FF Bø CF C6B6：9A $2 \varnothing$ CC FF A6 B8 4C C6 A4 C6B8：FF A2 $\quad$ Øø 86 B7 A9 $0 \mathrm{OF} 85 \mathrm{5F}$
 C6C8：20 CF FF 99 A7 Ø2 2C 9D 2F C6Dø：9E 10 ø3 $2 \varnothing$ D2 FF C8 $246 \varnothing$ C6D8：9Ø 50 ED 84 B7 $2 \varnothing$ CC FF Aø C6E0：A5 B8 4C C3 FF A9 53 20 A2 C6E8：21 C8 85 B7 A6 3A E8 F0 46 C6F0： 03 4C 7E C7 CE 9D 9E $2 \varnothing$ A9 C6F8：5E C6 2ø FD C4 4C C6 C6 F6 C7ø0：A9 $4 \mathrm{E} \quad 20 \quad 21 \mathrm{C} 8 \quad 85 \mathrm{B7} 85$ 5F C708：B8 AA $2 \varnothing 79$ øø C9 2C DØ 8A C710：36 9D A7 ø2 Aø 01 B1 7A 1E C718：C9 49 Dø 2B C8 $2 \varnothing$ FB A8 13 C720：AØ FF C8 E8 Bl 7A 9D A7 02 C728：Ø2 Fø Ø8 C9 24 F С ØВ C9 57 C730：2C DØ EF CØ Ø2 FØ 日D 4C 4E C738：A3 C4 $26 \quad 26$ C8 AA A5 B8 26 C740：C9 02 D 0 F3 20 FB A8 8657 C748：B7 4C 7B C7 A9 43 2C A9 ØF C750：52 48 A2 13 A9 3D 9D A7 C5 C758：Ø2 2 Ø 24 C8 85 B7 A9 A4 $0_{5}$ C760：20 FF AE 682021 C8 C9 3D C768：13 F6 13 BD A7 6299 A7 1C C770：ø2 C8 E8 E4 B7 Dø F4 84 ØE C778：B7 Fø ø3 CE 9D 9E $2 \varnothing$ 5E 73 C780：C6 4C DD C6 A9 56 2C A9 57 C788：49 2ø 4A C8 E8 86 B7 Dø 3C C790：ED A2 01 A9 24 8D A7 0223 C798：86 B7 2ø 5B C6 CE 98 9E 54 C7AD：AØ Ø3 84 ØB $2 \varnothing$ CF FF 8548 C7A8：14 202 F C6 20 CF FF 8562 C7Bの：15 2ø 2F C6 C6 ØB DØ EC 16 C7B8：A6 14 A5 1520 CD BD A9 $\quad 04$ C7Cの： $2 \varnothing$ 2ø 59 C5 $2 \varnothing$ CF FF 85 B5 C7C8：øB $2 \varnothing 21$ CD $2 \varnothing 2 \mathrm{~F}$ C6 A5 D7 C7D®：ØB DØ EE $2 \varnothing$ FD C4 AØ Ø2 $4 \varnothing$ C7D8：D C8 A2 FF $2 \varnothing 24$ C8 85 FF C7EØ： 77 CE 98 9E $2 \varnothing$ 5B C6 $2 \varnothing 19$ C7E8：CF FF AA $2 \varnothing$ CF FF $2 \varnothing$ 2F A5 C7F0：C6 Aø 07 B9 69 9E 20 D2 61 C7F8：FF 88 10 F7 30 D5 A6 3A 8C C800：E8 Dø 15 AØ ØС В9 719 EAF C8ø8：20 D2 FF 88 10 F7 20 CF 57 C810：FF C9 59 Fø ø3 4C 97 C4 8B
 C82Ø：Cl $2 \varnothing$ 4A C8 86 B8 2ø ØF D6

C828：CD Fø EE C9 11 Bø ED A6 25 C830：B8 85 B8 Aø øø E8 B1 22 C9 C838：9D A7 Ø2 C8 C4 B8 Dø F5 EF C840：98 1869 Ø3 A8 E8 8A A2 22 C848：13 60 A2 øø 9D A7 ø2 E8 48 C850：A9 3ø 9D A7 Ø2 E8 A9 3A 32 C858：9D A7 Ø2 60 4C 97 C4 $2 \varnothing 53$ C860：8C C4 C8 Bl 2B Fø F5 88 2F C868：B9 57 9E 99 BC 9E С8 Cø CC C87ø：Ø6 9ø F5 85 ØB 8D 9B 9E A4 C878：8D 9E 9E $2 \varnothing 79$ Øø Dø ø8 C3 C880：20 79 øø Fø 1C 20 FD AE 9B C888：20 6B A9 A5 ØB AA ØA A8 54 C890：A5 1499 BC 9E A5 159948 C898：BD 9E E8 86 ØB EØ 03 9ø A8 C8AD：DF $2 \varnothing 74$ C9 C8 Bl 5 F 8D AE C8A8：Cø 9E C8 Bl 5F 8D Cl 9E C9 C8B0：A5 6218 C9 FA $90 \quad 034 \mathrm{C}$ B9 C8B8：B2 C9 $2 \emptyset$ BA C9 D 9 F1 $2 \emptyset$ 5B C8C 0 ：D7 C9 9ø øC 4 C 5B C9 $2 \emptyset \quad$ Ø7 C8C8：A8 C4 4C 94 C4 $2 \varnothing \mathrm{FE}$ C9 21 C8D $:$ B $\varnothing 712 \emptyset 13$ A6 $9 \varnothing$ Fø A4 4A C8D8：14 A5 15 CD Cl 9 E 90 ED F4 C8EØ：DØ 05 CC CØ 9E $9 \varnothing$ E6 854 C
 C8FØ：9E $3 \varnothing 29$ C4 ØB Fø D6 9ø A9 C8F8：$\varnothing \mathrm{E} 98$ E5 ØB 1865 2D 85 5B C9øø：2D 9ø CA E6 2E Bø C6 A5 7D С9ø8：ØВ 84 ØВ 38 Е5 ФВ 85 ØВ 98 C910：A5 2D E5 ØB 85 2D Bø B5 27 C918：C6 2E 9ø B1 C4 ØB FØ Ø3 FE C920：2ø 8ø CA Aø øø B9 øø Ø1 2 F C928：FØ Ø5 9145 C8 DØ F6 98 ØC C930：18 6545 9ø Ø2 E6 $46 \quad 8598$
 C940：4C CD C8 2C 9E 9E 30132 C C948：CE 9E 9E 2б BD C4 0826 Fl C950：A8 C4 28 Вø ø3 4С BF С8 øВ C958：4C AØ C4 2 Ø 74 C9 AØ ØЗ E3 C960：A5 6291 5F 88 A5 6391 BA C968：5F $2 \varnothing$ BA C9 DØ FØ $2 \varnothing 6092$ C970：A6 4C 97 C4 AD C6 9E 85 DC C978：14 AD C1 9E $85 \quad 15 \quad 2 \emptyset 13 \quad 77$ C980：A6 A5 5F 48 A5 6048 AD 2 E C988：BC 9E 85148563 AD BD E6 C99日：9E $85 \quad 158562 \quad 2 \varnothing 13$ A6 $3 \varnothing$ C998：68 AA 68 E4 6Ø $9 \varnothing$ ø8 D 8 8C C9AØ： 11 C5 $5 \mathrm{FF} 9 \varnothing 62$ Dø ØB 8613 C9A8：60 85 5F AØ Ø1 Bl 5 F FØ 42 C9B0：BD 60 A9 FF 8D Cl 9E 4C 6D C9B8：6E CB A5 6318 6D BE 9E F3 C9C0：85 63 A5 62 6D BF 9E 85 F7 C9C8：62 Aø 01 B1 5F 4888 Bl CF C9Dの：5F 85 5F $688560602 \varnothing 76$ C9D8：8E A6 Aø $\varnothing 2$ B1 7A D $\varnothing 62$ AC C9E0： 3860 C8 B1 7A 8539 C8 62 C9E8：Bl 7A 85 3A 20 FB A8 A5 $3 \varnothing$ C9F0：7A 85 3D A5 7B 85 3E A9 3D
 CAøØ：Øø $2 \emptyset 21$ CD FØ D4 24 ØF Dø CAø8：3Ø Fl C9 CB DØ ø9 $2 \varnothing 7386$ CA10：00 C9 A4 Dø Ø2 A9 89 Aø 24 CA18：04 D9 CE 9E F6 158810 E6 CA20：F8 C9 8A Fø ØE C9 91 Dø $9 \varnothing$ CA28：Ø2 85 ØE C9 3A FØ Cø 24 B9
 СА 38 ：A $\varnothing \mathrm{FF}$ C8 B1 7A C9 $3 \varnothing 9 \varnothing$ 3E CA $40: \emptyset 4$ C 9 3A $9 \varnothing$ F5 84 ØB A5 18 CA48：7A $85 \quad 45$ A5 7B $8546 \quad 20$ 1E CA50：79 øø $2 \varnothing 6$ 6 A9 $18602 \varnothing$ EB
 CA60： 03 Bl 5 F AA 88 Bl 5 F E4 29 CA68：25 DØ Fl C5 24 Dø ED $2 \varnothing$ BF CA $7 \varnothing$ ： 05 CE $2 \varnothing$ DF BD AØ $\emptyset \varnothing$ B9 68 CA78：Øø Ø1 Fø Ø3 C8 Dø F8 6078 CA80：90 2298 E5 ØВ 85 ØВ АØ 7D CA88：øø B1 2D A4 øB 91 2D A6 1A CA90：2E A4 2D Dø ø1 CA 8886 E3 CA98：2E 84 2D C4 45 D6 E8 E4 7C CAA ： 46 D E 46 6 8 C B4 CA A5 A2 CAA8： $45 \quad 85 \quad 22$ A5 $46 \quad 85 \quad 23$ A4 14 CABØ：øB B1 22 Aø Øø 9122 A6 B7 CAB8：23 A4 22 C8 Dø Ø1 E8 86 BC CACØ：23 $84 \quad 22$ C4 2 DD D $\varnothing$ E8 E4 FC CAC8：2E Dø E4 $6 \varnothing$ FØ Ø3 4 C 76 EE

CADØ：CB A9 Øø 8514 A9 9F 85 1B CAD8：4A A9 018549 E6 14 A5 2A CAEØ： 14 AA 0930 8D 52 9E AØ E2 CAE8： 06 B9 $5 \varnothing$ 9E $2 \varnothing$ D2 FF 88 B8 CAFØ：DØ F7 BD F8 9E FØ $5085 \quad 13$ CAF8：15 Bl 4948 C9 $22 \mathrm{~F} \emptyset$ ØA F5 CBøø：29 7F C9 14 F0 ø4 C9 øD BE CBø8：DØ 2C A6 D4 FØ Ø3 A2 øø ØE CB1ø：2C A2 ø2 BD 5D 9E C9 29 A4
 CB2ø：68 AA 9848 A9 øø 20 CD 89 CB28：BD 68 A8 2062 CB FO 17 ØB
 CB38：D $\varnothing 64 \quad 88 \quad 2 \varnothing \begin{array}{llllllll} & 5 \mathrm{~F} & \mathrm{CB} & 68 & 2 \varnothing & 67\end{array}$ CB4ø：67 CB D $\emptyset$ B5 $2 \emptyset 5 \mathrm{~F}$ CB A6 B CB48：14 EØ Ø8 FØ ØF BD F8 9E 32 CB50：18 65498549 9ø Ø2 E6 46 CB58：4A 4C DD CA A9 øD 2C A9 14 CB60：22 2C A9 29 2C A9 $2 \mathrm{AB} 2 \varnothing$ 5A CB68：D2 FF C8 C4 15 6Ø A2 ØE 4C CB70：2C A2 17 4C 15 Cl 20 9E FC CB78：B7 8A FØ F2 C9 ø9 B $\emptyset$ EE 9 E CB80：8D 52 9E A9 2C 20 øC CD A9 CB88：AØ Øø A2 Ø9 A9 øø CA Fø 29 CB90： 0618 7D F8 9E 90 F7 9931 CB98：A7 $02 \mathrm{C} 8 \mathrm{C} \varnothing 04 \mathrm{~F} \quad 21 \mathrm{AE} 7 \mathrm{E}$ CBAØ： 52 9E BD F8 9E $48 \quad 38$ E5 BC CBA8：øD 99 A7 ø2 C8 A5 øD 4881 CBB $0: 38$ FD F8 9E 99 A7 0268 C4 CBB8：9D F8 9E 8A 48 C8 D $\varnothing$ CC AD CBC0：48 $18 \quad 65$ ØD 99 A7 92 C8 38 CBC8：68 99 A7 0268 AA $6848 \quad 17$ CBD0：18 79 A7 62 99 A7 0268 BF CBD8：85 ØB C5 ØD Fø $\begin{array}{ll}\text { BB } 901 D 32\end{array}$
 CBE8：9F 9D 61 9F C8 E8 EC A7 3D CBFØ：$\varnothing 2$ Dø F3 Fø 24 A5 ØB 9D B6 CBF8：F8 9E 4C 71 CB AD A7 02 BB CC00：18 6D A9 02 Bø EF AA AC 9D CC08：A7 Ø2 CC AA 0290 ØA B9 5A CC10：ø1 9F 9D Ø1 9F CA 88 10 1F CC18：Fl AE AA 62 AØ øø C4 øD 67 CC2ø：Fø ø9 B1 22 9D Ø1 9F E8 E5 CC28：C8 DØ F3 A9 øø 8D 9F 9E 87 CC30：6Ø Ø8 ØA Ø2 Ø9 15 15 24 5A CC38：8B 9E 97 EE EA F2 F5 $24 \begin{array}{llllll} & 54\end{array}$ CC40：F9 1E 15 F1 F3 F8 D8 D9 2F CC48：D7 D6 F7 DC 99 F4 62 D1 42
 CC58：45 $43 \quad 544 \mathrm{~F} 52$ D9 $48 \quad 45$ B4 CC60：4C DØ $53 \begin{array}{llllllll} & 43 & 52 & 41 & 54 & 43 & 76\end{array}$ CC68：C8 $52 \quad 454 \mathrm{E} 414 \mathrm{D}$ C5 56 A9 CC70：49 45 D7 4B 45 D9 $5155 \quad 39$ CC78：49 $\begin{array}{lllllllll} & \text { D } & 44 & 43 & 4 C & 45 & 41 & \text { D2 } & 75\end{array}$ CC80：48 45414445 D2 $43 \quad 4 \mathrm{~F} 47$ CC88：4C 4C 4543 D4 52454 E Ø1 CC9ø：55 4D 42 CC98：CE $54 \begin{array}{lllllll}52 & 4 \mathrm{~F} & 46 & \text { C6 } & 54 & 52 & 36\end{array}$ CCAØ：41 D $\emptyset 5245 \begin{array}{lllllll}53 & 55 & 4 D & C 5 & \text { FD }\end{array}$ CCA8：44 $45 \quad 4 \mathrm{C} \quad 45 \quad 54$ C5 $41 \begin{array}{lllll}55 & 25\end{array}$
 CCB8：50 D9 42414 E CB 4445 BC СССØ：С3 504 F 494 E 5445 D 2 EF CCC8： 484558 A4 455252 A4 E9 CCD0：58 4F D2 øø C1 EE C5 D8 F2 CCD8：C5 B2 C7 90 C4 D8 C6 E4 FF CCE0：C7 4 AE C7 7 D9 CA CB C4 5 C F3 CCE8：C7 86 C6 FF C7 83 C8 5E 1 D CCF0：C4 CF C4 D2 C3 25 Cl C 0 9D CCF8：C3 E6 Cø E3 C6 ø8 C7 4B B5 CDø日：Cø 36 Cø 1 B CD 76 CD 35 6C CDø8：CD A8 Cø 0120 FF AE 20 5B CD10：9E AD $2 \varnothing$ A3 B6 85 øD 60 EA CD18：2Ø FF AE $2 \varnothing$ 8A AD 4C F7 37 CD20：B7 48 C9 øø Fø ø8 C9 22 4ø CD28：Dø Ø6 A5 øF 49 FF 85 ØF $\quad$ B7 CD30：68 60 4C 6E CB A6 15 Dø 7C CD38：F9 A5 14 FØ F5 C9 1F 9071 CD40：øD Fø ø6 Ø8 C9 22 DØ EA 43 CD48：28 $2 \varnothing 6 \mathrm{E}$ Cl Dø ØC ØA AA 5F CD50：BD 26 A3 $85 \quad 22$ BD 27 A3 1B CD58：85 23 A 0 FF C8 B1 22 10 F4 CD60：FB C8 9820 7D B4 A0 FF 41 CD68：C8 B1 $22 \begin{array}{lllllll} & 48 & 29 & 7 F & 91 & 62 & 6 A\end{array}$ CD70：68 10 F5 4C CA B4 A9 0448

CD78：2ø 7D B4 A9 ø2 85 ØВ Аø 91
 CD88：$\varnothing \mathrm{F}$ AA $68 \quad 4 \mathrm{~A} 4 \mathrm{~A} 4 \mathrm{~A} \quad 4 \mathrm{~A}$ A8 Cø CD9ø： B 9 7E 9 E A4 419162 BD 99 CD98：7E 9 E C8 $91 \quad 62$ A5 $65 \quad 85 \quad 47$ CDAØ：64 C6 ØB Dø DC 4C CA B4 Fø CDA8：A5 1448 A5 15 48 A9 2 C C8 CDBD： 2018 CD $68 \quad 45 \quad 15 \quad 85 \quad 628 \mathrm{E}$ CDB8：68 4514 4C 03 CE A9 28 EF CDC $0: 2 \varnothing$ øC CD $482 \varnothing$ F7 AE 6854
 CDDØ： 05 BØ 15 A9 Øø AØ FF 8560 CDD8：63 $85 \quad 62$ C8 B1 22 A2 $\quad$ ØF CA CDEØ：DD 7E 9E Fø $\quad 66$ CA 10 F8 62 CDE8：4C 6E CB A5 ØD 29 Ø1 Dø F9 CDF0： 0 B 8A ØA ØA ØA ØA 8563 7D CDF8：C6 ØD 10 DF 8A 6563 C6 31 CEø日：øD DØ D6 8563 A2 9038 8A
 CE10：CA 30 AB A5 1448 A5 1511 CE18：48 8A ØA Fø 9748 A9 28 A1 CE 20：2ø 18 CD 68 AA BD 02 CD 32 CE28：85 56 BD ø3 CD $85552 \emptyset 55$ CE30：54 øø $68 \quad 85 \quad 15 \quad 68 \quad 85 \quad 14 \quad \mathrm{C} 6$ CE38：4C F7 AE A5 7A 48 A5 7B E5 CE40：48 $2 \varnothing 73$ Øø C9 CE FØ F9 DD CE48：A2 65 DD 4F CC FØ BC CA 97 CE50：10 F8 2C 9F 9E 3ø 2A C9 87 CE58：44 DØ 26 2ø EE C2 FØ 2198 CE60：2Ø B9 C6 A9 FF 8D 9F 9E 64 CE68：88 98 AØ ø2 91 2D A9 A7 EØ CE7ø：85 7A A9 0285 7B $2 \varnothing 7998$ CE78：øø $2 \varnothing$ F3 BC A9 ø9 $2 \varnothing$ D3 ED CE80：9E $68 \quad 85$ 7B $68857 A \quad 4 \mathrm{C}$ 8A CE88：86 AE A9 øø 8D 9F 9E 8D FF CE90：9C 9E 8D 9B 9E 20 BD C4 45 CE98：84 3 （ $8432852 F 85315 \mathrm{D}$ CEAØ：AØ 1B B9 Aø 9E 912 D 88 B4 CEA8： 10 F8 6ø Aø FF E6 ØB A6 FA CEB0：7A CA E8 C8 BD øø Ø2 3812 CEB8：F9 55 CC FØ F5 C9 80 DØ F9 CECD：2A A5 ØB 38 E9 4A A8 B9 45 CEC8：38 CC 85 ØB Aø $0788 \quad 3 \varnothing 79$ CED $0: 15$ D9 31 CC D $\varnothing$ F8 Cø $\varnothing 2$ 5ø CED8：90 Ø3 A9 FE 2C A9 CE E6 31 CEE0：71 A4 7199 FB Ø1 A9 Øø 5 F CEE8：4C 9D CF B9 $55 \mathrm{CC} 3 \varnothing$ Ø6 ED CEF0：C8 B9 55 CC 10 FA B9 56 ØF CEF8：CC DØ B2 A6 7A BD Øø Ø2 BE CFø日：4C 9 F CF $43 \begin{array}{lllllll} & 41 & 4 \mathrm{E} & 27 & 54 & \mathrm{Cl}\end{array}$ CF08：2ø $5245 \quad 53 \quad 554 \mathrm{C}$ C5 44 D9 CF10：49 $52 \begin{array}{llllllll}45 & 43 & 54 & 20 & 4 D & 4 F & D\end{array}$ CF18：44 $45 \quad 204 \mathrm{~F} 4 \mathrm{E} 4 \mathrm{C}$ D9 8501 CF20：89 86 8A $878 \mathrm{BB} 88 \quad 8 \mathrm{C} \quad 848 \mathrm{BB}$ CF28：Ø5 05 Ø5 0404050544 EE CF30：49 D2 ØD 3F 445324 øD 83 CF38：48 45 4C 50 日D $\begin{array}{llllll}56 & 49 & 45 & 75\end{array}$ CF40：57 $22 \quad 52 \quad 554 \mathrm{E}$ ØD $4 \mathrm{AB} 45 \quad 36$ CF48：59 øD 4C $49 \begin{array}{llllllll}53 & 54 & \text { øD } & 51 & 4 D\end{array}$ CF50：55 $49 \begin{array}{lllllll}54 & \text { 日D } & 2 \mathrm{C} & 23 & 59 & 45 & 2 \mathrm{E}\end{array}$ CF58：4B ØD ØA øø ØA øø øø øø 72 CF60：22 2B $43 \quad 48 \quad 52 \begin{array}{llllll}24 & 28 & 29 & 65\end{array}$ CF68：93 $94 \quad 95$ 9F $\quad$ ØD 47 4E 49 ØF CF70：57 $4549 \begin{array}{llllll}56 & 3 F & 45 & 52 & 55 & \text { A4 }\end{array}$ CF78：53 $2 \varnothing \begin{array}{lllllll}55 & 4 F & 59 & 2 \varnothing & 45 & 52 & 91\end{array}$ CF80：41 $30 \begin{array}{llllllll}31 & 32 & 33 & 34 & 35 & 36 & 21\end{array}$ CF88：37 $38 \quad 394142434445$ F9 CF90：46 ø๐ FF øø øø øø FF øø 53 CF98：øø øø øø øø øø øø øø øø 38 CFAØ：Øø FF Øø 44 D3 Øø A7 0274

 CFB8：45 52 81 8ø øø øø øø øø C7 CFCØ：øø øø øø øø øø øø øø 4C AC CFC8：AB CE $2 \varnothing$ ø5 C5 øø 9 EE øC BD CFD0：9E 89 8D A7 D6 D7 A4 2E DB CFD8： $18 \quad 65$ 2D $9 \varnothing 01$ C8 AA 4 C 59 CFED：D4 BB $8184 \begin{array}{llllll}85 & 87 & 88 & 96 & 44\end{array}$ CFE8：A1 A7 $50464 \mathrm{~B} \quad 45 \quad 59 \quad 36$ 日A CFF0：34 $2066279204 \mathrm{~A} \quad 45 \quad 46 \quad 91$ CFFB：46 $206041 \begin{array}{llllll}52 & 54 & 43 & 48 & 94\end{array}$

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

## Program 1: Zookeeper

, ZooKeeper

- Convert image definition files
to DATA statements 4
- Copyright 1987 COMPUTE! Public ations, Inc. 4
' All rights reserved. 4
PRINT"Copyright 1987": PRINT"Comp utel Publications, Inc." 4
PRINT"All Rights Reserved.":FOR $\mathrm{X}=1$ TO 2øøø:NEXT X 4
CLS 4
MainLine: 4
GOSUB HouseKeeping 4
GOSUB ParameterEntry ${ }^{4}$
GOSUB DefineFieLds 4
IF NoErrors THEN 4
GOSUB CreateZooFiLe $\prec$
GOSUB FiLeMaintenance 4
END IF4
GOSUB EndJob 4
END 4
4
HouseKeeping: 4
DEFINT $\mathrm{a}-\mathrm{z}^{4}$
WINDOW 1,"The ZooKeeper", $(0,56)$ (500, 186), 154
TRUE $=-14$
FALSE $=04$
HeaderBytes $=264$
CoLorMapBytes $=64$
RETURN 4
4
ParameterEntry: 4
PRINT 4
INPUT "Enter name of AmigaBASIC
object file: ",FiLename\$ 4
INPUT "Enter maximum number of $d$ ata elements per statement: ", Ma xBytes
PRINT 4
RETURN 4
DefineFieLds: 4
PRINT "Input file: ";FiLename\$ OPEN FiLename\$ FOR INPUT AS 14 ImageS=INPUT\$ (LOF (1) , 1) 4
CLOSE $1 \nless$
Depth $\&=\operatorname{CVL}(\operatorname{MID}(\operatorname{Image} \$, 9,4)) \leftarrow$

Wide $\&=\operatorname{CVL}($ MIDS $($ ImageS, 13,4$)) 4$
Height $\&=\operatorname{CVL}($ MIDS $($ Images, 17,4$)) \leftarrow$
Flags $=\operatorname{CVI}(M I D \$(I m a g e \$, 21,2)) \leftarrow$
BytesPerRow $=2$ *INT((Wide\&+15)/16 ) 4
BytesPerPlane $=$ BytesPerRow*Heigh t\& 4
BytesInBitmap $=$ BytesPerPlane*Dep th\&
IF Flags AND 1 THEN 4
ObjectIsSprite= TRUE ${ }^{4}$
ReqBytes $=$ HeaderBytes + BytesInBit
map+CoLorMapBytes 4
ELSE 4
ObjectIsSprite= FALSE 4
ReqBytes $=$ HeaderBytes + BytesInBit map
END IF4
IF LEN(ImageS) < > ReqBytes THEN 4
PRINT FiLenameS;" is not compati
ble with the ZooKeeper." 4
NoErrors $=$ FALSE 4
ELSE4
NoErrors $=$ TRUE 4
END IF4
RETURN 4
4
CreateZooFiLe: $\&$
PRINT "Output file: ";FiLenames;
".ZOO" 4
PRINT 4
PRINT "Please wait..." $\leqslant$
PRINT 4
OPEN FiLename\$+". zOO" FOR OUTPUT AS 14
PRINT \# 1,4
PRINT \# 1, "ObjectData:" $\&$
IF ObjectIsSprite THEN 4
PRINT \# 1, "' SPRITE Format" 4
ELSE 4
PRINT \# 1, "' BOB Format" \&
END IF 4
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\&4
CurrentByte $=14$
Comment $\$=$ "' Object Header" 4
CALL FormatData (Comment\$,MIDS (Im ages, CurrentByte, HeaderBytes), Ma xBytes,1) 4
CurrentByte $=$ CurrentByte + Header $B$ ytes 4
FOR PLane $=1$ TO Depth\& 4
Comment $\$=$ "' BitPlane $"+\operatorname{STR}(P L$ ane) 4
CALL FormatData (Comment\$,MIDS (Im age $\$$, CurrentByte, BytesPerPlane), MaxBytes,1) 4
CurrentByte $=$ CurrentByte + BytesPe rPlane 4
NEXT PLane 4
IF ObjectIsSprite THEN 4
Comment\$="' Sprite Color Map"
CALL FormatData (CommentS,MID\$ (Im
age§, CurrentByte, CoLorMapBytes),
MaxBytes,1) 4
END IF4
CLOSE 14
RETURN 4
4
FiLeMaintenance: 4
PRINT "Shall I delete ";FiLename
\$;" (y/n)";
INPUT Response\$4
IF UCASES(Response\$)= "Y" THEN $\langle$ KILL FiLename\$4
PRINT FiLenames;" deleted." 4
END IF 4
PRINT 4
RETURN

EndJob: 4
PRINT "Job complete: returning $t$

- AmigaBASIC." 4

PRINT 4
RETURN 4
4
SUB FormatData(Note\$, Dat\$, DatLim
it,FiLeNo) STATIC
PRINT \# FiLeNo, Note\$ 4
NoBytes= LEN(Dat\$) 4
NoFuLLLines= INT(NoBytes/DatLimi
t) 4

CurrentByte $=14$
FOR LineOut= 1 TO NoFuLLLines 4
CALL PrintDataLine (MIDS (Dats, Cur rentByte, DatLimit), FiLeNo) 4
CurrentByte= CurrentByte+DatLimi t 4
NEXT LineOut 4
IF CurrentByte $<=$ NoBytes THEN 4
BytesLeft $=$ NoBytes-CurrentByte +1
4
CALL PrintDataLine(MIDS (Dats, Cur rentByte, BytesLeft), FiLeNo) 4
END IF4
END SUB 4
4
SUB PrintDataLine(Dat\$,FiLeNo) S TATIC 4
NoBytes $=$ LEN $($ Dat $) ~ 4$
PRINT \# FiLeNo, USING " DATA
\#\#\#";ASC(MIDS(Dat\$,1,1)); ${ }^{4}$
FOR ELement $=2$ TO NoBytes 4
PRINT \# FiLeNo, USING " , \#\#\#";A
SC(MIDS (Dat\$, ELement,1)T; $\leftarrow$
NEXT ELement 4
PRINT \# FiLeNo, 4
END SUB 4

## Program 2: Demonstration

${ }^{4}$ zookeeper demonstration 4

- Copyright 1987 COMPUTEI Public ations, Inc. 4
- All rights reserved

PRINT"Copyright 1987":PRINT"Comp
utel Publications, Inc." 4
PRINT"All Rights Reserved.":FOR
$\mathrm{X}=1$ TO 2øøб:NEXT X 4
CLS 4
MainLine: 4
GOSUB HouseKeeping 4
GOSUB InitPLayer 4
WHILE INKEY\$=""\&
IF MOUSE $(\varnothing)<>\varnothing$ THEN $\langle$
OBJECT.X 1 , MOUSE (1) $\&$
OBJECT.Y 1, MOUSE (2 2 ) 4
END IF\&
WEND 4
END4
4
HouseKeeping: 4
DEFINT a-z孔
WINDOW 1,"Ball Demo", $(\square, 136)-(45$
Ø,186),154
PRINT "Manipulate object with mo
use." ${ }^{4}$
PRINT "Hit any key to exit." 4
RETURN 4
4
InitPLayer: 4
ByteCount = 1064
Image $=$ = " 4
FOR LOOp= 1 TO ByteCount 4
READ ImageData 4
Image $\$=$ Image $\$+$ CHR $\$($ ImageData $) ~ \psi$
NEXT Loop 4
OBJECT.SHAPE 1, Image\$4
OBJECT.ON4
RETURN 4
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:

$$
\begin{array}{ll}
\text { Starting address: } & 84 \mathrm{DO} \\
\text { Ending address: } & 9 \mathrm{E} 47
\end{array}
$$

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 f4 (SHIFT-f3) to go back to the previous series. The f5 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 f3-f6 to put the shape you want to copy into the editing area. Press f 1 to copy the shape; then use f3-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 $f 7$ 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 properly, 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．
84D $: 4 \mathrm{C} \quad 35 \quad 85 \quad 20 \quad 95 \quad 88$ C9 3092 84D8：9Ø F9 C9 39 BØ F5 8D 21 ØF 84EØ：85 A9 Ø3 20 6B $87 \quad 38$ E9 4D 84E8： $3 \emptyset$ ØA AA BD $23 \quad 8585$ FD F5 84FØ：E8 BD $23 \quad 8585 \mathrm{FE} 6 \mathrm{C}$ FD 99 84F8：Øの $2 \emptyset$ Fの 85 4C D3 $842 \emptyset$ 5B 85øø：E4 FF Fø FB 60 ØØ A5 FB A5 85ø8：18 6D $058585 \mathrm{FB} 90 \quad$ Ø2 B2 8510：E6 FC 60 ØØ A5 FD 18 6D 9C 8518：13 8585 FD 90 F4 E6 FE C3 852Ø：6Ø 2Ø ØØ 0794 E3 9394 C3 8528：8B CE 97 BF 98 6D 98 3E 85 8530：9B C7 95 88 96 A9 EF 8D FE 8538：28 ø3 A9 C1 8D 18 ø3 A9 E5 8540：8E 20 D2 FF A9 6820 D2 75 8548：FF AD 86 Ø2 8D FE 9F AD 65 8550：20 D 8 8D FD 9F AD 21 D 67 8558：8D FC 9F AD 8A 028 DDF AF 8560：9F A9 01 8D 86 ø2 8D 2016 8568：Dø A9 15 8D 18 Dø $2 \varnothing$ FØ F6 8570：85 A9 6085 F9 85 FA 8 D 6 A 8578：23 9F 20 96 FF A9 33 8D A4 8580： $21852 \varnothing 68$ 8E A9 øD 85 C2 8588：F7 85 F8 A9 308 D 79 9F F4 859ø：8D 7A 9F A9 80 8D．8A 02 EØ 8598：A9 31 8D 2185 A9 $63 \quad 2 \varnothing 81$
 85A8：A9 94 8D 5B 86 A9 4285 D5
 85B8：8D 27 64 A9 7D 8D E7 9768 85Cø：A9 6D 8D Cø 67 A2 25 A9 78 85C8：43 9D Ø1 Ø4 9D 51 64 9D 15 85Dø：C1 67 CA 10 F4 28758874 85D8：A9 6B 8D $5 \varnothing$ ø4 A9 73 8D 85 85Eø：77 Ø4 A5 2285 Ø2 A9 $00 \varnothing 7$ 85E8：20 6B 87 A5 $\varnothing 2852260$ F4 85F6：28 48 86 A9 6B 8D $3 \varnothing 6681$ 85F8：A9 72 8D 62 øB A9 7D 8D 9C 86ø0：42 ø6 A2 10 A9 43 9D 31 CB 86ø8：ø6 CA 10 FA A2 ØA Aø 12 øD 861Ø：A9 $78 \quad 2 \varnothing 5886$ A9 614 C C2 8618：6B 87 A9 FF 8D 15 Dø $2 \varnothing 74$ 862ø：A5 85 A9 72 8D 6964 A9 81 8628：71 8D D9 87208788 A9 D6 8630：6B 8D E9 66 A9 73 8D F7 22 8638：06 A2 øC A9 43 9D EA 6679 8640：CA 10 FA A9 024 C 6B 8750 8648：A9 øø 8D 15 DØ 8D 21 D $\varnothing$ FC 8650：A9 61 8D 86 ø2 4C A5 85 9E 8658：85 FB A9 FF 85 FC A9 28 F7 8660：8D 65 85 A5 22 91 FB 26 EF 8668：Ø6 85 CA 10 F6 A5 226827 8678：53 $505249 \begin{array}{lllll}54 & 45 & 53 & 2 \varnothing & 98\end{array}$ $\begin{array}{llllllll}8678: 44 & 45 & 53 & 49 & 47 & 4 \mathrm{E} & 45 & 52\end{array} 48$ 8680：ø0 31 $2 \mathrm{E} \quad 20494 \mathrm{E} 4954$ ØC
 8690：1D $32 \begin{array}{lllllll} & 2 \mathrm{E} & 20 & 45 & 44 & 49 & 54 \\ \text { A2 }\end{array}$ 8698：ØD 1D 1D 33 2E 20414 E øD 86AG：49 4D 415445 日D 1D 1D C8 86A8：34 $2 \mathrm{E} 20 \begin{array}{lllllll}53 & 41 & 56 & 45 & 6 \mathrm{D} & 8 \mathrm{~F}\end{array}$ 86BG：1D 1D $35 \quad 2 \mathrm{E} 204 \mathrm{C} 4 \mathrm{~F} 41 \quad 2 \mathrm{~F}$ 86B8：44 øD 1D 1D 36 2E $2 \varnothing 448 \mathrm{~F}$ 86CO： $41 \begin{array}{llllllll}54 & 41 & 20 & 42 & 41 & 53 & 49 & \text { B4 }\end{array}$ 86C8：43 ØD 1D 1D 37 2E 20 4D 36 86D $: 4 \mathrm{~F} 4 \mathrm{E} 4 \mathrm{~F} 4348524 \mathrm{~F} 4 \mathrm{D} A \mathrm{E}$


86Eø：55 4 C 54 $49 \begin{array}{llllll} & 43 & 4 \mathrm{~F} & 4 \mathrm{C} & 4 \mathrm{~F} & \text { ØA }\end{array}$ 86E8：52 4544 ØD 1D 1D $3 \emptyset 2 \mathrm{E}$ B5 86FD：20 51554954 ØD ØD 1D AF 86F8：1D $41 \begin{array}{llllllll} & 43 & 54 & 49 & 4 \mathrm{~F} & 4 \mathrm{E} & 2 \varnothing & \mathrm{D} 6\end{array}$ 87øø：øø $3 \varnothing 2 \varnothing 2 \varnothing 2 \varnothing 2 \varnothing 311116$ 87ø8：11 1111 9D 9D 9D 9D 9D 1C 871ø：9D 32 2ø $2 \varnothing$ 2Ø $2 \varnothing \begin{array}{llllll} & 33 & 11 & 79\end{array}$ 8718：11 1111 9D 9D 9D 9D 9D 2C 8720：9D $342 \varnothing 2 \varnothing 2020 \quad 3511 \quad$ 日E 8728：11 1111 9D 9D 9D 9D 9D 3C 8730：9D $3620202 \varnothing 2 \varnothing 3711$ A2 8738：11 1111 9D 9D 9D 9D 9D 4C 8740：9D 9D $53 \quad 45$ 52 $4945 \begin{array}{lllll}53 & \text { D9 }\end{array}$ 8748：3A 11 9D 9D 9D 9D 9D 9D 82 8750：9D $53505249 \begin{array}{lllllll}54 & 45 & 3 A & 92\end{array}$ 8758：11 11 9D 9D 9D 9D 9D 9D FD 8760：9D 2B $2 \varnothing$ C3 C3 $2 \varnothing 4845$ BD 8768：4C $5 \emptyset$ øø ØA ØA A8 A2 ø3 8D 8770：B9 878748 C8 CA 10 F8 3E 8778：68 A8 68 AA $1820 \mathrm{~F} \quad \mathrm{FF} \mathrm{C} \varnothing$ 8780：68 A8 68 4C 1E AB øø 70 CF 8788：86 ø1 øС 8186 Ø3 Ø2 ø1 F9 8790：87 Ø3 1D 2185 øD 9981 CD 8798：91 16 1C 618716 1C CF 2 C 87A0：93 10 ø2 1F $96 \quad 0718$ 2A DA 87A8：96 ø7 1F $1496 \quad 05$ 18 A7 8A
 87B8： 9710 Ø2 4D $981 \varnothing$ Ø2 FF B5 87C0：9E 14 Ø2 E4 91 øC 19 1C BD
 87Dø：87 14 ø2 F9 9310 Ø2 7F E8 87D8：95 9713 A6 9515 Ø2 4A 9ø 87E0：96 15 Ø2 8C $9914 \quad \emptyset 2$ B6 61 87E8：88 ø4 02 AF 89 øE 027879
 87F8：9B $1 \varnothing$ ø2 A9 D8 8D 5B 86 EE 88ø0：A5 22 8D øø D8 8D 27 D8 42 88ø8：8D E7 DB 8D C $\varnothing$ DB A2 25 ØE 8810：9D ø1 D8 9D 51 D8 9D C1 10 8818：DB CA 10 F4 $2 \varnothing 7588$ 8D 90 8820：50 D8 8D 77 D8 A2 1F 9D E5 8828：2C D8 CA 10 FA 8D 69 D8 99 8830：8D D9 DB 208788 8D E9 5F 8838：DA 8D F7 DA A2．ØC 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 99 9D 14 BF 886ø：DB CA $1 \emptyset$ FA A2 $\varnothing 89 \mathrm{D} 3 \mathrm{C} 7 \varnothing$ 8868：DB CA 10 FA A2 $089 \mathrm{D} \mathrm{8C} \mathrm{C8}$ 8870：DB CA 10 FA 60 A2 16 Aø 2 E 8878：日ø A9 $28 \quad 20 \quad 58$ 86 A2 1633 8880：AØ 27 A9 $284 \mathrm{C} 58 \quad 86$ A2 $\begin{array}{lllllll} & \text { D6 }\end{array}$ 8888：14 AØ 19 A9 78 4C $58 \quad 86$ B5 8890：12 2092 9D øø A9 9ø Aø 47 8898： $88 \quad 18201 \mathrm{E}$ AB A9 EC 85 3D 88AØ：A2 $2 \emptyset$ E4 FF Dø $0^{\circ}$ A5 A2 58 88A8：DØ F7 AD $9 \varnothing 884980$ 8D D6 88B $\varnothing$ ： $9 \varnothing 884 \mathrm{C} 95886 \varnothing 1 F 4457$ 88B8： $49 \quad 53 \quad 504 \mathrm{C} 414345 \quad 20$ D3 88Cø：54 $4845 \quad 2 \varnothing 4355 \quad 52532 \varnothing$ 88C8：4F $52 \quad 2 \varnothing \quad 2 \varnothing$ 9E 43525316 88Dø：52 2Ø 1C 4B 455953 øD 8E 88D8：ØD 1D 1D 1F 4 D 4 F 4449 C 4 88EØ：46 $592 \varnothing 2 \emptyset 2 \varnothing 4 D 4 F 4 E 94$ 88E8：4F $43 \quad 48 \quad 524 \mathrm{~F}$ 4D 45 2ø FA 88FØ：20 9E 53 50 41434511 DB 88F8：9D 9D 9D 9D 9D 534849 El 8900：46 54 2D 53 50 41434579 89ø8：ØD 1D 1D 1D 1D 1D 1D 1D 13 8910：1D 1D 1F 4D 554 C 54497 F 8918：43 $4 \mathrm{~F} \quad 4 \mathrm{C} 4 \mathrm{~F} \quad 524544 \quad 206 \mathrm{~F}$ 8920：20 9E $3 \varnothing 2 \varnothing 2 \varnothing 2 \varnothing 312 \varnothing \mathrm{~F} 6$ 8928：2Ø $2 \varnothing \quad 32$ 2б $2 \varnothing 2 \varnothing 331194$ 8930：9D 9D 9D 9D 9D 9D 9D 9D 43 8938：9D 9D 9D 9D 9D 9D 1C 28 D2 8940：9E 5A 1C 29 2ø 28 9E 5886 8948：1C 29 2б 28 9E 43 1C 29 9D 8950：20 28 9E 56 1C 29 øD ØD 63 8958：1D 1D 1F 4D 4 F $5645 \quad 2078$ 8960：41 $524 \mathrm{~F} \quad 554 \mathrm{E} 442053 \mathrm{FE}$ 8968：43 $52 \begin{array}{llllllll} & 45 & 45 & 4 \mathrm{E} & 2 \varnothing & 2 \emptyset & 2 \varnothing & \varnothing 2\end{array}$ 897ø：9E 51 2Ø 1C 4 C 4546 8978： $2 \varnothing$ 2б 9 E 45 2ø 1C 424 F 11

8980：54 54 4F 4D ØD 1D 1D 1F C7 8988： 43 4F 4D 4D 4 F 44 4F 52 øC 8990：45 20 4B 45 59 $20414 \mathrm{E} \quad 28$ 8998：44 2E 2E $2 \varnothing$ 2б $9 \mathrm{EE} 572 \varnothing 6 \mathrm{~B}$ 89Aø：1C 5249474854209 E 66 89A8：52 2ø 1C $544 \mathrm{~F} 5 \varnothing$ øø 1F $9 \varnothing$ 89Bø：53 59 4D 4D $45 \quad 545259$ BB 89B8：2Ø $2 \varnothing 2 \varnothing 2 \varnothing 2 \varnothing 2 \varnothing 2 \varnothing 2 \varnothing$ CB
 89C8：1C $48 \quad 4 \mathrm{~F} \quad 52495 \mathrm{~A} 4 \mathrm{~F} 4 \mathrm{E} \quad \mathrm{AB}$ 89Dø：54 41 4C ØD 1D 1D 1F 4397 89D8： $4 \mathrm{~F} \quad 4 \mathrm{D} 4 \mathrm{D} \quad 4 \mathrm{~F} 444 \mathrm{~F} 5245 \mathrm{CE}$ 89Eø：2ø 4B $45 \quad 592 \varnothing 414 \mathrm{E} 44 \mathrm{FB}$ 89E8：2E 2E $2 \varnothing$ 2б 9E 49 2ø 1C 1B 89Fø：56 $45 \begin{array}{llllllll} & 52 & 54 & 49 & 43 & 41 & 4 \mathrm{C} & 36\end{array}$ 89F8：øD ØD 1D 1D 9E $46312 \varnothing$ DB 8Aøø：05 C3 C3 $2 \varnothing$ 1C 434 F 50 DF 8Aø8：59 øD 1D 1D 9E $46 \quad 322 \emptyset 15$ 8A10：05 C3 C3 201 C 524556 1E 8A18：45 525345 øD 1D 1D 9E D8 8А2ø：46 $332 \varnothing$ Ø5 C3 C3 $2 \varnothing 1 \mathrm{C}$ ø3 8A28：53 $45 \begin{array}{llllllll}52 & 49 & 45 & 53 & 2 \emptyset & 28 & \text { F6 }\end{array}$ 8A30：9E $46 \quad 341 C 29$ øD 1D 1D 43 8A38：9E $46 \quad 35 \quad 2 \varnothing \quad 65$ C3 C3 $2 \varnothing$ B5 $8 \mathrm{~A} 40: 1 \mathrm{C} 53505249 \begin{array}{lllll}54 & 45 & 2 \varnothing \mathrm{AD}\end{array}$ 8A48：28 9E 4636 1C 29 øD 1D ø2 8A50：1D 9E $46 \quad 37 \quad 2 \varnothing \quad 05$ C3 C3 38 8A58：2ø 1C 53505249544599 8A60：27 53 øD 1D 1D 1D 1D 1D Ø6 8A68：1D 1D 1D 43 4F 4C 4F 52 C7 8A7 $7: 2 \varnothing \quad 28$ 9E 46 8A78：9E 43 4C $52 \quad 2 \varnothing \quad 05$ C3 2019
 8A88：9D 9D 9D 9D 9D 9D 5350 BB 8A9ø：52 $49 \begin{array}{lllllll}54 & 45 & 11 & 11 & 9 D & 9 D & \text { A5 }\end{array}$ 8A98：9D 9D 9D 9D 9D 9D 9D 9D AD 8AAø：9D 9D 9E 2A $2 \varnothing$ Ø5 C3 C3 C2 8AA8： $2 \varnothing$ 1C 4 D 454 E 551111 CD 8ABD：11 9D 9D 9D 9D 9D 9D 9D 7F 8AB8：9D 05 $53 \begin{array}{lllllll}54 & 52 & 49 & 4 B & 45 & 21\end{array}$
 8AC8：2E øø $2 \varnothing 4886$ A9 6B 8D BC 8ADも：C8 Ø4 8D 9ø 05 8D ø8 ø6 7A 8AD8：8D 8Ø ø6 A9 73 8D EF $0^{4} 45$ 8AEØ：8D B7 05 8D 2 F Ø6 8D A7 78 8AE8： 06 A9 71 8D D4 07 A9 43 CB 8AFD：A2 25 9D C9 ø4 9D 91 Ø5 AF 8AF8：9D 09 Ø6 9D 81 Ø6 CA 1083 8Bøø：F1 A9 72 8D 94 ø6 A9 66 B7 8Bø8：8D 5B 86 A2 $\varnothing 6$ Aø 14 A9 3C 8B1ø：42 $85 \quad 22$ A9 A8 $2 \varnothing \begin{array}{lllllllll}58 & 86 & 85\end{array}$ 8B18：A9 18206 6B 87 A9 1920 F9 8B2ø：6B 87 A9 1A 206 B 87 A9 9 D 8B28：øø 85 C6 A5 C6 FØ FC A9 71 8B3ø：øø 85 C6 4C 94 8B $3 \varnothing 31$ AA 8B38： $32 \quad 33$ 5A $5843562 \emptyset$ Aø 5A 8B46：11 91 1D 9D 868788 8A AF 8B48：8B 8C 8985 AB B3 B2 B1 15 8B50：A1 A2 93 2B 2A EB 8B EB ØA 8B58：8B EB 8B EB 8B 1F 8C 2476 8B60：8C 298 C 2 E 8 C C1 8B C1 Cø 8B68：8B 49 8C 52 8C 5 B 8C 6 C A5 8B7ø：8C 8 8 8С 8F 8C 9B 8C 86 EA 8B78：8C 95 8С А3 8С AE 8C C2 62 8B80：8C C8 8C F3 8C 2B 8D 5A 67 8B88：8D 87 8D 99 8E 38 8E CA C7
 8B98：4D 8E 20 FF 848 D 93 8B ØB 8BAD：AØ 1E A2 øø DD 36 8B FØ B3 8BA8： 07 E8 88 10 F7 4C 9A 8B 41 8BB $0: 8 \mathrm{~A}$ ØA AA BD 55 BB 85 FD A2 8BB8：E8 BD 55 8B 85 FE 6C FD 16 8BCØ：øø AD 1C Dø Fø Ø3 4C 9A 9A 8BC8：8B AD 93 8B C9 $2 \varnothing$ Dø $ø 5$ B1 8BD6：A9 20 4C D7 8B A9 5185 F 6 8BD8：B5 $2 \varnothing 929 \varnothing 2 \varnothing$ F9 $9 \varnothing 2 \varnothing 58$ 8BEØ：49 $9120729 \varnothing 2 \varnothing 2090 \quad 92$ 8BE8：4C 9A 8B AD 1C Dø Dø ø3 E1 $8 B F 6: 4 \mathrm{C} 9 \mathrm{~A} 8 \mathrm{~B}$ AD 938 B 29 øF 4D 8BF8：C9 ø2 Dø ø8 A6 FA BD 27 D3 8Cøø：D 4 C Ø8 8C AA BD 24 9F 92 8Cø8：85 B6 $2 \varnothing 929 \varnothing$ AD 93 8B AC 8C10：20 $368 \mathrm{C} 2 \varnothing 7290 \mathrm{AD} 93 \mathrm{FF}$ 8C18：8B $2 \varnothing \quad 37$ 8C 4 C E2 8 BB A9 5D

8С20：30 4C $3 \varnothing$ 8С A9 31 4C $3 \varnothing$ ØE 8С28：8C A9 32 4C $3 \emptyset$ 8С A9 $33 \quad 37$ 8С $30: 8 \mathrm{D} 93$ 8B 4C EB 8B 4A 4A 97 8С38：ВØ Ø5 A9 $2 \emptyset$ 4C 41 8С A9 4 C 8C40：51 85 B5 $2 \emptyset$ F9 $9 \varnothing$ 4C 49 1б 8C48：91 2092 9ø $2 \emptyset 58$ 9Ø 4C 5D 8C50：7A $8 \mathrm{C} \quad 20 \quad 92 \quad 90 \quad 20 \quad 65 \quad 9 \varnothing 57$ 8С58：4C 7A 8C $2 \varnothing 92$ 9Ø 207253 8C60：9Ø AD 1C DØ Fø 14207248 8C68：9Ø 4C 7A 8C $20 \quad 92$ 9Ø $2 \emptyset 81$ 8C7Ø：82 9Ø AD 1C DØ Fの Ø3 2Ø D6 8C78：82 9 9Ø 20 2Ø 90 4C 9 A 8 8 73 8C80：20 B9 8E 4C 89 8C $2 \emptyset$ D4 42 8C88：8E $2 \emptyset \quad 68 \quad 8 \mathrm{E} 4 \mathrm{C}$ 9A $8 \mathrm{BB} 2 \emptyset$ EA 8C9ø：$\varnothing 4$ 8F 4C 9A 8B 2Ø 27 8F 7D 8C98：4C 9A 8B A6 FA FE 27 DØ 4D 8СAØ：4C A8 8C A6 FA DE 27 D 78 8СА8： $20 \quad 70 \quad 8 \mathrm{~F} 4 \mathrm{C}$ 9A 8B $2 \emptyset$ ØB F 2 8CB ： 90 AØ 3 F B1 FB 49 FF 91 D 3 8CB8：FB 88 10 F7 20 B1 8F 4C A6 8ССØ：9A 8B $2 \varnothing$ 8B 914 C 9A 8B 45 8CC8： 20 1E 8D AØ 3E B1 FB ØA EF 8CD0：91 FB 88 B1 FB 2A 91 FB 85 8CD8：88 B1 FB 2A 91 FB Ø8 C8 1A 8CEØ：C8 B1 FB 4A 28 2A 91 FB F7 8CE8：88 8888 10 EØ CA 10 DB A8 8CFØ：4C BC 8C $2 \varnothing$ 1E 8D AØ 3C 97 8CF8：B1 FB 4A 91 FB C8 B1 FB AE 8Døø：6A 91 FB C8 B1 FB 6A 91 A4 8Dø8：FB $\quad 08 \quad 88 \quad 88$ B1 FB $\begin{array}{llllllll} & 28 & 76\end{array}$ 8D10：6A 91 FB $88 \quad 88 \quad 88 \quad 10$ EØ 34 8D18：CA 1ø DB 4C BC 8C $2 \emptyset$ ØB $4 \emptyset$ 8D2Ø：9Ø A2 ØØ AD 1C DØ FØ Ø2 ØF 8D28：A2 Ø1 6Ø $2 \varnothing$ ØB 9Ø A2 Ø2 C4 8D3Ø：AØ Ø2 B1 FB 9522 88 CA 23 8D38：10 F8 AØ Ø3 Bl FB $88 \quad 88 \mathrm{~F} 4$ 8D40：88 91 FB C8 C8 C8 C8 C $\emptyset \quad \mathrm{CB}$ 8D48：3F D 0 F1 A2 Ø2 AØ 3 E B5 64 8D50：22 91 FB 88 CA $1 \emptyset$ F8 4C BD 8D58：BC 8C $2 \emptyset$ ØB 9ø A2 Ø2 Aø 5D 8D60：3E B1 FB 952288 CA 10 B8 8D68：F8 B1 FB C8 C8 C8 $91 \mathrm{FB} \quad 01$ 8D70：88 $88 \quad 88 \quad 88$ CØ FF DØ F1 25 8D78：A2 Ø2 Aø Ø2 B5 $22 \quad 91 \mathrm{FB}$ EE 8D80：88 CA 10 F8 4C BC 8C $2 \emptyset$ B2 8D88：ØB 9ø AD 1C DØ Dø 31 AØ 91 8D9Ø：3E A2 0718 B1 FB $2 \mathrm{~A} ~ 91 \quad 39$ 8D98： $\mathrm{FB} 88 \quad 88 \mathrm{Bl} \mathrm{FB}$ 6A 91 FB A8 8DAØ：C8 C8 CA $1 \emptyset$ EF Bl FB 2A 15 8DA8： 91 FB 88 A2 07 B 1 FB 2A E7 8DBØ： 66 Ø2 CA $1 \emptyset$ FA A5 Ø2 91 DD 8DB8：FB $88 \quad 88$ 10 $\quad$ D4 4 C BC 8 CC E3 8DCØ：AØ 3 E A2 $\begin{array}{lllllll} & 18 & \mathrm{~B} 1 & \mathrm{FB} & 2 \mathrm{~A} & \mathrm{E} 9\end{array}$ 8DC8： 08 2A $66 \quad 22 \quad 28 \quad 66 \quad 22$ CA 4 B 8DD $: 1 \varnothing$ F5 8888 A2 Ø3 18 Bl ØE $\begin{array}{lllllllll}\text { 8DD8：FB } & 2 A & \text { Ø8 } & 2 A & 66 & 23 & 28 & 66 & 96\end{array}$ 8DE ： 23 CA 10 F5 A5 2291 FB 76 8DE8：C8 C8 A5 23 91 FB 88 A2 B1 8DFØ：Ø3 B1 FB 2A 08 2A 66 Ø2 $\quad \mathrm{D} 3$ 8DF8： 28 66 Ø2 CA 10 F5 A5 5254 8EØØ：91 FB $88 \quad 88$ 1ø BC 4 C BC 47 8EØ8：8C 2Ø ØВ 9Ø AØ ЗС A2 ØØ 19 8E1ø：B1 FB 9D 3C Ø3 C8 E8 Bl 3B 8E18：FB 9D 3C $03 \mathrm{C8} \mathrm{E} 8 \mathrm{BI} \mathrm{FB} 9 \mathrm{~B}$ 8E20：9D 3C Ø3 E8 $88 \quad 88 \quad 88 \quad 88$ ØA 8E28：88 1Ø E5 AØ 3 F B9 3C Ø3 $\mathrm{B} \emptyset$ 8E30：91 FB 88 10 F8 4C BC 8C 26 8E38：2Ø ØB 9Ø AØ 3 E A9 FF 916 E 8E4 ：FB $88 \quad 10$ FB 4 C BC $8 \mathrm{C} \quad 2 \emptyset \mathrm{CD}$ 8E48：48 8F 4C F9 $84 \quad 20 \quad 85$ 8E D4 8E5 ： $2 \emptyset$ A5 $8 \mathrm{E} \quad 2 \emptyset \quad 68$ 8E $2 \emptyset \quad 56 \mathrm{CE}$ 8E58：8F $20 \quad 4 \mathrm{E} \quad 92 \quad 20$ E6 $8 \mathrm{E} \quad 2 \emptyset \quad 12$ 8E60：3C 8F $20 \quad 67 \quad 93$ 4C Bl 8F BA 8E68：A5 F9 ØA ØA ØA 6987 A8 66 8E70：A2 07 9D F8 $\varnothing 7 \quad 88 \quad 98$ CA 3 A 8E78：10 F8 AD $2185 \mathrm{C} 933 \mathrm{~F} \quad 4 \mathrm{E}$ 8E80：Ø3 $2 \emptyset$ B1 8F 60 A9 FF 8D 8D 8E88：10 DØ A9 ØA $85 \quad 22$ A9 32 F1 8E90：85 23 A2 ØE A5 23 9D ØØ 63 8E98：DØ CA CA A5 22 9D ØØ DØ DC 8EAØ：CA CA 10 FØ $6 \emptyset$ A9 AA A2 88 8EA8：ØE 38 9D Ø1 DØ CA CA 9D 83 8EB ：Ø1 D $\emptyset$ E9 $2 \emptyset$ CA CA $1 \emptyset$ F2 56 8EB8：6Ø $20 \quad 48$ 8F E6 F9 A5 F9 74

8ECø：C9 10 Dø ø4 A9 øб 85 F9 73 8EC8： $2 \varnothing \quad 568 \mathrm{~F} \quad 2 \varnothing 4 \mathrm{E} 92 \quad 2 \varnothing 67 \mathrm{E} 3$ 8ED $: 934 \mathrm{C}$ E6 $8 \mathrm{BE} 2 \varnothing 48 \quad 8 \mathrm{~F}$ C6 98 8ED8：F9 A5 F9 C9 FF Dø E9 A9 F8 8EE 0 ：$\sigma \mathrm{F}$ 85 F9 4 C C8 8E A2 $\varnothing \varnothing$ Bø 8EE8：A5 F9 C9 ØA $9 \varnothing 64$ E8 E9 81 8EFV：6A 1869 36 8D 7A 9F 8D 6C 8EF8：1D 87 8A 69 30 8D 79 9F 98 8F00：8D 1C 0760 E6 FA A5 FA 3D 8FØ8：C9 ø8 Dø ØA A9 0085 FA 1 C 8F10：20 B9 8E 2668 8E AD 217 B 8F18：85 C9 33 FØ 6628 Bl 8F 85 8F20：28 $6793 \quad 28$ 3C 8F 60 C6 45 8F28：FA A5 FA C9 FF DØ E7 A9 E6 8F36：67 85 FA 28 D4 8E $2 \varnothing 68 \quad 1 \mathrm{~F}$ 8F38：8E 4C 16 8F A5 FA $18 \quad 69$ 2ø 8F48：30 8D 7B 9F 8D $44876 \varnothing$ 3ø 8F48：28 64 8F BD 27 Dø 997 CBA 8F56：9F 88 CA 10 F6 68286499 8F58：8F B9 7C 9F 9D 27 Dø 88 EA
 8F68：©A 186967 A8 A2 07606 E 8F7Ø：AD 1C DØ FØ 66206 C 93 B3 8F78：4C D4 92 A9 7985 FB A9 63 8F80：D8 85 FC A9 28 8D 6585 AE 8F88：A6 FA BD 27 D $\varnothing 85 \quad 22 \quad 29$ ED 8F96：øF D 06 A9 øC 4C 9A 8F FC 8F98：A9 ØØ 8D 21 DØ A2 14 Aø 2A 8FA6：17 A5 22 91 FB 8810 FB 30
 8FBG：9Ø AD 1C DØ FØ Ø3 4C D4 15 8FB8：92 2878 8F 20 ØВ $9 \varnothing$ A9 28 8FCl：79 85 FD A9 6485 FE A9 36 8FC8：28 8D 13 85 A9 $9085 \quad 2597$ 8FDØ：A9 ø2 8522 Aø øø A9 $\varnothing 777$ 8FD8：85 23 84 62 A4 25 B1 FB 4D 8FED：85 24 A 4 Ø2 66 24 $9 \varnothing 6567$ 8FE8：A9 514 C EF 8 FF A9 2891 AE 8FF6：FD C8 C6 23 10 EE E6 25 7B 8FF8：A9 3F C5 25 Fø 日A C6 $^{2} 22 \quad 27$ 9øø0：10 D4 2014854 C D8 8F 32 9øø8：4C 2890 A6 FA BD F8 $\varnothing 7$ 9B 9ø10：85 FB A9 ø0 85 FC A2 0592 9ø18：66 FB 26 FC CA $1 \varnothing$ F9 $6 \varnothing$ BA 9ø20：AD 2185 C9 $33 \mathrm{D} \varnothing$ Ø1 $6 \varnothing \mathrm{EC}$ 9ø28：20 C7 9ø Aø øø AD 1C Dø 27 9ø38：Fø ø3 4C 8293 Bl FB C9 61 9ø38：20 F6 67 C9 51 FØ ø3 4C C3 9ø4ø：44 9ø 85 B5 A5 B5 С9 $2 \varnothing$ 6B 9048：F0 65 A9 D1 4C 51 90 A9 E7 9650：AØ 91 FB A9 0191 FD 60 EA 9658：A5 F7 C9 17 Dø $\varnothing 4$ A9 92 E $\varnothing$ 9ø60：85 F7 E6 F7 60 A5 F7 C9 F1 9ø68：03 D6 64 A9 18 85 F7 C6 E7 9ø76：F7 60 A5 F8 C9 18 D $\varnothing 0741$ 9ø78：A9 0085 F8 20 58 90 E6 19 9ø80：F8 60 A5 F8 C9 01 D8 0775 9ø88：A9 1985 F8 206590 C6 83 9ø90：F8 6ø 20 C7 $9 \varnothing$ Aø øø AD 7B 9ø98：1C D夭 FØ 1F A9 51 9øA6：A5 B6 91 FD A9 018 BD 05 C 5
 9бB6：14 85 A9 5191 FB A5 B6 66 9øB8：91 FD 60 A5 B5 91 FB A6 1 B 9øCø：FA BD 27 D 91 FD $6 \varnothing$ A9 AF 9øC8：00 85 FB 85 FD A9 848547 9øDø：FC A9 D8 85 FE A9 28 8D CA 9øD8：05 85 8D 13 85 A6 F7 F6 68
 9øE8：4C DF 98 A5 F8 8D $\quad 6585 \quad 22$ 9øF0：8D 1385 9øF8：85 A5 F8 8529 C6 29 A9 1E
 9108：2A C6 2A C6 2A C6 2 AA A5 $\quad$ ØA 9110：2A 18652 A 652 A 852 A A6 9118：A5 F8 85 FB C6 FB A9 18 4E 9120：25 $\begin{array}{llllllll} & \mathrm{FB} & 4 \mathrm{~A} & 4 \mathrm{~A} & 4 \mathrm{~A} & 18 & 65 & 2 \mathrm{~A}\end{array} 6 \mathrm{6A}$ $9128: 85$ 2A $2 \varnothing$ ØB 90 A5 2 A 8 D 4 A 9130：05 $852 \varnothing$ ø6 85 Aø øø B1 FB 9138：FB 8522 A9 80 А6 29 Fø 7B 9140：85 4A CA 4 C 9148：68 A5 23 48 A5 $2248 \quad 2 \varnothing 54$ 9150：75 $93 \begin{array}{lllllllll}93 & 68 & 22 & 68 & 85 & 23 & 59\end{array}$

9158：B $\varnothing$ ØA A5 B5 C9 51 Dø ØD A8 9160：20 6E 9160 A5 B5 C9 201 F 9168：Dø ø3 $2 \varnothing$ 6E 9160 A5 231 C 9178：49 FF 8523 A5 $2245 \quad 23$ 7E 9178：49 FF Aø øø 91 FB 8522 FD 9180：60 43 4F 50 9188：2E 2E øø A9 ø4 2ø 6B 87 E7 919ø： $2 \varnothing$ ØB $9 \varnothing$ A5 $\begin{array}{ll}\text { FB } & 85 \\ \text { AA A5 } & \text { A3 }\end{array}$ 9198：FC 85 AB 20 FF 84 C9 86 3F 91Aø：Dø ø9 $2 \varnothing$ B9 8E $2 \varnothing 68$ 8E 62 91A8：4C 9B 91 C9 8A D6 992671 91B0：D4 8E 20688 E 4 C 9 B 91 DA 91B8：C9 87 DØ 66 91Cø：9B 91 C9 8B Dø ø6 $2 \varnothing 27$ øE 91C8：8F 4C 9 B 91 C9 85 Dø $\varnothing$ ØF 68 91D8：2ø ØB 9ø Aø 3F B1 AA 918 A 91D8：FB 8810 F9 20 B1 8F A9 4E 91Eø：05 4C 6B 87 AB C3 C3 AE 22 91E8：11 9D 9D 9D 9D C2 $3 \varnothing 2 \varnothing$ Ø2 91F6：C2 11 9D 9D 9D 9D C2 3161 91F8：12 2092 C2 11 9D 9D 9D 83 9200：9D C2 $3212 \quad 2092$ C2 11 ED 9288：9D 9D 9D 9D C2 $3312 \quad 2 \varnothing 18$ 9210：92 C2 11 9D 9D 9D 9D AB 75 9218：C3 C3 BD øø C2 $2 \varnothing 2 \varnothing 2 \varnothing$ BE 922б：11 9D 9D 9D 9D C2 $2 \varnothing$ 2б 1B 9228：2б 11 9D 9D 9D 9D C2 28 38 9230：20 2011 9D 9D 9D 9D C2 CA 9238：20 202011 9D 9D 9D 9D C6 9240：C2 262020119 D 9 D 9 D AC 9248：9D C2 262020 00 A6 F9 3B 9250：BD 68 9F 8D 1C Dø Dø 19 1A 9258：A9 Ø1 8D $86 \quad \varnothing 2$ A9 1ø $2 \varnothing$ A3 9260：6B 87 AD øø D8 29 øF Dø 2D 9268：87 A9 ø1 85 $22 \quad 26$ FB $87 \quad 65$ 927ø：6ஏ $2 \varnothing 5897$ A2 ø3 B9 28 øF 9278：9F 9D 24 9F 88 CA 10 F6 D9 9280：AD 25 9F 8D 25 D 0 AD 2781 9288：9F 8D 26 D $\begin{gathered}\text { AD } 24 \text { 9F 8D 7D }\end{gathered}$ 9290：21 DØ A5 F8 4A Bø Ø3 $2 \varnothing$ F9 9298：82 90 20 Cø 93 8D 86 ø2 15 92A ：：85 ø2 A9 ØF $2 \varnothing$ 6B 87 A5 92 92AB： 028522 A9 4B 85 FB A9 21 92B6：DA 85 FC A9 28 8D 6585 E5 92B8：Aø øø A2 Ø1 BD 24 9F 91 E1 92C0：FB $2 \varnothing$ ø6 85 E8 Eø 64 Dø A8 92C8：F3 AD ø6 D8 C5 22 Fø 83 7C 92DØ： $2 \varnothing$ FB $876 \varnothing 2 \varnothing$ ØB $9 \varnothing$ A5 EF 92D8：FB 8522 A5 FC 8523 A9 E9 92E0：79 85 FB 85 FD A9 648520 92E8：FC A9 D8 85 FE A9 ø0 85 8E 92F：：24 85 26 A4 24 B1 2285 4A 92F8：25 A9 628 BD Ø5 85 8D 13 Aø 9300：85 A2 ø3 A9 ø0 85 ø2 ø6 AD 93ø8：25 26 ø2 ø6 25 26 ø2 A5 57 9310：ø2 $86 \quad 02 \quad 2 \varnothing 46932 \varnothing 06$ E2 9318：85 $2 \varnothing 1485$ A6 $62 \mathrm{CA} 10 \mathrm{C7}$ 9320：E2 E6 26 A9 03 C5 26 DØ 1 E 9328：12 A9 ø0 8526 A9 10 8D Aø
 9338：28 1485 E6 24 A9 3F C5 9F 9348：24 D8 B8 4 C 28 98 A8 C9 E6 9348：ø2 D $\varnothing$ ø8 A6 FA BD 27 D ${ }^{9}$ FD 9350：4C 56 93 B9 24 9F Аø øø 22 9358：91 FD C8 91 FD Aø øø A9 16 9360：51 91 FB C8 91 FB 60 AD 8B 9368：1C DØ F6 ø8 A6 FA BD 2734
 9378：46 23 Bø 64284 C 75 93 D2 9380：28 60 A2 63 B1 FB C9 51 BA 9388：Dø ø6 B1 FD 29 øF 85 B6 F6 9390：BD $24 \mathrm{9F}$ C5 B6 FØ 65 CA 3 E 9398：10 F6 A2 ø2 8A 1869 B6 32 93AØ：91 FB $2 \varnothing$ CØ 93 91 FD 85 ø4 93A8：22 A9 918 DD ø5 85 8D 13 Bø 93В 185 2ø $66852 \varnothing 1485 \mathrm{A9} \mathrm{Cl}$ 93B8：AØ 91 FB A5 2291 FD 6022 93Cø：AD 24 9F C9 Ø1 Dø 65 A9 57 93C8：00 4C CE 93 A9 01604971
 93D8：45 $2 \varnothing 28592 \mathrm{~F} 4 \mathrm{E} 292 \varnothing 6 \mathrm{~A}$ 93E0：3F $2 \varnothing$ ø0 A9 06 2ø 6B 8759
93E8: $2 \emptyset$ 3C 94 FØ Ø6 2Ø 4D 94 BØ

93F0：4C F9 842021 9E 4C F9 65
 94øø：2F $4 \mathrm{E} \quad 29$ 2ø $3 \mathrm{~F} 2 \varnothing$ Øø A9 9F 94ø8：13 $2 \varnothing 6$ 6 8720 3C 94 Fø B4 941ø：DF $2 \varnothing 34$ 9E AD FF 9F 8D DB 9418：8A Ø2 AD FE 9F 8D 86 Ø2 EE 942ø：AD FD 9F 8D $2 \varnothing$ Dø AD FC $\varnothing 9$ 9428：9F 8D 21 DØ A9 $932 \varnothing$ D2 64 9430：FF A9 ED 8D 28 ø3 A9 4742 9438：8D 18 Ø3 øø $2 \varnothing 9588$ C9 C0 9440：59 Dø ø3 A9 FF $6 \varnothing$ C9 4E A8 9448：DØ F2 A9 øø $6 \varnothing$ A9 øø 85 FA 9450：FB A9 2085 FC A9 8ø 8D 5B 9458：05 85 A2 1F Аø øø A9 FF ø4 9460：91 FB 88 D $\varnothing$ FB $2 \varnothing$ Ø6 8561 9468：2ø Ø6 85 CA 1ø EE A9 Ø1 11 9470：A2 7F 9D 7C 9F CA 10 FA 89 9478：A2 07 9D $27 \mathrm{D} \varnothing \mathrm{CA} 1 \varnothing \mathrm{FA} \mathrm{A7}$ 9480：A2 3F 9D 28 9F CA 10 FA 44 9488：A9 øø A2 ØF 9D 68 9F CA 64 9490：10 FA A9 $0 \emptyset 85$ F9 85 FA CF 9498：A9 33 8D 218520688 EE 33 94AD：A9 ØD 85 F7 85 F8 604124 94A8：2の $05122 \varnothing 2 \varnothing 2 \varnothing 2 \varnothing 92 \mathrm{BB}$ 94B0：ø5 $2 \varnothing 2 \varnothing 2 \varnothing 2 \varnothing 45209 C 5 D$ 94B8：12 $2 \varnothing 2 \varnothing 2 \varnothing 2 \varnothing 92$ Ø5 2ø 6E $94 \mathrm{C} \varnothing: 2 \varnothing 2 \varnothing 2 \varnothing 492 \varnothing 811220$ E5 94C8：2Ø $2 \varnothing 2 \varnothing 92 \quad \varnothing 5 \quad 2 \varnothing 2 \varnothing 204 \varnothing$ 94DØ：2の 4D $2 \varnothing 98122 \varnothing 2 \varnothing 2 \varnothing 5 C$ 94D8：2ø 92 Ø5 $6 D$ 1D 1D 42 2ø $2 A$ 94EØ：9ø $122020202092 \quad 0588$ 94E8：2Ø $2 \varnothing 2 \varnothing 2046201 \mathrm{E} 1231$ 94Fø：2Ø $2 \varnothing 2 \varnothing 2 \varnothing 92 \quad 052 \varnothing 2 \varnothing 41$ 94F8：2Ø $2 \varnothing 4 \mathrm{~A} 2 \varnothing 95122 \varnothing 2 \varnothing \mathrm{DA}$
 95ø8：4E $2 \varnothing 9912 \quad 2 \varnothing 2 \varnothing 2 \varnothing 2098$ 9510：92 ø5 øб 43 2ø 1C $122 \varnothing \mathrm{AF}$
 9520：20 47 2ø lF $122 \varnothing 2 \emptyset 2094$ 9528：2ø 92 Ø5 20 2ø $2 \varnothing 2 \varnothing 2 \varnothing$ 4B B7 9530：2ø $96122 \varnothing 2 \varnothing 2 \emptyset 2 \varnothing 92$ A9 9538：ø5 $2 \varnothing$ 2ø $2 \varnothing 2 \varnothing 4 \mathrm{~F} 2 \varnothing$ 9A ØD 9540：12 $2 \varnothing 2 \varnothing 2 \varnothing 2 \varnothing 92$ ø5 øD E4 9548：1D 1D $442 \varnothing$ 9F $122 \varnothing 2 \varnothing 79$ 9550：2Ø $2 \varnothing 92$ Ø5 $2 \varnothing 2 \varnothing 2 \varnothing 2 \varnothing 18$ 9558：48 2ø 9E $12202 \varnothing 2 \varnothing 2 \varnothing 86$ 9560：92 ø5 2ø $2 \varnothing 2 \varnothing 2 \varnothing 4$ C $2 \varnothing 56$ 9568：97 12 2Ø 2 2Ø $202092 \quad 0595$ 957ø：2ø $2 \varnothing 2 \varnothing 2 \varnothing 5 \varnothing 209 B 12$ ø6 9578：2ø $2 \varnothing$ 2ø $2 \varnothing 92$ ø5 øø 53 BD 958ø：5ø $52495445 \quad 53$ 2ø C3 52
 9590：36 3711 9D 9D 9D 9D 9D DC 9598：9D 9D 9D $12202 \varnothing 2 \varnothing 2 \varnothing$ Bø 95Aø：2ø $2 \varnothing$ 2ø $2 \varnothing 92$ øø 9 E 54 1ø 95A8：59 50 95B ： $54 \begin{array}{lllllll}54 & 45 & 52 & 2 \varnothing & 4 \mathrm{~F} & 52 & 2 \varnothing \\ \mathrm{~EB}\end{array}$ 95B8：9F $53 \quad 544 \mathrm{~F} 50$ 9E 205499 $95 \mathrm{C} 0: 4 \mathrm{~F} \quad 20454 \mathrm{E} 44$ Ø5 øø $2 \varnothing 7 \mathrm{~F}$ 95C8：61 97 A9 15 20 6B 8720 EE 95D0：6B 97 A9 1420 6B 8720 EB 95D8：64 8F B9 7C 9F 9D 5E D9 23 95EØ：88 CA 10 F6 $2 \varnothing$ FF 84 C9 48 95E8：Ø3 Fø 26 C9 41 90 F5 C9 35 95FØ：51 Bø F1 38 E9 412096 DD 95F8：97 85 $22 \quad 2 \varnothing 64$ 8F A5 2266 9600：99 7C 9F 88 CA 10 F9 A9 C9 96ø8：Øø A6 F9 9D 68 9F 4C C7 1A 9610：95 4C F9 $84 \begin{array}{llllll}53 & 45 & 52 & 49 & 4 \varnothing\end{array}$ 9618：45 53 3A $2 \varnothing$ 2ø $2 \varnothing$ øø $3 \varnothing$ B7 9620：11 9D 3111 9D 3211 9D E9 9628：33 øø 12 2ø 2ø 11 9D 9D 51 963ø：2ø D1 11 9D 9D D1 $2 \varnothing 1163$ 9638：9D 9D D1 D1 92 ØØ 1220 CB 9640：2ø $2 \varnothing \quad 2 \varnothing 92 \quad$ øø 122092 CD 9648：øø øø 9E $54 \begin{array}{llllll}59 & 5 \varnothing & 45 & 2 \varnothing & 45\end{array}$ 9650：41 2ø 4C $45 \begin{array}{llllll}54 & 54 & 45 & 52 & \text { D4 }\end{array}$ 9658：2ø $4 \mathrm{~F} 522 \varnothing 9 \mathrm{~F} 5245 \quad 54 \mathrm{DA}$ 9660：55 52 4E 9E 2C øD 1D 1D 6D 9668：9F $53 \quad 544 \mathrm{~F} 50$ 9E 20544 B 9670：4F $2 \varnothing \quad 45$ 4E $442 \mathrm{Cl} 2 \varnothing$ 9F 8 D 9678：44 $454 \mathrm{C} 9 \mathrm{E} 2 \varnothing 544 \mathrm{~F} 2 \varnothing 9 \mathrm{D}$ 9680：43 $414 \mathrm{E} \quad 43 \quad 454 \mathrm{C} \quad \varnothing 5 \quad \varnothing \varnothing \quad \emptyset 3$

9688：28 6197 A9 $97 \quad 2 \varnothing 6 \mathrm{~B} 87 \mathrm{C} 2$ 9690：A9 ø8 20 6B 87 A9 16 207 E 9698：6B $87206 B \quad 972058979 D$ 96Aø：A2 Ø3 B9 28 9F 9D 24 9F F4 96A8：88 CA 10 F6 A2 03 8E 49 C5 96BØ：96 BD $249 \mathrm{~F} 2 \varnothing 8797 \mathrm{AE} 14$ 96B8：49 96 CA $1 \varnothing$ F1 A9 018 CD 5 96C0：86 Ø2 AD $499618 \quad 693014$ 96C8：8D $46 \quad 96$ Aの 18 2ø 4C 97 9C 96Dø：A9 45 Aø $962 \varnothing 1 E$ AB $2 \varnothing 92$ 96D8：FF 84 C9 14 Dø 03 4C F9 C6 96Eø：84 C9 øD Fø 23 C9 ø3 Dø 8A 96E8： 03 4C $26 \quad 97$ C9 4190 E7 45 96FØ：C9 51 Bø E3 38 E9 4120 B7 96F8：96 97 AE 4996 9D 24 9F D4 97øø：2ø 8797 A9 Ø1 8D 86 ø2 FB 97ø8：Aø 18204 C 97 A9 46 Aø E6 9710：96 201 E AB EE 4996 AD 88 9718：49 96 C9 ø4 Dø ø5 A9 øб F8 9720：8D 49 96 4C C2 $962058 \quad 99$ 9728：97 A2 ø3 BD 24 9F 9928 ø3 9730：9F 88 CA 10 F6 20648 F 3C 9738：AD 26 9F 997 C 9 F 88 CA 93 9740：10 F6 A9 FF A6 F9 9D 68 2B 9748：9F 4C F9 84 AD $49 \quad 96 \quad 18$ B9 9750：69 Ø7 AA 18 20 Fø FF 60 Fl 9758：A5 F9 ØA ØA 1869 ø3 A8 CF 9760：60 А9 ØА $2 \emptyset 6$ В 87 А9 ØВ 45 9768：4C 6B 87 A2 øø A5 F9 C9 ø8 977ø：ØA 9ø 94 E 8 E 9 ØA 1869 E 9778：30 8D 1D 96 8A 69 3ø 8D 18 9780：1C 96 A9 994 C 6B 87 8D D5 9788：86 ø2 Aの 1A $2 \varnothing 4 \mathrm{C} 97$ A9 ЗС 979ø：3E Aø 96 4C 1E AB C9 Ø1 D2 9798：DØ Ø3 A9 øø $6 \varnothing$ C9 øø Dø 21 97AD：ø2 A9 Ø1 60 49 4E 5445 D2 97A8：52 $56414 \mathrm{C} 2 \varnothing 494 \mathrm{E} 2 \varnothing 66$ 97B0：36 3ø 5448 gD 1D 1D 4 F 7 C 97B8：46 205345434 F 4 E 44 ØA 97Cの：2Ø 28 31 $20644 \mathrm{~F} \quad 2 \varnothing 3284$ 97C8：35 3529 3A 20 øø A5 F9 EE 97D0：48 A5 FA 48 A5 F8 48 A9 BC 97D8：øC $2 \varnothing 6$ B $872 \varnothing 60$ A5 A2 6C 97EØ：ØØ BD ØØ Ø2 C9 $2 \varnothing$ FØ Ø4 54 97E8：E8 4C E1 97 Eø 04 Bø E7 B5 97FD：A9 øø 85 7A A9 02857 B 29 97F8： $2 \emptyset 79$ øø $2 \varnothing 6 \mathrm{~B}$ A9 A5 15 FA 98øø：DØ D5 A5 14 Fø 3B C6 14 1B 98ø8：A9 FF 45148514201 A CE 981ø：86 A9 øø 85 F9 $85 \mathrm{FA} 2 \varnothing 43$ 9818：4D 8E A5 1485 A2 $2 \varnothing$ 9F $2 \varnothing$ 9820：FF 8А С9 Аø Fø 1B C9 $2 \varnothing$ DE 9828：DØ ØA A9 øø 85 C6 $2 \emptyset \mathrm{FF} \emptyset 1$ 9830：84 4C 1A 98 A5 A2 Dø E6 C3 9838：2Ø ø4 8F $2 \varnothing$ Bl 8F 4C 1A EC 9840：98 6885 F 86885 FA 68 CF 9848：85 F9 4C F9 $8446494 \mathrm{C} F \mathrm{FF}$ 9850：45 4 E 414 L 45 3A $2 \varnothing$ Øø $\varnothing 8$ 9858：54 41 50 45 2Ø 4F $522 \varnothing 65$ 9860：44 $49534 \mathrm{~B} \quad 20 \quad 28542 \mathrm{~F} 9 \mathrm{E}$ 9868：44 29 3A $2 \varnothing$ øø 2ø 1D 99 A3 9870：Aø Øø $2 \emptyset$ BA FF A2 øø AØ CC 9878：20 A9 ED 8D 28 ø3 A5 2D 80 9880：48 A5 2E 48 A9 øø $2 \varnothing$ D5 EC 9888：FF $68 \quad 85 \quad 2 \mathrm{E} 68 \quad 85$ 2D A9 4 9890：EF 8D 28 ø3 20 9B 99 C9 BE 9898：14 Bø D2 A2 7F BD øø 40 B7 98Aの：9D 7C 9F CA 10 F7 A2 3F 45 98A8：BD 8ø 4ø 9D 28 9F CA $1 \varnothing 2 \varnothing$ 98Bø：F7 A2 ØF BD Cø 4ø 9D 68 EE 98B8：9F CA 10 F7 4C F9 84 A2 E3 98C0：7F BD 7C 9F 9D øø 40 CA E2 98C8：10 F7 A2 3 F BD 28 9F 9D B3
 98D8：68 9F 9D Cø 40 CA 1ø F7 2B 98Eø：2ø 1D 99 Aø FF $2 \varnothing$ BA FF 9C 98E8：A5 2B 48 A5 2C 48 A9 øø Fø 98FØ：85 2B A9 2085 2C A2 Dø D9 98F8：AØ $4 \varnothing$ 2ø ØD 996885 2C 05 99ø0：68 85 2B 20 9B 99 C9 14 1B 99ø8：Bø D6 4C F9 84 A9 ED 8D A6 9910：28 Ø3 A9 2B $2 \varnothing$ D8 FF A9 ØE 9918：EF 8D $28 \quad \emptyset 3 \quad 60$ A9 øD 20 BF

9920：6B $872 \varnothing 60$ A5 A2 øø BD 6A 9928：øø Ø2 C9 2ø FØ Ø4 E8 4C CC 9930：27 99 EØ Øø DØ ØF 686875 9938：AD 2185 C9 36 Dø ø3 20 F2 9940：21 9E 4C F9 84 8A A2 øø 68 9948：Aø Ø2 $2 \varnothing$ BD FF A9 $2 \varnothing$ A2 B5 9950：23 9D FF 9E CA 10 FA A9 9C 9958：$\varnothing \mathrm{E} 2 \varnothing$ 6B 87 A9 11206 B BD 9960：87 $20 \quad 9588$ C9 54 FØ 0723 9968：C9 $44 \mathrm{~F} \emptyset 034 \mathrm{C} 369985 \mathrm{D} 3$ 9970：ø2 2ø D2 FF A5 Ø2 C9 5424 9978：Dø ØA A9 12 2Ø 6B 87 A9 54 9980：ø1 4C 8699 A9 ø8 85 Ø2 2C 9988：AA A9 $0460 \quad 554 \mathrm{E} 4954 \mathrm{CC}$ 9990：2ø 4E 4F $542 \varnothing 524541 \mathrm{AC}$ 9998：44 59 øø C9 Ø5 Dø ø8 A9 Ø6 99Aø：17 2Ø 6B 87 A9 FF $6 \emptyset$ A5 $\varnothing 1$ 99A8：ø2 C9 ø8 Fø Ø3 A9 ØØ 6ø 7E 99Bø：A9 Ø8 $2 \varnothing$ B4 FF A9 6F $2 \varnothing \mathrm{AF}$ 99B8：96 FF A9 øø 8522 20 A5 $\varnothing 7$ 99Cø：FF C9 ØD FØ ØF 8523 A5 91 99C8：22 AA A5 23 9D FF 9E E6 AF 99Dø：22 4C BE 9920 AB FF A9 F2 99D8：øE $2 \varnothing 6 B 87$ A9 FF 85 7A D3 99EØ：A9 9E $857 \mathrm{~B} \quad 2 \varnothing 79$ Øø $2 \varnothing \mathrm{FF}$ 99E8：6B A9 A5 146064 ØA 01 DB
 99F8：2ø $2 \varnothing$ øø $2 \varnothing 535052491 \varnothing$ 9Aø日：54 $452 \varnothing 3 \varnothing$ øø $2 \varnothing 53502 \mathrm{~F}$ 9A08：52 $495445 \quad 20 \quad 31 \quad 00207 \mathrm{DD}$ 9Alø：53 50 $524954452 \varnothing 32$ ØC 9A18：øø $206350524954456 A$ 9A2ø：2ø 33 øø $2 \varnothing 53505249$ FD 9A28：54 45 20 34 øø $20 \begin{array}{llll}53 & 50 & 97\end{array}$ 9A30：52 $49 \begin{array}{lllllll}54 & 45 & 2 \varnothing & 35 & \text { øø } & 2 \varnothing & \text { B5 }\end{array}$ 9А38：53 5Ø 52495445203638 9A4Ø：øø $2 \varnothing 53505249544592$ 9A48：2Ø 37 Øø $2 \varnothing 3533 \quad 32387 \varnothing$
 9A58：32 $38 \quad 312 \mathrm{C} 35333238$ Bø 9A60：35 2C 43 4F 4C 4F 5253 30
 9A70：99 FB 99 Ø5 9A ØF 9A 1954 9A78：9A 23 9A 2D 9A 37 9A 4112 9A80：9A 4B 9A 55 9A 9E 5459 CF 9A88：5Ø 45 2ø 9F 2A 9E $2 \varnothing-5495$ 9A9ø：4F $2 \varnothing 53 \quad 454 \mathrm{C} 45435486$ 9A98： $05 \quad 2 \varnothing \quad 2 \varnothing \quad 2 \varnothing 3 \varnothing 3 \varnothing 2 \varnothing 2 \varnothing \varnothing 1$
 9AA8： $2 \varnothing$ 2ø $2 \varnothing 3 \varnothing 33$ ØD 1D 1D 22 9ABも：9E $5345 \begin{array}{llllll}52 & 49 & 45 & 53 & 2 \varnothing & \text { FD }\end{array}$ 9AB8：4F $52 \quad 2 \varnothing 9 F 52455455 \mathrm{CD}$ 9ACø：52 4 E 9E $2 \mathrm{CC} \quad 05 \quad 2 \varnothing 2 \varnothing 3 \varnothing 62$ 9AC8：34 $2 \varnothing 2 \varnothing 2 \varnothing$ 3ø 35 2ø $2 \varnothing$ DC
 9AD8：øD 1D 1D 9F 53544 F 5054 9AED： $2 \varnothing$ 9E $544 \mathrm{~F} 2 \varnothing 4255494 \mathrm{~B}$ 9AE8：4C $442 \mathrm{C} \quad 052 \varnothing 2 \varnothing 2 \varnothing 2 \varnothing$ ØD $9 \mathrm{AFD}: 2 \varnothing 3 \varnothing 382 \varnothing 2 \varnothing 2 \varnothing 3 \varnothing 3966$
 9Bøø：31 31 øD 1D 1D 9F 4445 C4 9Bø8：4C $2 \varnothing$ 9E $544 \mathrm{~F} 2 \varnothing 434149$ 9B10：4E $43 \quad 454 \mathrm{C} \quad 65 \quad 2 \varnothing \quad 2 \varnothing \quad 2 \varnothing$ B5 9B18：2Ø $2 \varnothing 2 \varnothing 31322 \varnothing 2 \varnothing 2 \varnothing$ Fø 9B2ø：31 33 2ø $2 \varnothing 20131342 \varnothing 11$ 9B28：2Ø $2 \varnothing 3135$ øø 52454 D 12 9B30：41 52 4B $532028 \quad 592 F \operatorname{BE}$
 9B4ø：2ø 6B 87 A9 øø 856985 5C 9B48：6A 85 6B A9 ø1 85 6C АØ B5 9B50：øø A9 ø3 85 6D A2 ø4 A9 52 9B58：51 $9994 \quad ø 69848$ 8A 48 D4 9B6ø：20 FF 8485 6E 68 AA 6863 9B68：A8 A5 6E C9 14 DØ Ø3 4C FD 9B7ø：F9 84 C9 ØD Dø 03 4C Aø 9B 9B78：9B C9 Ø3 Dø Ø3 4C BD 9B BD 9B8ø：C9 2A DØ D8 B9 95 Ø6 4948 9B88：8ø 9995 Ø6 B9 96 Ø6 49 F6 9B9ø：8ø 9996 Ø6 A5 6A 456 C 6 F 9B98：85 6A A5 6945 6B 8569 C4 9ВАФ：ø6 6C 26 6B A9 $2 \varnothing 9994 \quad \varnothing 7$ 9BA8：ø6 C8 C8 C8 C8 C8 CA DØ 8A 9BBø：A6 $98 \quad 18 \quad 6914$ A8 C6 6D 39

9BB8: $1 \varnothing$ 9B 4 C 4B 9B A9 $\quad$ Øø $\mathrm{C} 5 \quad 66$ 9BCØ: 69 DØ Ø7 C5 6A DØ Ø3 4C Ø7 9BC8:F9 $84 \quad 20$ Fø 85 A9 1C 20 5C 9BDØ: 6B $87 \quad 20 \quad 3 \mathrm{C} \quad 94 \quad 85 \quad 7 \emptyset$ A4 A7 9BD8:2E A5 2D 1869 FE 85 FD Ø8 9BEØ: $85 \quad 65 \mathrm{~B} \mathrm{\emptyset}$ Ø1 $88 \quad 84 \mathrm{FE} 8433$ 9BE8: $66 \quad 20 \quad 34$ 9E A9 $30 \quad 85 \quad 6348$ 9BFØ:A9 F2 8564 A9 2C 8D F8 C2 9BF8:9E A9 Øø 85 6D 466966 FF 9CøØ: 6A Bø ØB E6 6D A5 6D C9 11 9Cø8:10 DØ F2 4C B8 9C A2 Øø 1E 9C10:A5 6D C9 ØA 90 Ø4 E8 38 EF 9C18: E9 ØA Ø9 3Ø 8D F9 99 8A FE 9C20: 09 3Ø 8D F8 99 A5 6D ØA 73 9С28: ØA ØA 69 8Ø $2 \emptyset 10$ 9Ø A5 26 9C30:FC 1869 8 685 FC A5 $7 \emptyset$ FE 9C38: Dø $06 \quad 2 \emptyset \quad 39$ 9D 4C 4A 9C 42
 9C48:ØA 9D $2 \emptyset$ Ø3 9E A9 Ø1 8D 4D 9C50:ø5 85 A9 2085 29 A9 10 D8 9C58:85 2A A2 Ø5 $20 \quad 72$ 9D $2 \emptyset$ A9 9C60: 66 9D A9 7C 85 FB A9 9F 1ø 9C68:85 FC A5 6D ØA ØA ØA 8D 49 9C70: 0585 2Ø Ø6 85 AØ ø7 B1 6Ø 9C78: FB 29 ØF 91 FB 88 10 F7 ØF 9C80:A9 Ø1 8D $0585 \quad 85 \quad 29$ A9 ØF 9C88: Ø8 85 2A A2 05 2Ø 72 9D C1 9C90: 20 Ø6 9D A9 2885 FB A9 A2 9C98:9F 85 FC A5 6D ØA ØA 8D 32 9CAØ: $65 \quad 85 \quad 2 \emptyset \quad$ Ø6 85 A9 91 8D 84 9CA8: Ø5 $85085 \quad 29$ A9 $8485 \quad 2 \mathrm{~A} ~ 9 \mathrm{~B}$ 9CBØ:A2 $\quad 65 \quad 20 \quad 72$ 9D 4 C Ø3 9 C 68 9CB8:A9 00 A8 91 FD C8 91 FD 29 9CCØ:A9 02 8D $13 \begin{array}{lllllll} & 85 & 2 \emptyset & 14 & 85 & 8 C\end{array}$ 9CC8:A5 FD 85 2D A5 FE 85 2E 3A 9CDD: 20 12 9E 20 FØ 85 20 1D 6 F 9CD8:99 AØ FF $2 \emptyset$ BA FF A6 FD 2A 9CEØ:A4 FE $2 \emptyset$ ØD 99 2б 9 B 99 1F 9CE8: C9 $14 \mathrm{~B} \emptyset$ EA $2 \emptyset 21$ 9E 4C DF 9CFØ:F9 84 A5 64 8D Ø3 Ø2 A5 65 9CF8:63 8D Ø2 Ø2 $18 \quad 69$ Ø1 8595 9DØØ: 63 9Ø Ø2 E6 $646 \emptyset$ A5 $7 \emptyset$ 2ø 9Dø8:FØ 2F 2б F2 9C A9 8F 8D F2 9D10: 04 Ø2 A4 62 B9 6F 9A 8D D6 9D18: 26 9D C8 B9 6F 9A 8D 27 AA 9D20:9D A2 05 AØ ØØ B9 FF FF 64 9D28:FØ ø8 9D øø Ø2 E8 C8 4C 23 9D30:25 9D 2043 9D E6 62 E6 D1 9D38:62 20 F2 9C A9 83 8D Ø4 4F 9D4Ø: Ø2 6Ø CA A9 Øø 9D Øø Ø2 Ø1 9D48:86 61 E8 8A $18 \quad 65 \quad 65 \quad 85$ 8B 9D50:65 90 ø2 E6 66 A5 65 8D 33 9D58: øø Ø2 A5 66 8D Ø1 Ø2 A4 48 9D60:61 B9 Øø Ø2 91 FD 881080 9D68:F8 A5 6585 FD A5 668567 9D7Ø:FE $6 \varnothing 8661$ Aø Øø 2ø Aø 1ø
 9D80:20 42 9D C6 29 FØ 18 A5 5F 9D88:29 29 Ø3 DØ Ø6 2Ø Ø6 9D 6A 9D9Ø: 4C 96 9D $20 \quad 39$ 9D A9 1Ø $\mathrm{F} \emptyset$ 9D98:85 2A A2 95 4C 72 9D 60 8D 9DAØ:A2 Øø A9 3ø 8D F5 9E 8D 74 9DA8:F6 9E 8D F7 9E B1 FB DD C9 9DBØ:ED 99 9Ø ØA 38 FD ED 99 2B 9DB8:FE F5 9E 4C AF 9D E8 EØ 3ø 9DCØ: Ø3 DØ EC A6 61 B1 FB C9 4D 9DC8: 64 BØ Ø6 C8 C9 ØA BØ 11 88 9DDØ: C8 B9 F5 9E 9D ØØ Ø2 E8 61 9DD8:C8 Cø Ø4 Dø F4 6ø A9 Øø B2 9DEØ:8D EB 9D 8D EE 9D AØ $2 \emptyset$ B9 9DE8:A2 Øø AD FF FF 8D FF FF 61 9DFØ: EE EB 9D EE EE 9D CA DØ 95 9DF8:F1 EE EC 9D EE EF 9D 88 5B 9EØØ: DØ E6 6Ø AD ØE DC 29 FE 7 B 9Eø8:8D ØE DC A5 $\varnothing 129 \mathrm{FE} 85 \mathrm{B5}$ 9E1ø:ø1 6Ø A5 Ø1 09 Ø1 85 Ø1 Ø3 9E18:AD ØE DC Ø9 Ø1 8D ØE DC 13 9E20:60 2Ø Ø3 9E A9 Aø 8D EC B7 9E28:9D A9 2ø 8D EF 9D 20 DE 90 9E30:9D 4C 12 9E A9 20 8D EC 51 9E38:9D A9 Aø 8D EF 9D 4C DE 99


# 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 computers). 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 "COMPUTEI's Guide to Typing in Programs" elsewhere in this issue.

8A $1 \varnothing \mathrm{D} \$=\mathrm{CHR} \$(4):$ GOSUB 2øØ
1A 20 TEXT : HOME : HTAB 17: PRI NT "D.M.E.S.": VTAB 1: FOR
$X=1$ TO 16: HTAB $X:$ PRIN $T$ "-"; : NEXT $X$ : FOR $X=25$ TO 4ø: HTAB $X$ : PRINT "-"; : NEXT $X$
BF $3 \emptyset$ VTAB 13: PRINT "INSERT DIS K INTO SLOT 6, DRIVE 1": PR INT "AND PRESS ANY KEY": G ET A
98 4ø PRINT

$396 \emptyset$ POKE 48894, PEEK (48894) + 1
B9 70 PRINT D\$; "INIT HELLO, D1, S6 ": PRINT D\$; "DELETE HELLO"
3C 8Ø POKE 48894, PEEK (48894) -
$2 A 9 \emptyset S S=\varnothing: S E=\varnothing: B U=8192: 0 P$ $=1: T R=17:$ GOSUB 13ø
181 1ஏø POKE 8192 + 196,255: POKE 8192 + 197; 255: POKE 819 $2+52,36$
F6 $11 \emptyset S S=\varnothing: S E=\varnothing: B U=8192: 0$ $P=2: T R=17:$ GOSUB 139
$\begin{array}{ll}A D & 120 \\ \text { GOTO } & 2 \emptyset\end{array}$

$8514 \varnothing$ FOR SA $=5 S$ TO SE
F7 $15 \emptyset$ POKE 788, TR: POKE 789,SA: POKE 796, OP
C7 $16 \emptyset \mathrm{HB}=$ INT $(\mathrm{BU} / 256): \mathrm{LB}=$ BU - (HB * 256)
6E 179 POKE 792,LB: POKE 793, HB
27180 CALL 768: $\mathrm{BU}=\mathrm{BU}+256: \mathrm{N}$ EXT SA
23199 RETURN
372 Fg FOR I = 768 TO 822: READ A: POKE I, A: NEXT I: RETU RN
98 $21 \varnothing$ DATA $169,3,169,16,32,217$, 3,96, $\varnothing, \varnothing, \varnothing$
TC $22 \emptyset$ DATA $\varnothing, \varnothing, \emptyset, \emptyset, \emptyset, 1,96,1, \varnothing, 1$ 7,15
C2 $23 \emptyset$ DATA $48,3, \varnothing, 32, \emptyset, \emptyset, 1, \varnothing, 25$ 4,96,1
24 24ø DATA $\varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing, \varnothing$, $\emptyset$


# 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 CP/M disks for many other computers use a different system known as MFM (Modified Frequency Modulation). Since the 128 can operate as a $\mathrm{CP} / \mathrm{M}$ computer, the 1571 provides the ability to read and write MFM-format disks. $C P / M$ is one of the most widely used microcomputer operating systems, and vast amounts of public domain CP/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

$$
\begin{array}{ll}
\begin{array}{ll}
\text { bit } 7 & \text { transfer data }(1=\text { no transfer }) \\
\text { bit } & \text { error } \\
\text { bit } & \text { erore flag }(1=\text { ignore error) } \\
\text { bit } & \text { buffer transfer }(1=\text { transfer buffer) }
\end{array} \\
\text { bit } 4 & \text { side select (MFM only } 0=0=\text { front, } 1=\text { back) } \\
\text { bits 1-3 } & \text { burst command }(000 \text { for Read Sector) } \\
\text { bit } 0 & \text { drive select (keep at } 0 \text { for all commands) } \\
\$ 3803: \text { Track to be read ( } 0-35 \text { for GCR or } 0-39 \text { for MFM) } \\
\$ 3804 \text { : Sector to be read (range of valid values depends on format and } \\
\text { mode) } \\
\$ 3805: \text { Number of sectors (must be more than zero) } \\
\$ 3806 \text { : Next track (optional, normally unused) }
\end{array}
$$

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 $\$$ FB 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 $\mathrm{LO}=\mathrm{A}-\mathrm{HI} * 256$, 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: 3000
Ending address: 323 F
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 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.

```
1ø B=DEC("38ø\emptyset"):POKE251,\varnothing:POKE253,ø:POKE252,64:POKE254,65
2ø POKE B+3,2\emptyset: POKE B+4,3: POKE B+5,2
30 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.
$1 \varnothing$ OPEN15,8,15:BANK 15:SYS DEC("3øE8"): PRINT PEEK(250):END

## FORMAT MFM

Purpose: Format an MFM disk
Call address: \$30EE (12526)
Table address: $\$ 3811-\$ 381 \mathrm{~B}$ (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)
\$381B: 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:
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
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.
$1 \varnothing$ OPEN $15,8,15: B=\operatorname{DEC}(" 38 \varnothing \varnothing "):$ POKE $B+19,1 \varnothing 2:$ POKE $B+22,2$
$2 \emptyset$ POKE $B+2 \emptyset, 128:$ POKE $B+24,1 \emptyset:$ BANK 15:SYS DEC("3最"):END

## FORMAT GCR

Purpose: Format a GCR disk
Call address: $\$ 30 \mathrm{E} 4$ (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
$1 \emptyset$ OPEN $15,8,15: \operatorname{B=DEC}(" 38 \emptyset \emptyset "):$ POKE B+32, $71:$ POKE B+33, 67
$2 \emptyset$ POKE B+3ø, 6:POKE B+31, $0:$ BANK $15: S Y S$ DEC(" 30 E 4 "): END

## 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 $7 \quad$ 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.
$1 \varnothing$ OPEN $15,8,15:$ BANK $15: \operatorname{B=DEC}(" 38 \emptyset \sigma "):$ POKE B+36,136
$2 \emptyset$ SYS DEC("3øC4"):SI=PEEK (25ø):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:
bit 7 step head flag ( $0=$ track 0 )
bit 4 same as Read Sector
bits 1-3 select command (101 for Query Disk Format)
bit 0 same as Read Sector
$\$ 3829$ Track offset (if bit 7 of $\$ 3828$ is set to 1 )
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):

## 1ØøØ RESTORE:FOR I=DEC("38øø")

TO DEC("38Øø")+16*3-1
$101 \emptyset$ READ AS: POKE I, DEC(AS):NE XT I:RETURN
$1 \varnothing 2 \emptyset$ DATA $55,3 \varnothing, \varnothing \varnothing, \varnothing \emptyset, \varnothing 1, \varnothing 2, \varnothing 1$
$, 55,3 \varnothing, \varnothing 2, \varnothing \varnothing, \emptyset 1, \varnothing 2, \varnothing 1,55,3 \varnothing$
$1 \varnothing 3 \emptyset$ DATA $04,55,3 \varnothing, \varnothing 6,81, \varnothing \emptyset, \emptyset 2$
$, 27, \varnothing A, \varnothing \varnothing, \varnothing \emptyset, E 5,55,3 \emptyset, \varnothing 6, \varnothing \varnothing$
1040 DATA $58,58,55,30, \varnothing 8, \emptyset \emptyset, 55$
$, 3 \varnothing, \varnothing A, \varnothing \varnothing, 55,3 \varnothing, 8 C, \varnothing \varnothing, \varnothing \varnothing, \varnothing \varnothing$
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("38øø"): POKE B+41,10
20 POKE B+4ø,138:SYS DEC("3ø99"): 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: \$382C (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 $0 \quad$ 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.
$1 \varnothing$ OPEN $15,8,15:$ BANK $15:$ B=DEC ("38øø") : POKE B+44,140
20 SYS DEC("3ø75"):PRINT PEEK (25ø): END

## SENDCMD

Purpose: Send a command to the disk drive
Call address: $\$ 304 \mathrm{~A}$ (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.
$1 \varnothing$ OPEN 15,8,15:BANK 15:SYS DEC("3ø4A"),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.
$1 \varnothing$ SYS DEC("3Ø25"):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.
$1 \varnothing$ SYS DEC("3øø日"): 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 command into the corresponding storage 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 indicates that its storage area is at locations \$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 addresses are stored in locations \$FB-\$FC and \$FD-FE, respectively, using standard low-byte/highbyte 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).
1 B B=DEC("38øø"): POKE251, $0:$ POK E253, Ø: POKE252,64: POKE254,6 5
20 POKE B+3,10:POKE B+4,1:POKE $\mathrm{B}+5,2$
$3 \emptyset$ OPEN15,8,15:BANK 15:SYS DEC ("30F8"):END

Program 1: MFM Disk Copier
For instructions on entering this program, please refer 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 $\varnothing$ Ø0: NEXT
CJ 10 OPEN15,8,15
FB $2 \emptyset$ FAST
MQ 3 Ø BANK15
KK $4 \emptyset$ PRINT" $\{C L R\}\{4$ TAB $\}$ MFM DI SK COPIER"
FB 45 IFPEEK (DEC("38øø")) $=85 \mathrm{TH}$ ENGOTO6Ø
DX 50 BLOAD"BURST"
XF $6 \varnothing$ SYSDEC ("32øø")
PX $70 \quad \mathrm{~S} \$="\{$ BELL $\}\{C L R\}$ INSERT So URCE DISK"
$\mathrm{XB} 8 \emptyset \mathrm{D} \$="\{$ BELL $\}$ INSERT DESTINA TION DISK"
KG $9 \emptyset E \$="\{B E L L\}\{C L R\} E R R O R S: ~ "$
QF løø PRINT: PRINT"\{BELL\} INSER T SOURCE DISK"
MR 110 GETAS:IFAS < > CHRS (13)THE NGOTOIlø
FK 115 POKEDEC("3828"), 26:SYSD

## 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.
$1 \varnothing$ SYS DEC("3ø38"):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.
$1 \varnothing$ SYS DEC("3Ø41"): 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 $\$ 3800$.
$1 \varnothing$ SYS DEC("32øø"):END

EC("3Ø99"):A=PEEK(250): A=AAND15:IFA<2THENBS=1: ELSEBS=Ø
PX 116 POKE DEC("3828"), 10
SM 120 SYSDEC ("3ø99") :SB=PEEK ( 25Ø):SI=Ø
RC $13 \varnothing \mathrm{TD}=$ SBAND 128
KM $14 \emptyset$ IFSB=ØTHENPRINT:PRINT"I DONT COPY GCR DISKS":C LOSE15: RUN
MK $15 \emptyset$ PRINT"MFM FORMAT"
MJ $16 \emptyset$ BL=SBAND48
RA $17 \emptyset$ IFBL $=\emptyset$ THENP $1=\varnothing: B Y=128$
BR $18 \emptyset$ IFBL $=16$ THENP $1=1: B Y=256$
MF $19 \emptyset$ IFBL $=32$ THENPI $=2: B Y=512$
PH 2 Iの $1 F B L=48$ THENPl $=3: \mathrm{BY}=1 \varnothing 24$
QE 205 P2=PEEK (DEC ("37øø"))
HX 210 B=DEC ("38øø")
BX 220 POKEB+22, P1: POKEB+24, P2
CK 230 PRINTBY"BYTE SECTORS"P2 "SECTORS PER TRACK"
AF 270 PRINT: PRINTDS
QK 280 GETA\$:IFAS < > CHRS (13)THE NGOTO28Ø
EF 290 PRINT:PRINT" $\{3$ BELL $\} F O R$ MATTING. . ."
EC 294 SL=DEC("3900"):SA=252:E A=254: POKE 251, Ø: POKE253 , $\varnothing:$ IFBS $=1$ THENPOKEDEC (" 3 813"), 38: POKEDEC("3813" ), $\operatorname{PEEK}(\operatorname{DEC}(" 3813$ ")) OR64
RE 3øØ SYSDEC("3ØEE"):CLOSE15: OPEN15,8,15
DP $31 \varnothing$ FORD=øØTO39STEPINT (144/ P2/BY*256)

HM 320 PRINT: PRINTS\$
QE 330 GETAS:IFAS < > CHR\$ (13)THE NGOTO33 : ELSESYSDEC("3Ø 99")
KS $335 \mathrm{TL}=\operatorname{INT}(144 / \mathrm{P} 2 / \mathrm{BY} * 256)-1$
CX 340 SL=DEC("39øø"): DL=SL
QG $35 \emptyset$ FORT=ØTOTL
KB 360 FORS $=1$ TOP2
AD 370 GOSUB3øøø:POKESA, HI:POK ESA-1,LO:SL=SL+BY: GOSUB 3øøø: POKEEA, HI : POKEEA-1 , LO
AE $38 \varnothing$ POKEB $+3, T+D: P O K E B+4, S: P$ OKEB $+5,2:$ POKEB $+6, T+D+1$
GB $39 \emptyset$ PRINTSI"\{LEFT\}R: "T+D" \{LEFT\}\{2 SPACES\}" S " \{LEFT \} \{2 SPACES \} \{UP \}"
QX $4 \emptyset \emptyset$ SYSDEC("3ØF8")
MH $41 \varnothing$ IFT + D $>38$ ANDS $+1>$ P2THENGO TO420: ELSENEXT:NEXT
DC $42 \emptyset$ PRINT: PRINTD\$
AP 425 TL=INT (144/P2/BY*256)-1
DQ 430 GETAS:IFAS < > CHRS (13)THE NGOTO430:ELSESYSDEC ("3 99")
$\mathrm{PQ} 44 \emptyset$ FORT=øTOTL
GE $45 \emptyset$ FORS $=1$ TOP 2
MS $46 \varnothing$ GOSUB3ø1ø:POKESA,HI:POK ESA -1, LO: DL=DL+BY: GOSUB $3 \varnothing 10:$ POKEEA, HI : POKEEA-1 , LO
FJ 470 POKEB $+1 \varnothing, T+D:$ POKEB $+11, \mathrm{~S}$ : POKEB $+12, \varnothing$ : POKEB $+13, \mathrm{~T}+$ D+1
RH $48 \emptyset$ PRINTSI" $\{$ LEFT \}W: "T+D"
\｛LEFT\}\{2 SPACES\}"S" \｛LEFT\}\{2 SPACES\}\{UP\}"
CS 490 BANK15：SYSDEC（＂3153＂）：B ANK15
FH 5 ø 1 IFT＋D＞38ANDS $+1>$ P2THENGO TO5ø5：ELSENEXT：NEXT：NEX T
XR 505 IFBS $=1$ ANDS $=\varnothing$ THENGOTO 52 $\emptyset$
DR 510 PRINT＂\｛CLR\}\{3 BELL\}COPY COMPLETE．．．＂：SLEEP4：RU N
ES 520 POKEDEC（＂38ø2＂），16：POKE DEC（＂38ø9＂），18：POKEDEC（ ＂3828＂）， 26
HC 530 SL＝DEC（＂ $39 ø \varnothing "): S A=252: E$ A＝254：POKE251，Ø：POKE253 ，$\sigma: S I=1$
RE 540 GOTO31ø
SJ 3øøø HI＝INT（SL／256）：LO＝SL－H I＊256：RETURN
JJ $3 ø 1 \varnothing \mathrm{HI}=\mathrm{INT}(\mathrm{DL} / 256): \mathrm{LO}=\mathrm{DL}-\mathrm{H}$ I＊256：RETURN

## Program 2：MFM Disk Utility

For instructions on entering this 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 $\varnothing$ øø：NEXT
DQ 3 BANKI5
QE 4 DCLEAR：AS＝DS
AM 5 PRINTCHRS（14）
AK 6 RZ $\$=\operatorname{CHR} \$(19):$ FOR $J=1$ TO 1 4：RZ $\$=\mathrm{RZ} \$+\operatorname{CHR} \$(17): \mathrm{NEXT}$
SA 10 FAST
XJ $2 \emptyset$ OPEN15，8，15
HF $3 \varnothing$ PRINT＂\｛CLR\}\{15 DOWN\}[L] G IN NEW DISK＂
XD 40 PRINT＂［N］EW BLOCK＂
HR 50 PRINT＂$[\bar{R}]$ EWRITE BLOCK＂
BB 60 PRINT＂［ $\dagger$ ］NEXT BLOCK＂
DP $7 \varnothing$ PRINT＂$[-]$ PREVIOUS BLOCK＂
GK $8 \emptyset$ PRINT＂［ + ］NEXT TRACK＂
KX $9 \varnothing$ PRINT＂［ $\overline{\text { j }}$ PREVIOUS TRACK＂
EG $10 \varnothing$ PRINT＂［C］HANGE BYTE UND ER CURSOR＂
KH $11 \varnothing$ PRINT＂［T］EXT MODE＂
RA 115 PRINT＂［D］OUBLE SIDE SEL ЕСт $\left\{\right.$ HOME $^{\text {T }}$
PS $12 \emptyset$ PRINT＂\｛HOME\}\{15 DOWN\} \｛4ø RIGHT\}DISK INFO: $\{2$ SPACES $\} \bar{M} \bar{M} / G \bar{C} R: "$
PB $13 \emptyset$ PRINT＂$\{52$ RIGHT $\}$ BYTES $\underline{P}$ ER BLOCK：＂
JF 140 PRINTT＂\｛52 RIGHT $\}$ BLOCKS \｛SPACE\}PER TRACK:"
DR 145 IFPEEK（ $\overline{\text { DEC }}(\overline{ } / 38 \varnothing \varnothing "))=85 T$ HENGOTO17ø
JD 150 BLOAD＂BURST＂
HB 160 BLOAD＂SCREEN＂
SC $17 \varnothing$ POKE143ø2，øø：POKE143ø3， 45
JM 180 SYS13433：SYS13418
HB $19 \varnothing$ B＝DEC（＂38øø＂）：SA＝252：EN $=254: C P=\varnothing: S I=1: C S=\varnothing$
DJ 195 SYSDEC（＂ $320 \varnothing$＂）
EQ 2øø POKE251，0：POKE253，0：POK E252，44：POKE 254,46 ：POKE $\mathrm{B}+2,0$ ： $\mathrm{POKEB}+9,2$
MA $21 \varnothing$ GOSUB $142 \emptyset$
AF 211 GETB $:$ ：IFB $\$=$＂＂${ }^{\text {THENGOTO21 }}$ 1

BG $22 \varnothing$ IFB\＄く＜＂L＂THEN38ø
ED 230 SYSDEC（＂3ø99＂）：SYS 13433
DS 240 SU＝PEEK（25ø）
 ＂\｛RIGHT\}": NEXT
MC 260 PRINT＂\｛HOME \}\{14 DOWN\}"
RS $27 \varnothing$ PRINTAS；：PU＝SUAND128
XR 280 IFPU＝128THENP $\$="$ MFM＂$: E$ LSEPS＝＂GCR＂：SU＝16
XS $29 \emptyset$ PRINTP\＄
MQ $3 \emptyset 6$ PRINTAS；
BK 31ø AU＝SUAND48：POKE143ø2，$\varnothing$
FB $32 \emptyset$ IFAU $=\varnothing$ THENBY $=128$ ：POKE14 $3 \varnothing 2,8 \emptyset$ ：POKE143ø3，44
MJ 33ø IFAU＝16THENBY＝256：POKE1 4303，45
AM $34 \varnothing$ IFAU $=48$ THENBY $=1 \varnothing 24$ ：POKE 14303，48
JE 350 IFAU＝32THENBY＝512：POKE1 4303，46
GH 351 BL＝PEEK（DEC（＂37øø＂））
RB 352 IFPU＜＞128THENBL＝20：T＝1： $S=-1$
KF 355 PRINT＂\｛5 SPACES\}":PRINT AS：＂\｛5 SPACES\}"
PR 356 PRINT＂\｛2 UP\}";AS;
PQ 360 PRINTBY：PRINTAS；BL
MK $37 \varnothing$ GOTO 210
ES 380 IFB\＄く＞＂N＂THENGOTO5øØ
JG $39 \varnothing$ PRINT＂\｛HOME\}\{19 DOWN\}";
AD $4 \varnothing 0$ AS＝＂＂：FORF＝1TO4ø：A\＄＝A\＄＋ ＂\｛RIGHT\}": NEXT
PA $41 \varnothing$ PRINTAS＂TRACK＂；：INPUTT： PRINTAS＂BLOCK＂；：INPUTS
CK 42 Ø PRINT＂\｛2 UP\}"A\$"
\｛17 SPACES\}": PRINTA\$"
\｛2ø SPACES ${ }^{\prime \prime}$
MD 43 Ø POKEB $+3, \mathrm{~T}:$ POKEB +4 ， S ：SYS 13433 ：POKESA， 42
AP 431 PRINT＂\｛HOME \}\{22 DOWN\}"; LEFT（A\＄，4б）；＂TRACK \｛5 SPACES $\}$ \｛5 LEFT\}";T
XD 432 PRINTLEFTS（AS，40）；＂BLOC K $\{5$ SPACES $\}\{5 \text { LEFT }\}^{\bar{\prime}}$ ；S
EA 433 PRINTLEFTS（AS，40）；＂SIDE \｛6 SPACES $\}$ \｛5 LEFT\}" ${ }^{\prime}$ ；CS；
CC 435 POKEEN－1，$\varnothing$ ：POKESA－1，$\varnothing$ ：P OKESA， 44
PE 440 IFBY $=128$ THENPOKEEN， 44 ：P OKEEN－1， $8 \varnothing$
MA 450 IFBY $=256$ THENPOKEEN， 45
XH $46 \emptyset$ IFBY＝512THENPOKEEN， 46
CG $47 \emptyset$ IFBY $=1 \varnothing 24$ THENPOKEEN， 48
XB $48 \emptyset$ SYSDEC（＂ $3 \varnothing F 8$＂）
DD $485 \mathrm{C}=\varnothing$ ：PRINT＂$\{\mathrm{HOME}\} "$ ；
SB 490 GOTO 210
RH 5 Øø IFB $\ll>"+$＂THENGOTO58
CH 510 IFSI＝1THENS＝S +1 ：GOTO 515
BE 511 CS＝CS＋1：CS＝CSAND1：AV＝16 ＊CS：POKEB +2 ，AV：POKEB＋9， AV +2
EG 512 IFCS＝$\varnothing$ THENS $=$ S +1
MP 515 IFPU＝ØTHENGOTO 550
RB $52 \emptyset$ IFS $>$ BLTHENT $=T+1: S=1$
MK $53 \emptyset$ IFT＞39THENT＝$=\varnothing$
DF 540 GOTO 430
BP $55 \varnothing$ IFS $>2 \varnothing$ THENT $=T+1: S=\varnothing$
MS $56 \emptyset$ IFT＞35THENT $=1$
XJ $57 \emptyset$ GOTO43ø
GX 580 IFBS＜＜＂－＂THENGOTO670
BH 59ø IFSI＝1THENS＝S－1：GOTO6øø
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 $6 \varnothing \varnothing$ IFPU $=\varnothing$ THENGOTO64Ø
CF $61 \varnothing$ IFS $<1$ THENT $=T-1: S=B L$
PK $62 \varnothing$ IFT＜øTHENT＝39
MP 630 GOTO43ø
MD $64 \varnothing$ IFS $<\emptyset$ THENT $=T-1: S=2 \varnothing$
XJ 65 IFT $<1$ THENT $=35$

GR 660 GOTO430
JB $67 \varnothing$ IFBS＜＞＂$\pm$＂THENGOTO $74 \varnothing$
HA $680 \mathrm{~T}=\mathrm{T}+1$
FC $69 \varnothing$ IFPU $=\varnothing$ THENGOTO72ø
DE $7 \varnothing \varnothing$ IFT＞39THENT＝$=$
CB 710 GOTO43ø
XE $72 \varnothing$ IFT $>35$ THENT $=1$
MA 730 GOTO43ø
SQ 740 IFB\＄く＞＂ニ＂THENGOTO81ø
AF $750 \mathrm{~T}=\mathrm{T}-1$
XR 760 IFPU $=\emptyset T H E N G O T O 79 \varnothing$
KH $77 \varnothing$ IFT $<\emptyset T H E N T=39$
GE 780 GOTO430
KB 79ø IFT＜1THENT＝35
PE $8 \varnothing$ GOTO43Ø
AE 810 IFB $\ll>"$＂R＂THENGOTO930
PC $82 \varnothing$ PRINT＂$\{\mathrm{HOME}$ \} (19 DOWN \}"L EFT\＄（AS，40）；＂ARE YOU SU RE？＂；
SE 83Ø GETBS：IFB\＄＝＂＂THENGOTO83 Ø
AA 835 PRINT＂$\{17$ LEFT $\}$
\｛2ø SPACES\}"
DX 840 IFB $\$<>$＂ $\mathrm{Y} " T H E N G O T O 21 \varnothing$
PA 850 POKE251，ø：POKE253，ø：POK ESA， 44
PP 86Ø IFAU＝ØTHENPOKEEN，44：POK EEN－1， $8 \varnothing$
CP $87 \varnothing$ IFAU $=16$ THENPOKEEN， 45
SE $88 \emptyset$ IFAU $=32$ THENPOKEEN， 46
XQ $89 \varnothing$ IFAU $=48$ THENPOKEEN， 48
DK 9øø POKEB＋1ø，T：POKEB＋11，S
EK $91 \varnothing$ SYSDEC（＂3153＂）
GM 920 GOTO21ø
PP 93ø IFBS＜＞＂\｛DOWN\}"THENGOTO9 60
MM $94 \emptyset \mathrm{R}=\mathrm{INT}(\mathrm{C} / 8 \emptyset): I F C+8 \emptyset>B Y-1$ THENGOTO21ø
QE 950 PRINT＂\｛DOWN $\}$＂；：C＝C＋80：G OTO210
XM 960 IFBS＜＞＂\｛UP\}"THENGOTO99ø
EP 97ø R＝INT（C／8ø）：IFR＝øTHENGO TO21ø
HD 980 PRINT＂$\{$ UP $\}$＂；：C＝C－8ø：GOT 0210
AA 99ø IFBS＜＞＂$\{$ RIGHT\}"THENGOTO $1 \varnothing 2 \varnothing$
BE 1006 IFC＝BY－1THENGOTO210
FP $101 \varnothing$ PRINT＂$\{$ RIGHT $\} " ;: C=C+1$ ： GOTO21ø
XA 1ø2Ø IFB\＄く＞＂\｛LEFT\}"THENGOTO 1050
AR $1 \varnothing 30$ IFC＝$\varnothing$ THENGOTO21 $\varnothing$
GR 1ø4ø PRINT＂\｛LEFT\}";:C=C-1:G OTO21ø
GG 1050 IFB $\langle>$＂$\{$ HOME $\}$＂THENGOTO 1070
EK 1 Ø60 PRINT＂$\{$ HOME $\}$＂；：C＝ø：GOT 0210
DQ $107 \varnothing$ IFBS＜＜＂C＂THENGOTO116ø
QH $1 \varnothing 8 \varnothing$ PRINT＂$\{$ HOME $\}$ \｛19 DOWN $\} "$ LEFTS（AS，4ø）＂NEW VALUE ＂；：INPUTNV
PS 1090 PRINTLEFT $(A \$, 40) "\{U P\}$ \｛10 SPACES\}"
BE 110ø POKE11264＋C，NV：R＝INT（C ／80）： $\mathrm{O}=\mathrm{C}-\mathrm{R} * 80: \mathrm{M}=\operatorname{INT}(\mathrm{O} /$ 8）：$L=0-M * 8$
RQ $111 \varnothing$ PRINT＂$\{$ HOME $\}$＂；：IFR＝øTH ENGOTO113ø
SP $112 \emptyset$ FORF＝1TOR：PRINT＂ \｛DOWN \} ＂；：NEXT
KS $113 \varnothing$ IFM $=\emptyset$ THENGOTO115 $\varnothing$
MX 1140 FORF＝1TOM：PRINTCHRS（9） ；：NEXT
EX 1150 IFL＝øTHENGOTO1øø 0 ：ELSE FORF＝1TOL：PRINT＂
\｛RIGHT\}";:NEXT:GOTOIøø $\emptyset$
XK 1160 IFBS＜＜＞＂T＂THENGOTO135
BX $117 \varnothing$ PRINT＂$\{$ HOME $\}$ \｛19 DOWN $\} "$

LEFTS（AS，4б）＂RETURN TO EXIT＂；
AP 118 R $=\operatorname{INT}(C / 8 \emptyset): 0=C-R * 8 \emptyset: M$ $=\operatorname{INT}(0 / 8): L=0-M * 8$
GB $119 \emptyset$ PRINT＂$\{$ HOME $\}$＂；：IFR＝øTH ENGOTO121ø
BH 12øø FORF＝1TOR：PRINT＂\｛DOWN\} ＂；：NEXT
BD $121 \varnothing$ IFM＝ØTHENGOTO123ø
GC 122Ø FORF＝1TOM：PRINTCHR\＄（9） ；：NEXT
JQ 123 IFL＝ 12 THENGOTO $124 \emptyset:$ ELSE FORF＝1TOL：PRINT＂
\｛RIGHT\}"; :NEXT
MX 1240 GETB\＄：IFB\＄＝＂＂THENGOTO1 $24 \varnothing$
XP $1250 \mathrm{~A}=\mathrm{ASC}(\mathrm{B} \$):$ IFA＝13THENGO TO1270：ELSEPOKE11264＋C ， $\mathrm{A}: \mathrm{IFC}=\mathrm{BY}-1$ THENPRINT＂ \｛HOME\}"; C=ø:GOTO124ø
XB 1260 C＝C +1 ：PRINT＂\｛RIGHT\}";: GOTO124ø
RX 1270 PRINT＂$\{$ HOME $\}\{19$ DOWN \}" LEFT\＄（AS，4ø）＂
\｛16 SPACES\}";
SF 128 R $=\operatorname{INT}(C / 8 \emptyset): O=C-R * 8 \emptyset: M$ $=\operatorname{INT}(0 / 8): L=0-M^{*} 8$
JK 129 Ø PRINT＂\｛HOME ${ }^{\prime \prime}$ ；：IFR＝ØTH ENGOTO131ø
PS $13 \varnothing \emptyset$ FORF＝1TOR：PRINT＂$\{D O W N\}$ ＂；：NEXT
JP $131 \varnothing$ IFM＝ 1 THENGOTO133
RJ 132 FORF＝1TOM：PRINTCHR\＄（9） ；：NEXT
AE 1330 IFL＝ 13 THENGOTO1340：ELSE FORF＝1TOL：PRINT＂
\｛RIGHT\}"; :NEXT
JX 1340 GOTO21ø
FQ $135 \emptyset$ IFBS＜＞＂D＂THENGOTO21Ø
KS $136 \emptyset$ IFSITHENGOTO138
AH $137 \emptyset$ SI＝1：P $\$=$＂DOUBLE SIDE 0 FF＂：GOTO1 $\overline{3} 9 \varnothing$
RK 138 SI＝Ø：P\＄＝＂DOUBLE SIDE 0 $\mathrm{N}^{\prime \prime}$
ES 1390 PRINT＂$\{$ HOME $\}$ \｛ $2 \varnothing$ DOWN $\}$＂ LEFT\＄（AS，4Ø）P\＄；
SK $14 \emptyset \emptyset$ SLEEP1
QJ $141 \varnothing$ PRINT＂$\{2 \varnothing$ LEFT $\}$ \｛22 SPACES\}";:GOTO21ø
DG $142 \emptyset$ PRINT RZS；：RETURN

## Program 3：BURST

Please refer to the＂MLX＂article elsewhere in this issue before entering the following program．
3øøø：AD 65 D5 99 ø8 8D 05 D5 1A 3øø8：A9 7F 8D ØD DC A9 Øø 8D BA 3ø1ø：$\emptyset 5 ~ D C ~ A 9 ~ Ø 3 ~ 8 D ~ Ø 4 ~ D C ~ A D ~ 73 ~$ 3018：ØE DC 298 8 19955 8D ØE AA 3ø20：DC 2C ØD DC 6Ø AD $9 E$ DC $1 C$ 3ø28：29 8 8 Ø 69 Ø8 8D ØE DC AD EA 3ø30：05 D5 29 F7 8D 05 D5 60 B9 3ø38：AD Øø DD 9910 8D Øø DD $5 \emptyset$ 3ø4ø：6Ø AD Øø DD 29 EF 8D ØØ 3 E 3ø48：DD $60 \quad 8 \mathrm{C} 66$ 3ø $8 \mathrm{E} \quad 65$ 3Ø 6 E 3050：A8 A9 Øø $85 \mathrm{FA} A D$ 1C 0A 98 3ø58： 29 BF 8D 1C ØA A2 $\quad$ ØF $2 \emptyset$ C9 3ø6Ø：C9 FF A2 øø BD $26 \quad 38 \quad 2 \varnothing 11$ 3068：A8 FF E8 88 D 8 F6 20 CC 32 3070：FF 2C 1C ØA 6Ø A2 2 A AØ 82 3078：38 A9 $\quad 4 \quad 2 \emptyset \quad 4 \mathrm{~A} \quad 30 \quad 2 \emptyset \quad 25$ 5A 3ø8Ø：3Ø 2C ØD DC 20 38 30 A9 5 F 3088： 08 2C ØD DC FØ FB AD ØC 46 3ø9ø：DC 85 FA AA $2 \varnothing \quad 41 \quad 30$ 8A BB 3ø98：6Ø A2 26 AØ 38 A9 $\emptyset 4 \quad 2 \emptyset \quad 31$ 3ØAØ：4A $3 \varnothing \quad 20$ DF 3185 FA 29 F2 3øA8：8 $81 \emptyset$ 18 A5 FA 29 15 C9 18 3ØBØ：Ø2 9ø Øø A9 $9 \emptyset \quad 85 \mathrm{FB}$ A9 88 3øB8： 6585 FD A9 37 85 FC 85 A6 3ØCØ：FE DØ 3 E 6Ø A2 22 AØ 38 B9

3øC8：AD $24 \quad 38 \quad 2980$ DØ 105 A9 9D 3øDØ：Ø4 4C D6 3 3 A9 Ø3 $2 \emptyset$ 4A Ø8 30D8：30 AD $24 \begin{array}{lllllll}38 & 29 & 8 \emptyset & \mathrm{~F} \emptyset & \text { Ø3 } & \mathrm{F} 4\end{array}$ 3ØEØ： $2 \emptyset 75$ 3Ø $6 \emptyset$ A2 1C AØ 38 B9 3ØE8：A9 $66 \quad 2 \emptyset 4 \mathrm{~A} ~ 3 \varnothing \quad 6 \emptyset$ A2 11 Al 3ØFØ：A $\quad 38$ A9 ØA $2 \emptyset$ 4A $3 \emptyset \quad 6 \emptyset 7 \emptyset$ 3øF8：A2 Øø Aø 38 A9 97 20 4A 36 31øø： $3 \varnothing 78$ 2C ØD DC AD Øø DD 6A 31ø8：49 10 8D Øø DD A9 Ø8 2C 96 3110： $0 \mathrm{D} D \mathrm{DC}$ F FB AD Øø DD $498 \varnothing$ 3118：10 8D ØØ DD $A D$ ØC DC 85 Aø 312Ø：FA 29 ØF C9 Ø2 BØ 2A AØ $9 \emptyset$ 3128：Øб A9 Ø8 2C ØD DC FØ FB 72 313ø：AD Øø DD 4910 8D Øø DD 4E 3138：AD ØC DC 91 FB E6 FB Dø 6D 3140： 02 E6 FC A5 FD C5 FB DØ 27 3148：Eの A5 FE C5 FC DØ DA 58 F9 3150：6Ø 58 6Ø A2 97 AØ 38 A9 94 3158：$\varnothing 6 \quad 20 \quad 4 \mathrm{~A} \quad 30 \quad 4 \mathrm{C}$ Al 31 8D EA 316Ø：EF 37 Aø Øø $2 \varnothing$ Øø $3 \varnothing \mathrm{AD} A B$ 3168：ØØ DD CD ØØ DD DØ F8 4D 6D 3170：EF $37 \quad 29$ 40 Fg Fl AD EF 5C $\begin{array}{llllllll}3178: 37 & 49 & 40 & 8 D & \text { EF } & 37 & \text { B1 } & \text { FB } \\ 65\end{array}$ 318ø：8D ØC DC A9 ø8 2C ØD DC CA 3188：FØ FB E6 FB Dø Ø2 E6 FC 58 319ø：A5 FE C5 FC D $\varnothing$ D1 A5 FD 25 3198：C5 FB DØ CB 4C AC 315883 31AØ：60 78 A9 3E 8D Øø FF A9 8 8 31A8： 40 4C $5 \mathrm{~F} \quad 31$ A9 Øø 8D Øø A5 31Bø：FF $2 \varnothing$ C6 31 EE $2 \varnothing$ D $\quad \mathrm{AD} 4 \mathrm{E}$ 31B8：ØA 38 8D EF 37 AD ØB 38 9D $\begin{array}{lllllllll}31 \mathrm{C} & 8 \mathrm{D} & \mathrm{EE} & 37 & 4 \mathrm{C} & 9 \mathrm{~F} & 31 & 2 \emptyset & 25 \\ 78\end{array}$ 31C8：30 2C ØD DC $20 \quad 38$ 30 A9 A9 31DØ：Ø8 2C ØD DC Fø FB AD ØC 9ø

 31E8：A9 08 2C OD DC FØ FB AD C8 31FØ：ØC DC $6 \emptyset \mathrm{EA} \mathrm{AD}$ Øø DD 49 BD 31 F ： 10 8D ØØ DD AD ØC DC $6 \emptyset$ 5C 32øø：A2 2F BD ØC 32 9D Øø 38 3A 32ø8：CA 1Ø F7 $6 \varnothing 55 \quad 3 \emptyset$ Øø Øø 46 321ø：ø1 Ø2 Ø1 55 3ø 02 Øø 0175 3218：Ø2 0155 3ø 0455 3ø 0647 3220：81 Øø Ø1 27 1の Øø Øø $\mathrm{E} 5 \mathrm{3E}$ 3228：55 $3 \varnothing$ Ø6 øø 58 58 55 30 03 3230： 08 Øø 55 3ø $0 А$ Øø 55 30 71


## Program 4：SCREEN

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

34øø：A2 12 2ø DA CD 8D Dø 37 6D 34ø8：A2 13 2ஏ DA CD 8D D1 37 B7 341ø：A2 ØA $2 \emptyset$ DA CD 8D D2 37 7F 3418：A9 Øø A2 1220 CC CD E8 83 3420：20 CC CD A2 7F A9 øø $2 \emptyset 72$ 3428：CC CD A9 2C 8D 3634 A9 B9 343Ø：Øø 8D 3534 AD ØØ 2 E 2Ø CF 3438：CA CD EE 3534 DØ Ø3 EE 84 3440：36 34 AD 3534 CD DE 37 A7 3448：D $\emptyset$ EA AD 3634 CD DF 37 BC 3450：D D E2 AD D $\begin{array}{lllllll} & 37 & \text { A2 } & 12 & 2 \emptyset & 25\end{array}$ 3458：CC CD E8 AD D1 37 2 0 CC $\quad$ 日B 3460：CD A9 6Ø EA A2 ØA $2 \emptyset$ CC $1 F$ 3468：CD 4C 65 FA 78 A9 34 8D 87 3470：15 Ø3 A9 8D 8D 14 Ø3 58 4D 3478：60 A2 Øø A9 2ø 9D ØØ 2F FA 348ø：9D Øб 2C 9D øø 2D 9D ØØ Ø7 3488：2E E8 D F 16 CE CF 37 9 9 3490：F0 Ø3 4C 65 FA A9 Ø5 8D 28 3498：CF 37 4C Øø 34 Øø Øø Øø E1
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# Medium-Resolution Autorun For Atari ST 

Brian McCorkle

This compact program allows you to run 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-

\author{

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 <br> * <br> \begin{tabular}{ll}
GEMDOS \& equ 1 <br>
BIOS \& equ 13 <br>
XBIOS \& equ 14

 <br> .text <br> * See whether we're running on a monochrome system <br> 

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

 <br> * Shift to medium resolution <br> 

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

 <br> * Turn on flashing cursor <br> 

move.w \& \#40,-(sp) \& * Flashing cursor <br>
move.w \& $\# 1,-(\mathrm{sp})$ \& * Enable cursor <br>
move.w \& \#21,-(sp) \& * Cursconf, XBIOS function 21 <br>
trap \& \#XBIOS \& * Perform XBIOS trap <br>
addq.1 \& \#6,sp \& * Clean up stack

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

move.w \& \#0,-(sp) \& * Black color <br>
move.w \& \#3,-(sp) \& * Color \#3 <br>
move.w \& \#7,-(sp) \& * Setcolor, XBIOS function 7 <br>
trap \& \#XBIOS \& * XBIOS trap <br>
addq.1 \& \#6,sp \& * Clean up stack

 <br> skip: <br> * Terminate program and release our memory to the system <br> 

clr.1 \& -(sp) \& * <br>
trap \& \#GEM, GEMDOS function 0
\end{tabular} <br> .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 D0 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| 199 | rem "MEDRES.PRG" filemaker |
| :---: | :---: |
| 110 | rem Copyright 1987 COMPUTE Publications, Inc. |
| 120 | rem All rights reserved. |
| 130 | data $6 \varnothing, 1 A, \emptyset \varnothing, \varnothing \varnothing, \emptyset \varnothing, 4 E$ |
| 140 |  |
| 158 | data Øø, $\varnothing, \varnothing \varnothing, \varnothing \varnothing, \varnothing \varnothing, \varnothing \varnothing ~$ |
| 160 | data øø, Øळ, Øø, Øø, ØП, $\varnothing$ |
| 170 | data øø, øø, øø, ø¢, ЗF, ЗС |
| 189 | data $\varnothing \varnothing, \emptyset 4,4 \mathrm{C}, 4 \mathrm{C}, 54,8 \mathrm{~F}$ |
| 190 | data ØС, 4Ø, Øø, Ø2, 67, ЗС |
| 200 | data $3 \mathrm{~F}, 3 \mathrm{C}, \emptyset \emptyset, \emptyset 1,2 \mathrm{~F}, 3 \mathrm{C}$ |
| 210 | data FF, FF, FF, FF, 2F, 3C |
| 220 | data FF, FF, FF, FF, $3 \mathrm{~F}, \mathrm{SC}$ |
| 236 | data $\varnothing \varnothing, 65,4 E, 4 E, D F, F C$ |
| 240 | data ПП, Øø, øø, ØС, ЗF, ЗС |
| 250 | data øø, 28, 3F, ЗС, øø, Ø1 |
| 260 | data $3 \mathrm{~F}, 3 \mathrm{C}, \emptyset \emptyset, 15,4 \mathrm{C}, 4 \mathrm{~L}$ |
| 270 | data 5C, $8 \mathrm{~F}, 3 \mathrm{~F}, 3 \mathrm{C}, \emptyset \emptyset, \emptyset \emptyset$ |
| $28 \emptyset$ | data 3F, ЗС, øø, ØЗ, ЗF, ЗС |
| 296 | data $\varnothing \varnothing, \emptyset 7,4 \mathrm{E}, 4 \mathrm{E}, 5 \mathrm{~S}, 8 \mathrm{~F}$ |
| 3月6 | data 42, $47,4 \mathrm{E}, 41$, Øø, Øø |
| 310 | close:open "R", 1,"\MEDRES. PRG", 6 |
| 320 | field \#1, 6 as $\times \$$ |
| 330 | for $j=1$ to 18 |
| 340 | $y \$=" "$ for $k=1$ to 6 |
| 350 | ```read z$:byt=val ("&H"+z$):y $=y$+chr$ (byt)``` |
| 360 | $\mathrm{c}=\mathrm{c}+1$ : chk $=$ chk $+\mathrm{c}+\mathrm{byt}$ : next |
| 370 | $\begin{aligned} & \text { lset } \times \$=y \$: r=r+1: \text { put } 1, r: n \\ & \text { ext } \end{aligned}$ |
| 380 | close:if chk=11954 then en $d$ |
| 390 | 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 DOS 2.5 enhanced-density disk or a true double-density disk to contain all the data.

If you have a 130 XE 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 COPYRIEHT 1987 COMP UTE！PUBLICATIONS，INC． \｛3 SPACES\}ALL RIEHTS RE SERVED．
FF 1 © READ Nø，N1，N2，N3，N4，N 1 5，N12日，N155，N255，Q：GOT $026 \emptyset$
H2ø TRAP 25ø：CLOSE WN2：OPE $N$ 㭗2，N4＋N2，Nø，F\＄：INPU T \＃N2；A事：CLOSE 䚡N2
LC $3 \varnothing$ IF $A(N 2, N 2)<>"$＂THEN ？：？＂Fille not found＂ ：EDTD $32 \boldsymbol{0}$
CB 40 SEC＝VAL（A（N15，LEN（A \％） ））： $\mathrm{Q}=\mathrm{N} \varnothing$
$A A 5 \emptyset$ ？：＂Gingle（enhanced ）or Double density？＂；
PD 6 ■ EET WN1，K：IF Kく＞6日 AND $K<>83$ THEN $6 \emptyset$
KL 7 7 DEN＝N128－N3：IF $K=68 \quad$ TH EN DEN＝N255－N2
AK 8 8 ？CHR（K）：BLOCK＝INT（SE C
HB 9 © IF BLOCK＜N4 THEN POP： POP ：GOTO 6ぁぁ
NC 1ヵø A\＄＝＂飞＂：IF BLOCK／N2＞ME M／N255 THEN A $\begin{gathered}\text {＝＂区＂：IF } \\ \text { I }\end{gathered}$ BLOCK／N3＞MEM／N255 TH EN A＝＝＂ ＞MEM／N255 THEN A\＄＝＂E＂
IC $119 \mathrm{~B}=\mathrm{A}=\mathrm{A}: \mathrm{B}=\mathrm{N} 2+\mathrm{N} 3:$ IF INT（ BLOCK／（ASC（A§）－176）$+\boldsymbol{D}$ ．5）＞MEM／N255 THEN $62 \sigma$
FO 12פ IF BLOCK／B＜N4 THEN B＝ B－N1：GOTO 12ஏ
 A
내140 ？：？＂File is＂；BLOCK ；＂BLOCKS long．＂：？＂包 Plit into how mand 目 Les G＂；A\＄；＂日＂；B\＄；＂ロ马 ＂
BF 159 日ET WN1，K：IF KくASC（AG ）$-N 12 B$ OR K＞ASC（B\％）－N 128 THEN $15 \varnothing$
ND $16 \emptyset$ FOR I＝Nの TO N4：FIL（I） ＝NØ：NEXT I
BK 17ø ？CHR（K）：NUM＝K－4日：FO

R I＝Nø TO NUM－N2：FIL（ $I)=I N T((B L O C K / N U M)+\varnothing$ ． 999）：NEXT I
M 18 F FOR $I=N$ N TO NUM－N2：FI $L(N U M-N 1)=F I L(N U M-N 1)$ ＋FIL（I）：NEXT I：FIL（NU $M-N 1)=B L O C K-F I L(N U M-N$ 1）
HK 19 R RETURN
ED 2øø FOR J＝N1 TO FIL（I－N1）
AH21б A $2="\{\} ":, A(N 255)=A \$:$ $A(N 2)=A$
HB 229 TRAP 24．XID N4＋N3，解N 2，N4，ND，A
AL 23ø B\％（LEN（B\＄）＋N1）＝A \＆ 2 NEX T J：RETURN
 \＄：RETURN
KB 25．？：？？＂\｛BELL\}ERROR －＂；PEEK（195）：TRAP $4 \%$ øøø：CLR ：END
0126 DIM A（N255），F（N15）， FN（N15），M\＄（N4＋N1），FI L（4）：MEM＝INT（FRE（Nø）／ N255）\＆N255：IF FRE（g）－ MEM＜1פஜ THEN MEM＝MEM－ N255
IF 270 DIM B\＄（MEM）：M\＄＝STR（M EM）：FOR I＝N1 TO LEN（M （）：$J=\operatorname{ASC}(M \$(I, I)): J=J$ $+N 128: M \$(I, I)=$ CHR（J） ：NEXT I
HP 28ø GRAPHICS Ng：POKE 71ø， N128
HK 290 ？＂\｛4 SPACES\} DOLCUMETM
 \｛4 EPACES\}": ? "CopNE: Eht 1987 Cowntiel PNE L．Inc：
 its Resterved． \｛7 डFPGES\} "


AB उøø CLOSE NN1：OPEN \＃N1，N4 ，N历，＂K：＂
KP $31 \varnothing$ ？？＂Enter filename of text fileto （B SPACES\}to besplit into several filem．＂
HB 320 TRAP 32g：？：？＂Ffile＂ ＂ 3 ：INPUT FN $:$ IF FN $=$ ＂＂THEN ？＂\｛UP\} QUTET \｛3 DELETE\}": 日OTO 59月
JD 33ø IF LEN（FN\＄）＜N3 THEN 3 7 ロ
BE 34 IF $\mathrm{FN}(\mathrm{N} 1, \mathrm{~N} 2)=$＂D：＂TH EN FN $=$ FN（N3）：BOTO 3 78
BP 35 IF $F$ FN $(N 2, N 2)\rangle ": " A N$ D FN\＆（N3，N3）＜＞＂：＂THE N 37 g
L8 36！IF FN（N3，N3）$=$＂：＂THE N F $=$ FN $=$ ： 0 OTO $38 \varnothing$

NP 38g DRV＝VAL（F（N2，N2））
PF 390 ？：？＂Insert disk wit h＂；Fक；＂into＂：？＂dis $k$ drive＂pRV；＂and $p$ ress RETURL＂；
 THEN 4øø
ME 41 g ？
JL42ø IF $Q$ THEN GOSUB 2ø：？ ＂\｛UP\}"
ME 430 ？？：＂Eave filles o

F1 44 日ET \＃1，K：IF Kく49 OR K $>52$ THEN 44 g
FH 456 FN\＄mF ： 4 FN（N2，N2）$=$ CHR （K）：？CHR（K）
CH 46ø ？：？＂Insert SAVE dis $k$ in drive＂；K－48：？＂ and press Reciuse＂；

IH 470 GET 解1，K：IF Kく＞N155 T HEN 47
18 48ø ？：？：TRAP 256：CLOSE粒N2：OPEN 茾N2，N4，ND，F ：B $=$＝＂＂：FOR I＝N1 TO NU M

BA 49б ？＂Reading＂；F\＆；＂－＂ ；FIL（I－N1）；＂BLOCKS＂： GOSUB 2øø
MK 5øø IF I＝NUM THEN ？＂Clea ring nulls＂；
CF 510 IF $I=N U M$ THEN IF B（L EN（B\＄））＝＂\｛，\}"THEN B
 ：GOTO $51 \varnothing$
AK $52 \boldsymbol{2}$ IF I $=$ NUM THEN ？
IL 536 FOR $M=N 4$ TO LEN（FN\＄）： IF $\operatorname{FN}(M, M)="$－＂THEN FN $(M+1)=" Z Z ": F N$（ $M+3$ ）＝STR（I）：POP：GOTO 5 $5 \%$
 1）$=$＂．ZZ＂：FN（LEN（FN ${ }^{(1)}$ ） $+\mathrm{N} 1)=$ STR（I）
FO55ø ？＂Saving＂；FN\＄；＂－ ＂；INT（（LEN（Bも）／DEN）$+\boldsymbol{\emptyset}$ ．999）：＂SECTORS＂
LD 56．TRAP 25\％：CLOSE \＃NJ：QP

JC 57ø ？WN3；Be；：CLOSE WN3：B （\＃＝＂＂：NEXT I
FD 58．？：？＂（BELL）DONED \｛BELL\}\{3 SPACES\}Hit E: ETVDR to quit＂： $\mathrm{Q}=\mathrm{N} 1: \mathrm{B}$ OTO 31 由
00596 CLOSE WN1：CLOSE \＃N2：C LDSE \＃NJ：TRAP 4月øøø：C LR ：END
BM Gのg ？：？F我；＂has less th an 162．＂：＂BYTES．Th is program will only split＂：？＂files great er than 1 m2m BYTES．＂
8061 日 BOTO 59
 too long to split＂：？ ＂5 ways with＂！MEM；＂ byte buffer．＂：？＂Mod ify it to split more than that：＂
DC 63円 ？＂DIM FIL（5）．．．．Lines 1ø๓－12 59ø
KD 640 DATA $\sigma^{2}, 1,2,3,4,15,128$ ，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? 6000

## ENDING ADDRESS? <br> 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．

F7 10 REM PRINT SHOP（TM）
4920 REM CONVERTER
BD $3 \emptyset$ REM COPYRIGHT 1987
$054 \varnothing$ REM COMPUTE！PUBLICATIONS， INC．
6C 5 © REM ALL RIGHTS RESERVED．
6E 69 REM
CF $7 \emptyset$ TEXT ：HOME ：HIMEM： 8191
BJ B Ø $\mathrm{FU} \mathrm{\%}=\varnothing: \mathrm{X} \varnothing \%=\varnothing: Y \varnothing \%=\varnothing: \times 1$ $\%=\varnothing: Y 1 \%=\varnothing: V \emptyset \%=\varnothing$
6F $90 \mathrm{D} \$=$ CHR $\$(13)+$ CHR\＄（4）： Q ${ }^{(1)}$ CHR（34）
7D 1 Øø IF PEEK（41868）＜$>113$ T HEN PRINT＂Sorry！You mus t use DOS 3．3＂：END
CC 116 POKE 1ø13，76：POKE 1פ14，$\varnothing$ ：POKE 1ø15，96
B2 120 POKE 768，1ø4：POKE 769， 16 8：POKE 77ø，104：POKE 771 ，166：POKE 772，223：POKE 773，154：POKE 774，72：POK E 775，152：POKE 776，72：$P$ OKE 777，96
2B $13 \varnothing$ PRINT D\＄＂BLOAD CV＂
of 14ø IF PEEK（ 64435 ）＜＞ 6 THE N FU\％＝6：\＆
29 15ø VTAB 1ø：HTAB 15：PRINT＂PR INT SHOP＂：HTAB 12：PRINT＂ CONVERTER＂：PRINT： HTAB 13：PRINT＂COPYRIGHT 1987＂：VTAB 15：HTAB 7：PRIN T＂COMPUTE！PUBLICATIONS，
INC．＂：FOR I＝ 1 TO 2øøø： NEXT I
2E 155 UTAB 17：HTAB 1ø：PRINT＂ All Rights Reserved＂：FDR $I=1$ TO 1øøø：NEXT I
A1 $16 \emptyset$ HOME ：HGR ：POKE 49234，$\varnothing$
98 170 POKE 44596，234：POKE 4459 7，234：POKE 44598，234
92 189 REM
D4 $19 \emptyset$ REM Main Menu
83 200 REM
A8 21ø HOME ：HGR ：POKE 49235，$\emptyset$
E8 220 HOME ：VTAB 21：PRINT＂C onvert from．．．＂ $\operatorname{SPC}(1 \varnothing) "$ D＝Quit＂
B7 23ø PRINT TAB（6）＂1 $=$ HIRES $p$ icture＂
$93 \mathbf{2 4 6}$ PRINT TAB（6）＂2 $\mathbf{2}=\operatorname{Print} 5$ hop（tm）graphic＂
IC 25 PRINT TAB（ 6 ）＂ $3=$ Instruc tions＂；：VTAB 1：HTAB 1
4B $26 \emptyset$ FOR I $=\emptyset$ TO 1 STEP $\emptyset$
$8827 \emptyset \mathrm{~KB}=$ PEEK（49152）：IF KB $>127$ THEN I $=1$
83 28ø NEXT I：POKE 49168，$\emptyset$
CA $29 \emptyset F \emptyset=K B-176:$ IF $F \emptyset<\emptyset$ OR FD＞ 3 THEN 26』
83 $3 \emptyset \emptyset$ IF $F \emptyset=3$ THEN $169 \varnothing$
F4 31ø IF Fg $=\emptyset$ THEN TEXT ：HOM E：END
F8 32ø VTAB 21：HTAB 1：PRINT＂ Convert to．．．＂；：CALL－ 8 68

63336 VTAB 24：HTAB 1：CALL－ 8 68：VTAB 1：HTAB 1
48 34ø FOR I $=\varnothing$ TO 1 STEP $\emptyset$
$8835 \emptyset \mathrm{~KB}=\operatorname{PEEK}(49152):$ IF KB $>127$ THEN I $=1$
8636 NEXT I：POKE 49168， 0
A9 37ø IF KB $=155$ THEN 21ø
$B D$ 3Bø F1 $=K B-176: I F F 1<1$
QR F1＞ 2 THEN $34 \varnothing$
68390 ON Fø GOTO 43ø，52ø
85 4øø REM
AA $41 \emptyset$ REM Load HIRES
$8942 \varnothing$ REM
C6 430 GOSUB 1 10øロ
4 4 440 ONERR BOTO $43 \varnothing$
C3 459 GOSUB 166ø：PRINT D\＄＂BLOA D＂FI\＄＂，A\＄4ø日ぁ，D1＂：POKE 2 16，$\varnothing$ ：CALL 768
B1 46 D FU\％＝Ø：IF PEEK（43616） +256 （ PEEK（43617）＜8ø øø THEN FU\％$=4$
1C $47 \emptyset$ \＆
A5 480 GOTO 56ø
97 490 REM
68 5øø REM Load Print Shop
88510 REM
C5 52 GOSUB 1 Gのø
39530 ONERR GOTO 520
$0754 \varnothing$ GOSUB 166ø：PRINT D\＄＂BLOA D＂FI\＄＂，A\＄5Bøø，D1＂：POKE 2 16，$\varnothing$ ：CALL 768
7C $550 \mathrm{FU} \mathrm{\%}=1$ ：\＆
2月 $56 \emptyset$ ON F1 GOTO 6פØ，77の
94 57ø REM
8B 58ø REM Save HIRES
98590 REM
13 Gøø GOSUB 989：HOME ：VTAB 21 ：PRINT＂Save this as．．．

09610 PRINT TAB（6）＂1＝Full－si ze HIRES picture＂
FA $62 \emptyset$ PRINT TAB（ 6）＂2＝Compres sed HIRES picture＂
$4963 \emptyset$ FOR I $=\varnothing$ TO 1 STEP $\emptyset$
$89640 \mathrm{~KB}=\operatorname{PEEK}(49152)$ ：IF KB $>127$ THEN I $=1$
$4465 \emptyset$ NEXT I：POKE 49168，$\varnothing: ~ V T A$ B 1
AA $66 \emptyset$ IF KB $=155$ THEN 210
$8 D 67 \emptyset F \emptyset=K B-176:$ IF FD $<1$ OR FD $>2$ THEN $63 \varnothing$
F7 68ø FI\＄＝FI\＄＋＂．PIC＂
02690 IF $F \mathscr{}=1$ THEN PRINT D $\$$＂B SAVE＂FI \＆＂，A\＄2øøø，L\＄1FFF，D 1＂：GOSUB 1536：GOTO 219
$757 ø \emptyset$ FU\％＝3：\＆
9E $716 L=$ PEEK（1）－ 64
$1072 \emptyset \mathrm{~L}=256$＋ $\mathrm{L}+2$（PEEK（ $\varnothing$ ，
AC 73 PRINT D\＄＂BSAVE＂FI\＄＂，A\＄4øø Ø，L＂L＂，D1＂：BOSUB 153ø：B OTO 21 ロ
$9674 \emptyset$ REM
46759 REM Save Print Shop
$9476 \emptyset$ REM
CF 770 FR $=5:$ GOSUB $144 \varnothing$
$8478 \emptyset \mathrm{X} 7 \%=95: Y \emptyset \%=5 \varnothing: \times 1 \%=1$ 83：Y1\％＝1ø2：FU\％＝5：\＆
$57796 \mathrm{~J}=9$
45 8øø FOR $I=\emptyset$ TO 1 STEP $\emptyset$
$44810 \mathrm{~KB}=\operatorname{PEEK}$（49152）：IF KB ＜ 128 THEN NEXT I
6A 820 POKE 49168，Ø：\＆$: K B=K B$ -32 （KB＞223）
$1 A 83 \emptyset$ IF $K B=141$ THEN $93 \emptyset$
FA $84 \emptyset$ IF $K B=136$ THEN $X \varnothing \%=X \emptyset$ $\%$－J：IF X $\quad$＜$\varnothing$ THEN Xø $\%=\varnothing$
6C $85 \emptyset$ IF $K B=138$ THEN $Y \varnothing \%=Y \emptyset$ ． $\%+$ J：IF Y $\% \%>139$ THEN $Y \varnothing \%=139$
AB $86 \emptyset$ IF KB $=139$ THEN $Y \emptyset \%=Y \emptyset$ $\%$－J：IF Yø\％＜$\quad$ THEN Yø $\%=\varnothing$

4B 87ø IF KB $=149$ THEN $X \varnothing \%=X \emptyset$ $\%+\mathrm{J}:$ IF Xø\％＞191 THEN $\mathrm{X} 0 \%=191$
A6 $88 \emptyset X 1 \%=X \emptyset \%+88: Y 1 \%=Y \emptyset \%$ $+52$
B2 89の IF KB $=155$ THEN 210
EJ 9øø IF KB＞ 176 AND KB＜ 186 THEN $J=K B-176$
9 C 910 IF $\mathrm{KB}=198$ THEN $F=4923$ $4+(F=49234):$ POKE $F, \varnothing$
E2 929 \＆：NEXT I
66930 GOSUB 989：FU\％＝2：\＆
19 940 FI\＄＝FI\＄＋＂．PS＂：PRINT D象＂BSAVE＂FI\＄＂，A22528，L576 ，D1＂：GOSUB 153ø：GOTO 21 ©
94950 REM
BD $96 \emptyset$ REM SUBROUTINES
$5 E 970$ REM File name
91980 HOME ：VTAB 21：POKE 4923 5，Ø：PRINT＂What name sho uld I use to save this？＂
22990 GOSUB 109ø：GOSUB 155ø：R ETURN
2E 1øøø HOME ：VTAB 21：PRINT＂W hat graphic do you want to convert？＂
05 1ø1ø VTAB 24：PRINT＂Press＇R ETURN＇for a catalog of files＂；
3F 1 g2ø GOSUB $111 \varnothing$
EB 1ø3ø IF FI $\gg " n$ THEN $1 \varnothing 7 \emptyset$
77 1ஏ4ø TEXT ：HOME ：PRINT D\＄＂C ATALOE，D1＂
$90165 \emptyset$ PRINT＂Press any key to continue．．．＂；：CALL－ 7 56：HER
62 1ø6ஏ GOTO 1øøø
AC 1979 GOSUB 154ø：RETURN
651 10日g REM Get file name
D2 199Ø VTAB 23：PRINT＂CTRL－X＝E rase file name＂SPC（ 3）＂ ESC＝Main menu＂
61 11øø PRINT＂＜－or DELETE＝Dele te char RETURN＝Accept＂；
E2 1110 VTAB 22：HTAB 1：CALL－ 86B：FI $=" "$
$36112 \emptyset$ FOR $I=\emptyset$ TO 1 STEP $\emptyset$
761130 CALL $-756: K B=\operatorname{PEEK}(49$ 152）：POKE 49168，
CB $1140 \mathrm{~KB}=\mathrm{KB}-32$（ $\mathrm{KB}>96$ ）
$7 E 1159$ IF $K B=13$ THEN RETURN
4D 1160 IF $K B=27$ THEN $21 \emptyset$
89 117ø IF KB $=24$ THEN $111 \varnothing$
$18118 \emptyset$ IF KB＜$>8$ AND KB＜＞9 5 AND PEEK（36）$=25$ THE N CALL－198：NEXT I
$5 F 119 \emptyset$ IF KB＜ 8 AND KB $<32$ THEN NEXT I
A9 12øø IF KB＜$>8$ AND KB＜＞ 9 5 THEN FI $=$ FI ${ }^{(1)}+$ CHR （KB）：PRINT CHR（KB）；： NEXT I
81 1219 IF PEEK（36）$=\varnothing$ THEN CA LL－198：NEXT I
$19122 \emptyset$ PRINT CHR\＄（8）CHR\＄（32） CHR（ ${ }^{(B)}$ ；
C4 1230 IF LEN（FI\＄）$=1$ THEN FI ＝＂＂＂：NEXT I
$93124 \emptyset$ FI\＄$=$ LEFT（FI\＄，LEN（F 1\＄）－1）：NEXT I
D2 $125 \emptyset$ REM Move window frame
78 126ø GOSUB 144g：\＆
4D $127 \emptyset$ FOR K $=\varnothing$ TO 1 STEP $\emptyset$
$5 A 1280 \mathrm{~KB}=\operatorname{PEEK}$（49152）：IF KB ＜ 128 THEN NEXT K
D5 1290 POKE 49168，$: ~ \&: K B=K B$ -32 （KB＞223）
A5 $13 \emptyset \emptyset$ IF $K B=141$ THEN \＆：RET URN
$041310 \mathrm{IF} \mathrm{KB}=136 \mathrm{OR} \mathrm{KB}=139$ THEN Yø\％$=Y \emptyset \%-J=$（FR ＝1）：Y $1 \%=Y 1 \%-J$（ $F$ $R=2): X \varnothing \%=X \varnothing \%-J \geqslant($
$F R=3): X 1 \%=X 1 \%-J \vdots$ （FR＝4）
© 1320 IF KB $=149$ OR $\mathrm{KB}=138$ THEN $\mathrm{Y} \sigma \%=Y \emptyset \%+J$（FR $=1): Y 1 \%=Y 1 \%+J *(F$ $R=2): X \varnothing \%=X \varnothing \%+J *$（ $F R=3): X 1 \%=X 1 \%+J *$ $(F R=4)$
79 1330 IF KB＞ 176 AND KB＜ 186 THEN $J=K B-176$
01 134ø IF $X \emptyset \%<35$ THEN $X ø \%=3$ 5
68 1359 IF $\times 1 \%>266$ THEN $\times 1 \%=$ 266
A4 $136 \emptyset$ IF $Y \emptyset \%<\emptyset$ THEN $Y \emptyset \%=\varnothing$
IF $137 \varnothing$ IF $Y 1 \%>167$ THEN $Y 1 \%=$ 167
FB 138Ø IF Xø\％＞ $\mathrm{X} 1 \%-2$ THEN $X \varnothing$ $\%=X 1 \%-2$
CC 139の IF Yø\％＞Y1\％－ 2 THEN Yg $\%=Y 1 \%-2$
D 14 Øø IF $X 1 \%<X \emptyset \%+1$ THEN $\times 1$ $\%=X \varnothing \%+1$
A1 $141 \varnothing$ IF $Y 1 \%<Y \varnothing \%+1$ THEN $Y 1$ $\%=Y ø \%+1$
751429 \＆：NEXT K
941430 REM Messages
CB $144 \varnothing$ HOME ：VTAB 21：PRINT＂A RROWS $=$ Move＂；：ON FR GO TO 145ø，146ø，147 148 ， 1 49ø
$64145 \emptyset$ PRINT＂TOP＂；：GOTO $149 \varnothing$ B5 1469 PRINT＂BOTTOM＂；：GOTO 1 490
E7 147ø PRINT＂LEFT＂；：GOTO 149 ■
$50148 \emptyset$ PRINT＂RIGHT＂；
© $149 \emptyset$ PRINT＂window frame＂
71 15øø PRINT SPC（ 3）＂1－9＝Dist ance of frame movement＂
87 151ø PRINT SPC（5）＂F＝Turn $f$ ull screen ON／DFF＂
321520 PRINT＂RETURN＝Accept $p$ osition＂；：VTAB 1：RETUR N

3C 1530 HOME ：VTAB 21：PRINT＂S aved as＂Q\＄FI＊Q\＄：FOR I $=1$ TO 2ஏøø：NEXT I：RET URN
4B 154ø A\＄＝＂Place the disk con
 \＄：GOTO 156ø
5E 155ø A\＄＝＂Place the disk you want to save＂$+Q \$+F$

$73156 \emptyset \mathrm{~A} \$=\mathrm{A} \$+\prime$ in drive 1 a nd press any key＂
12 157ø HOME ：UTAB 21： $1=4 \varnothing$
16 158ø J $=\varnothing$
CB 1590 B $\$=$ LEFT $\$(A \$, I-J)$
18 16øø IF LEN（B\＄）＝LEN（A\＄） 0 R RIGHT\＄（B\＄，1）＝CHR $($ 32）THEN 162ø
C6 161ø J＝J＋1：GOTO 159ø
BC $162 \emptyset$ PRINT LEFT $\$(B \$, I-1)$
$9 B 163 \emptyset K=$ LEN（A\＄）－LEN（B\＄）
Ab 164ø IF $K=\varnothing$ THEN CALL -198 ：CALL－198：CALL－ 756 RETURN
$24165 \emptyset$ A $\$=$ RIGHT $\$(A \$, K):$ GOTO $158 \emptyset$
AE 166ø HOME ：VTAB 21：PRINT＂L oading＂Q＊FI \＆
DC 1670 REM
C8 $168 \emptyset$ REM Help
651690 TEXT ：I＝ 1
D4 17øø HOME ：INVERSE ：PRINT $S$ PC（ 15）＂CONVERTER＂SPC（ 15）：NORMAL ：UTAB 3：HT AB 1
91 1710 FOR $\mathrm{J}=\mathrm{I}$ TO I +9
5E 1720 READ A\＄：IF A\＄$=$＂END＂$T$ HEN 177ø
8D $173 \emptyset$ PRINT A\＄：PRINT

D6 174ø NEXT J：I $=+I+9$
C7 175ø VTAB 24：PRINT＂Press an $y$ key to continue．．．＂；
1A 1760 GET B\＄：PRINT ：GOTO 17ø g
CF 1770 VTAB 24：PRINT＂Press an $y$ key to continue．．．＂；
93 178ø GET B\＄：PRINT ：RESTORE ：GOTO 21ø
$94179 \emptyset$ DATA＂Broderbund Softwar $e^{\prime} s$ Print Shop（tm）＂
67 18Gの DATA＂program uses a spe cial format to store＂
$45181 \varnothing$ DATA＂graphic images．C ONVERTER converts＂
$93182 \emptyset$ DATA＂graphics back and forth between＂
$12183 \emptyset$ DATA＂Apple＇s high resol ution（HIRES）screen＂
DA $184 \emptyset$ DATA＂and Print Shop＇s $f$ ormat．You have＂
IF 1850 DATA＂three choices of $f$ ormats you can＂
0F $186 \emptyset$ DATA＂convert to or from ：＂
F4 1879 DATA＂1）A normal Apple HIRES screen，which＂
93 188ø DATA＂will let you store up to 17 images on＂
2D $189 \emptyset$ DATA＂a disk．＂
4E 19øø DATA＂2）A special HIRE $s$ format that＂
9E 1919 DATA＂appears normal whe n you view it，but＂
$43192 \emptyset$ DATA＂is stored on disk in a＂compressed＂＂
5A $193 \emptyset$ DATA＂format that lets $y$ ou store up to 5ø＂
D4 1940 DATA＂images on a disk．＂ C9 1950 DATA＂3）The standard $P$ rint Shop image．＂
7A $196 \emptyset$ DATA＂CONVERTER lets you convert an＂
5 197ø DATA＂image in any of th ese three formats to＂
$36198 \emptyset$ DATA＂any of the other $f$ ormats．Just select＂
DB $199 \emptyset$ DATA＂the＇from＇and＇to format you desire＂
DA 2øøø DATA＂from the menus and CONVERTER will do＂
F5 2 Ø1ø DATA＂the work＇automati cally．＂＂
BD 2029 DATA＂The computer will add the fallowing＂
BF 2936 DATA＂prefix or suffix $t$ －the name you＂
$88264 \varnothing$ DATA＂choose：＂
112059 DATA＂＂filename．PS＂for Print Shop images．＂
DE 266 DATA＂＇filename．PIC＇for normal or＂
DF $297 \emptyset$ DATA＂compressed HIRES i mages．＂
D6 $2 ø 8 \emptyset$ DATA＂END＂

## Program 2．CV

Please refer to the Apple＂MLX＂article in this issue before entering the following program．
6øøஜ：A5 D9 4B A5 7648 A5 B8 46 6øø8：48 A5 B9 4B A9 92 日5 76 EB 6010：A9 FF 85 D9 A9 BF 85 33 7E 6ø18：A9 $0 \emptyset$ 日5 F3 4C 1F 60 A9 E6 6ø2छ：6ø 85 85 A9 7D Aø An 9E 6פ28：1D 2ø ED 6B A5 69 8D øø E1 6ø3ஜ：7D A9 6ø 日D 61 7D A5 6A A6 6ø38：8D ஏ2 7D A9 øø 日D ø3 7D 44 6ø4ø：A9 Ø1 日5 日A A9 פ® AE Ø3 1D 6ø48：7D AC 62 7D 2曰 BF 6B 8E 7ø 605ø：63 7D BC 92 7D 18 AD ø9 4B 695B：7D 6D 02 7D 8D 14 7D AD Bg 6『60：51 7D 6D 93 7D ED 15 7D AB 6ø68： 18 AD 14 7D 69 ø3 日D GE 7B
 6ø78：7D AD ©E 7D 8D 86 6ø AD F1 6ø日ๆ：gF 7D 8D 87 6ø AD øø 10 1C 6ø日8：BD g® 7D A9 øø 8D $0_{1}$ 7D 1ø
 6098： 604 CF CD CA 10 D6 4 C 哣
 6ФAB： 4 C 4 C 63 AC CF 60 CA 1979 6øB®： 164 C BB 644 C CF $6 \varnothing$ CA 72 6øBB： 10 Ø6 4C B3 65 4C CF 6ø 24 6øCø：CA 10 Ø6 4C $69664 C$ CF BD 6øCB： $6 \varnothing$ CA 10 ø3 $4 C$ B1 $672 \varnothing$ B6 6øDg：58 FC 2036 FB 2022 6B 74 6øDE：C6 D5 AS Aø CD DS D3 D4 73
 6øEB：C1 CE C7 C5 Aø Bø AD B7 6E 6øFø：øø $2 \varnothing \emptyset 76 B 4 C D \varnothing 日 3$ A9 Ab
 61øø：7D AD Ø1 7D 4B 4969 1ø 1D 61ø日：$\varnothing 5683015101968$ C9 1A 611ø： $6 \varnothing$ Зø ØE Dø ø9 AD øø 7D 5A
 6129： 61 AD øD 7D BD 2 E 61 AD 6 C 6128：$\varnothing 1$ 7D 8D 2F 61 AD øø 1041 6130：日D बE 7D A9 øø 日D 9F 7D 59 6138： 38 AD øø 7D E9 ø® BD 92 C6 6140：7D AD 01 7D E9 2ø 日D ø3 13 6148：7D AD 92 7D BD 5961 AD BF 6159： 93 7D 8D 5A 61 AD ©E 7D AG 6158：BD øø 1ø EE ๆ® 7D Dø ø3 6D 616ø：EE $\emptyset_{1} 7 \mathrm{D}$ 4C $\emptyset_{1}$ 61 4C CF 45 6168：6A A9 FF BD ©C 7D A9 57 A4 617פ：8D 9D 7D A9 32 日D 18 7D FC 6178：A9 00 BD 19 7D A9 5F 日D 32 6189： 16 7D A9 øø 日D 17 7D A9 5ø 6188：Øø 8D ø4 7D A9 øø 日D 0574 6190：7D AD ø5 7D 4849 øø 10 6D 6199： $05 \quad 68 \quad 3015101068$ C9 AA 61A历：Øø 3ø छE Dø Ø9 AD Ø4 7D C2 61AB：C9 $969 \varnothing$ ø5 Fg $934 C 49$ A9 61Bg： 63 A9 gø BD 92 7D A9 9 Cl 61B8：8D 93 7D AD 93 7D 484975
 61CB：68 C9 $9 \varnothing$ 3ø øE D $\varnothing 9$ AD AB 61Dø：ø2 7D C9 $979 \varnothing 65$ FØ 931 B 61DE： 4 C उE 63 A9 $9 \varnothing$ 日D 9 DD ØC
 61E8： 4849 g® 10 0568301562 61Fg：10 10 68 C9 øø 3ø ØE D 17 61FB： 99 AD øø 7D C9 ØA 9ø 9520 62øø：Fg ø3 4C 18 63 EE øC 7D 75 62ø日：Dø ø3 EE øD 7D AD øC 7D DC 621ø： 8 D 1A 62 AD gD 7D 8D 1B DD 6218： 62 AD øø 1ø 8D ØA 7D A9 BS 6220：øの 8D ©B 7D AD 94 7D C9 C3
 6230：Dø 11 AD 62 7D C9 94 Dø 63 6238：ØA AD 93 7D C9 øø Dø ø3 9B 6240：4C CF 6A A9 日g 日D 10 7D DE 624日：A9 øø 8D 11 7D A9 øø 8D C4 625ø： 06 7D A9 90 日D 67 7D AD DD 6258： 67 7D 48 49 ©® 10956850
 6268：बE Dø 99 AD g6 7D C9 9725 627ø：9ø 65 Fø 63 4C FC 62 A2 CA 6278：Øø 2ø Fg FG 38 AD 10 7D EB 6289：E9 ø1 8D 12 7D AD 11 7D BF 6288：E9 øの 日D 13 7D AD øB 7D 5B 6290：4B 4D 13 7D 10 95 683090 6298：2C 1012 6B CD 13 7D 3626 62Aø： 24 Dø פA AD ØA 7D CD 12 BB
 62Bø：$F \emptyset$ FG 38 AD ©A 7D ED 10 BF 62BE：7D 8D 9A 7D AD gB 7D ED 3B 62Cø： 11 7D 8D øB 7D 18 AD 16 日D 62C8：7D 6D g6 7D 8D 12 7D AD 9D 62D』： 17 7D 6D 97 7D 8D 13 7D 64 62DB：AD 18 7D AE 12 7D AC 13 ge 62Eø：7D $2 \varnothing 11$ F4 20 5A F4 AD DF 62EB： 11 7D бA GE 11 7D GE 1029 62Fø：7D EE 66 7D D 9 © EE 9740 62FB：7D 4C 5762 18 AD 16 7D C1 63ø日： 69 ø日 日D 16 7D AD 17 7D DE 6398： 69 øの 8D 17 7D EE Øø 7D CB 6310：Dø 63 EE 91 7D 4C E5 61 3日 6318： 18 AD 18 7D 69 g1 8D 18 B3

6320：7D AD 19 7D 69 øg 8D 19 日B 6328：7D A9 5F 日D 16 7D A9 øø D6 633ø：8D 17 7D EE 92 7D Dø ø3 CC 6338：EE 93 7D 4C BB 61 EE 94 FD 6340：7D Dø 03 EE 95 7D 4C 9191 6348： 61 4C CF GA A9 FF 8D øC E7 635ø：7D A9 57 日D øD 7D 2ø 2D CF 6358：6B AD 18 7D BD øø 7D AD AE
 6368：48 4D 1D 7D 1ø 956830 B7 6379： 17 10 12 6日 CD 1D 7D 309 D 6378：øF Dø ØA AD øø 7D CD 1C C4 6380：7D 90 95 Fg ø3 4C BB 64 FB 638日：A9 øø 8D ø2 7D A9 øø 日D 16 639ø：ø3 7D AD ø3 7D 4849 øø BD 6398： $10.056830151010682 A$ 63Aø：C9 øø $3 \varnothing$ øE Dø 99 AD 92 3B 63AB：7D C9 ØA 9ø ø5 Fø $\emptyset 3 ~ 4 C ~ 29 ~$ 63Bg：AD 64 EE gC 7D Dg ø3 EE 2A 63B8：ØD 7D A9 øø 8D ØA 7D A9 DЗ 63Cø：øD 8D øB 7D A9 日ø BD 10 9E 63C8：7D A9 ØD 日D 11 7D A9 9063 63D9：8D 94 7D A9 øø 日D ø5 7D 67 63DB：AD ø5 7D 4849 øø 10 $105 \mathrm{5B}$ 63E9： 683015101068 C9 0941 63E8： 30 ØE D 99 AD 94 7D C9 38 63Fø： 97 9ø 95 Fg Ø3 $4 \mathrm{C} 9 \varnothing 64 \mathrm{DD}$ 63F8：A9 øø 85 8A A9 øB AE ø3 BB 64ø日：7D AC 92 7D 2ø BF 6B BE 30 64ø日：बF 7D 8C פE 7D 18 AD ØE DF 6410：7D 6D 04 7D BD gE 7D AD 9E 6418：øF 7D 6D g5 7D 日D ©F 7D 83 6429：18 AD 16 7D 6D 日E 7D ED 27 6428：ஏE 7D AD 17 7D 6D gF 7D BB 643ø： $8 D$ ØF 7D AD Øø 7D AE ØE $6 F$ 6438：7D AC ©F 7D 2ø 11 F4 B1 85 6440： 26253029 7F Fg 62 A9 6B 6448：ø1 8D 12 7D A9 øø 日D 13 BA 6450：7D AD 11 7D 85 BA AD 10 FE 6458：7D AE 13 7D AC 12 7D 20 EE 6469：BF 6B 8E 69 7D BC ø日 7D F1 646B：18 AD ©A 7D 6D ø日 7D 8D D5 647ø：øA 7D AD øB 7D 6D 99 7D 35 6478： 8 D ØB 7D AD 11 7D ØA GE 56 6489： 11 7D 6E 10 7D EE 94 7D 2D 6488：Dø ø3 EE ø5 7D 4C D8 63 DA 649ø：AD ØC 7D 日D Aø 64 AD øD BA 6498：7D 8D A1 64 AD ©A 7D 8D 1C 64Ag：øø 1ø EE 92 7D Dg 03 EE BF 64AB： 93 7D 4C 9263 EE 61 7D 59 64Bø：Dø ø3 EE 11 7D 4C 6563 DB 64BB：4C CF 6A A9 øø 85 ø® A9 43 64Cg：40 85 91 A9 FE 8599 A9 BF 64C8：日ø 日5 øB A9 øø 85 øC Ag FD 64Dø： 27 A9 78 85 92 A9 $20857 B$ 64DE： 93 A5 92 38 E9 28 85 62 4D 64Eø：Bø 02 C6 93 A5 928594 CF 64E日：A5 031869648595 A5 C4
 64FB：C6 05 A5 9485 06 A5 65 EF 6509： $18 \quad 69 \quad 29 \quad 85 \quad 97$ A5 97 38 A2 6598：E9 $948597189 \varnothing 2 \varnothing$ A5 D2 6510： 07 C5 65 Dg Fø A5 94 C5 69 6518： 92 D 9 D4 A5 65 C5 ø3 D 023 652ø：CE AS 62 Dø B4 B8 1ø A9 9A 6528：A9 Bø 85 øC 18 9ø 2A B1 62 653ø： 6624 日B $3 \varnothing 24$ C5 ø日 Dø 84 653日： $2 \varnothing$ A $\emptyset A$ Eø FF Fø 1A E6 EA 654ø：ØA EB EØ 94 Bø ØE C5 99 FB
 655ø：Dg 62 E6 1185 ø日 1899 FD 655B：B6 AA 489848 BA A2 ø® 6D
 6568：EB A5 øø 38 E9 ø3 85 øø FA 657ø：Bø 92 C6 9124 日B 3017 C1 6578：A5 ØA C9 04 Bø 06 A5 ø日 $ø 3$ 6589：C5 99 Dø øB Aø øø A5 9994 658B： 91 øø CB AS øA 91 øø 86 AC 6599：פB A5 Øø EØ Ø1 18 Dø $\varnothing 567$ 6598： 6906 B8 $590269 \boxed{ } 965$ F6 65Aø：øø 9ø 92 E6 $\varnothing 1$ A9 ø1 8574 65AB：ФA 68 AB 68 24 øC 109636 65Bø：4C CF 6A A9 øø 85 øø A9 3D 65BB： 40 85 01 A9 FE 85 ø8 A9 87 65Cø：פீ 85 ØA Aפ 27 A9 78 85 日E 65C8： 62 A9 $2 \varnothing 85$ פ3 A5 923846

65Dø：E9 28 日5 $ø 2$ Bø 62 C6 0389 65DB：A5 928594 A5 931869 BA 65Eø： 0485 ø5 A5 9438 E9 8ø 5F 65E8： 85 ø4 Bø 92 C6 95 A5 9447 65Fø： 85 ø6 A5 951869208531 65F8： 97 A5 9738 E9 94859786 66øø：189ø 1C A5 97 C5 95 D 95 66ø日：Fø A5 94 C5 92 Dg D4 A5 36 6610： 95 C5 03 Dø CE A5 92 Dø 20 6618：B4 88 10 A9 4C CF 6A 24 9B 6629：øA 3ø 38 A2 øø A1 øø 85 3B 6628：øB C5 ø日 Dø 21 E6 øø Dø $6 F$ 663ø：ø2 E6 $\emptyset_{1}$ A1 øø 85 g9 E6 $\emptyset_{1}$ 6638：Øø Dø ø2 E6 ø1 A1 øø 85 FB 664ø：øB E6 øø Dø ø2 E6 $\emptyset_{1}$ A9 Bø 6648：Bø 85 øA 189ø 9 D A5 øB 88 665ø： 91 Ø6 E6 øø Dø 92 E6 $0_{1}$ A1 6658： $189 \varnothing$ AB AS øB 91 פ6 C6 36 6669：Ø9 Dø Aø A9 øø 85 øA Fø AF 6668：9A 2g 2D 68 AD 18 7D BD gD 6670： 62 7D AD 19 7D 8D 03 7D BA 6678：AD 16 7D 日D øø 7D AD 1792 6689：7D 8D ø1 7D AD $\emptyset_{1}$ 7D 48 1C 6688：4D 1B 7D $1095683017 \mathrm{B4}$ 669ø：10 12 68 CD 1B 7D 3ø øF 12 6698：Dø ØA AD øø 7D CD 1A 7D DA 66Aø： $9 \varnothing 05 \mathrm{Fg}$ Ø3 4 C B5 66206 B 66A8：E7 67 EE Øø 7D Dø ø3 EE 45 66Bø： 01 7D 4C 84 66 EE 18 7D CB 66B8：Dø EE 19 7D AD 1A 7D 72 66Cø：8D øg 7D AD 1B 7D BD Ø1 C9 66C8：7D AD 18 7D 日D 92 7D AD B7 66Dø： 19 7D 8D 93 7D AD ø3 7D 91 66D8：48 4D 1D 7D 10 $6568302 E$ 66Eø： 17 10 1268 CD 1D 7D 3614 66EB：פF Dø gA AD 02 7D CD 1C 4B 66Fg：7D 9ø ø5 Fg g3 4C ø6 67 øD 66FB： $2 \varnothing$ E7 67 EE 92 7D D 9356 67øø：EE 03 7D 4C D5 66 AD 1A 39 6798：7D Dø 93 CE 1B 7D CE 1A 9D 6710：7D AD 1C 7D 8D 02 7D AD 81 6718：1D 7D 8D 93 7D AD 16 7D 93 6720：BD Øø 7D AD 17 7D 8D ø1 øB 6728：7D AD $\quad$（1 7D 4B 4D 1B 7D 44 6730： $1065 \quad 683017101268 \mathrm{DD}$ 6738：CD 1B 7D 36 बF Dø øA AD E4 674の：ø® 7D CD 1A 7D 9ø ø5 Fの F2 6748： 03 4C 5A 67 2ஏ E7 67 EE CB 675ø：øø 7D Dø ø3 EE 01 7D 4C 8B 6758： 2967 AD 1C 7D Dø 93 CE 11 6760：1D 7D CE 1C 7D AD 16 7D ø5 6768：8D øø 7D AD 17 7D 8D ø1 53 677ø：7D AD 18 7D 8D g2 7D AD 61 6778： 19 7D 8D 93 7D AD 93 7D 3B 6789：48 4D 1D 7D 10 日5 $68 \quad 30 \mathrm{D7}$ 6788： 17 10 12 68 CD 1D 7D 30 BD 679ø：פF Dg øA AD $ø 2$ 7D CD 1C F4 6798：7D 90 95 Fg． 03 4C AE 67 ø日 67Aの： 20 E7 67 EE 92 7D Dø 93 FF 67AB：EE 03 7D 4C 7D 67 4C CF 16 67B9：6A A5 67 85 96 A5 688580 67B8： 97 Aの 91 B1 Ø6 Dø 93 4C 34 67Cの：CF 6A Ag $94 \mathrm{B1}$ Ø6 FD 10 FD 67C8：C9 7F Bø 99 C9 619095 FC 67D9：38 E9 2991 g6 CB Dの EC 35 67DB：Aø ஏø B1 あb AA CB B1 øb $7 \varnothing$ 67Eø： 86 ø6 $85 \quad 97$ 38 Bg D2 AD 6D 67EB：ø2 7D AE øø 7D AC Ø1 7D øC 67Fg： 2011 F4 B1 26253029 1D
 689ø：A9 øø 8D ø9 7D A2 øø 20 7E 68øB：Fø FG AD ø日 7D C9 $ø \emptyset$ Dø 29
 6818：A2 93 2ø FD Fb AD 92 7D FD
 6828：F4 20 5A F4 6ø 18 AD 14 EB $683 \mathrm{D}_{1} 7 \mathrm{D} 69$ 6A BD øø 7D AD 159 A 6838：7D 69 øø 8D 91 7D AD $9 \varnothing 54$ 6840：7D 8D 4B 6B AD 91 7D 8D 1D 6848：4C 68 AD 90 10 8D 16 7D 6F 685פ：A9 øø 8D 17 7D AD øø 7D 39
 6869：AD gの 7D 8D 6D 6B AD $01 \mathrm{F9}$ 6868：7D BD 6E 68 AD øø 10 8D CA 6日7ø：gE 7D A9 gø 日D gF 7D A9 2A 6878： $6_{1} 85$ 8A A9 Øø AE gF 7D 6D

6889：AC ©E 7D 20 BF 6B 8E ©F B4 6888：7D BC बE 7D 18 AD 16 7D FS 6890：6D बE 7D 8D 16 7D AD 17 3D 6898：7D 6D øF 7D 8D 17 7D 1819 6BAD：AD 14 7D 6911 日D $9 \varnothing$ 7D CF 68AB：AD 15 7D 69 øD 8D 91 7D 91 68Bg：AD øø 7D 8D BD 6B AD 11 CC 68B8：7D BD BE 68 AD øø 10 日D 25 68Cø：18 7D A9 øø 日D 19 7D 1816 68C8：AD 14 7D 69 18 日D 90 7D 30 68Dg：AD 15 7D 69 øD BD $0_{1}$ 7D B9 68D8：AD øD 7D 8D E5 68 AD 8136 68Eの：7D BD E6 68 AD øø 10 8D 52 68E8：1A 7D A9 øø 8D 1B 7D AD DC 68Fø：øø 7D Dø $\emptyset 3$ CE $0_{1}$ 7D CE AF 68F8：øø 7D AD øø 7D 8D 976978 69øø：AD 11 7D 8D 0869 AD 90 B3 69ø8：10 8D øE 7D A9 øg 日D øF 57 6919：7D A9 $\emptyset_{1}$ 85 BA A9 gø AE 2E 6918：øF 7D AC बE 7D 29 BF 6B 9F 6929：BE ØF 7D BC ØE 7D 18 AD BA 6928：1A 7D 6D פE 7D 8D 1A 7D C9 6930：AD 1B 7D 6D gF 7D 8D 1B CB 6938：7D 18 AD 14 7D 69 1F 8D 24 694ø：øø 7D AD 15 7D 69 øø 8D 98 6948： 11 7D AD øø 7D 8D 5769 EA 6959：AD 91 7D 8D 5869 AD 90 86 6958：10 8D 1C 7D A9 øø 日D 1D 77 6968：7D 18 AD 14 7D 6926 日D 5A 6968： 02 7D AD 15 7D 69 øø 8D C1 6970： 03 7D AD 62 7D 8D 7F 6984 6978：AD 93 7D 8D 8ø 69 AD øg 7ø
 6988：7D AD $\varnothing 2$ 7D Dø $\emptyset 3$ CE 93 D 6990：7D CE 02 7D AD 92 7D 日D EB 6998：A1 69 AD 93 7D BD A2 69 4D 69AD：$A D$ øø 10 BD ©E 7D A9 Øø DE 69AB：8D øF 7D A9 ø1 85 8A A9 2D

69Bø：øø AE פF 7D AC बE 7D 2ø A1 69BE：BF 6B 日E gF 7D BC gE 7D CD 69Cø：18 AD øg 7D 6D ge 7D 8D gF 69CB：ØD 7D AD g1 7D 6D gF 7D FD
 69D8：7D A9 2g 8D ø7 7D AD 9944 69EØ：7D 85 88 AD øB 7D A2 øø 3B 69E日：Aø ø日 $2 \varnothing 49$ 6B 日E øB 7D CF 69Fø：BC ©A 7D AD 69 7D 85 B8 EE 69F8：AD 98 7D A2 øø Aø 4ø 2ø A1 6Aøg： 49 6B BE gD 7D BC øC 7D AA 6Аø8：A9 øø 85 BA A9 ø8 AE øB EØ 6A10：7D AC פA 7D 20 BF 6B 日E 4D 6A18：ØF 7D 8C gE 7D 38 AD ø8 76 6A29：7D ED øE 7D BD פE 7D AD 16 6A28：99 7D ED øF 7D 日D øF 7D 4D 6A3ø： 38 AD øE 7D ED øC 7D BD 4E 6A38：פE 7D AD gF 7D ED gD 7D 55 6A4ø：8D ØF 7D A9 04 85 8A A9 DE 6A48：Øø AE ØF 7D AC øE 7D 2ø 3B 6A5ø：BF 6B 8E gF 7D 8C ge 7D 5A 6A58：18 AD ©6 7D 6D פE 7D 日D 69 6A6ø：ø6 7D AD 97 7D 6D gF 7D FA 6A68：8D 07 7D A9 $\boxed{ } 10$ 85 BA A9 E4 6A7ø：8ø AE ØB 7D AC ØA 7D 2ø 13 6A78：BF 6B 8E פF 7D 8C פE 7D 82 6ABø：18 AD 66 7D 6D פE 7D BD 91 6ABB：ø6 7D AD 97 7D 6D øF 7D 23 6A9ø：8D 97 7D A9 øø 85 8A A9 9D 6A98： 28 AE øD 7D AC øC 7D $2 \varnothing 57$ 6AAD：BF 6B 8E GF 7D 日C gE 7D AA 6AAB： 18 AD $\operatorname{b6}$ 7D 6D DE 7D GD B9 6ABg： 66 7D AD 97 7D 6D gF 7D 4B 6ABE：8D 97 7D 18 AD 96 7D 6D 35 6ACø：64 7D 8D 56 7D AD 97 7D 37 GACB：6D $\quad 557 D \quad 8 D \quad 67$ 7D 606875 6ADg： 85 B9 6885 B8 68857625 GADE：6日 85 D9 A9 8D 8D $\emptyset_{1}$ ø2 BF

6AE0：A9 018534 A9 DD 8533 C1 6AEB：6ø øø C9 84 Dø $\varnothing 6$ A2 $\emptyset_{1} 54$ 6AFD：8E E9 6A 6® C9 8D FD ØF 5ø 6AF8：AE E9 GA Fø $\varnothing 7$ 9D FF 61 AB 6Bøø：EE E9 6A 6ø 4C ED FD AE Eø 6Bø8：E9 6A A9 øø 8D E9 6A 8A 17 6B1ø：Fø øD A9 日D 9D FF $\emptyset_{1} 2 \varnothing \mathrm{BF}$ 6B18：ø3 BE 9ø E7 4C øC BE 4C øD 6B20：BE FD 68858568858682 6B28：Aø $\emptyset_{1}$ B1 85 F Ø बE $\varnothing 9$ 日の $7 \varnothing$ 6B3ø：C9 Aø 9ø ø2 ø5 F3 20 EA 69 6B38： 6 A C8 Dø EE 38986585 FJ 6B4б： 858590.02 E6 86 6C 85 1D 6B48：øø 8587848986 8A Aø D5 6B5ø： 008486848588 8A 10 D4 6B58：ФE उB A9 øø E5 89858963 6B6ø：A9 øø E5 BA 85 BA CB A5 FE 6B68：88 10 øE 38 A9 ø® E5 87 6D 6B7ø： 8587 A9 øø E5 888588 ø6 6B78：CB B4 8B A2 øF $9687 \quad 2636$ 6B80： $8826 \quad 85268638$ A5 851 E 6B88：E5 89 AB A5 86 E5 BA 9095 6B90： 66 E6 8785868485 CA 89 6B98： 10 E3 A5 BB D $\varnothing 1$ A 38 A9 E6 6BAD：Øロ E5 878587 A9 $\boxed{6}$ E5 03 6BAB： 88858838 A9 $\varnothing \varnothing$ E5 8558 6BBø： 8585 A9 $\varnothing \varnothing$ E5 868586 BB 6BBB：A6 88 A4 87 A5 8660859 F 6ВСб： 8984878688 A9 908547 6BC8： 858586468866879076 6BD6： $9 D 18$ A5 896585858553 6BD8：A5 BA 65868586968916 6BED： 26 8A AS 88 Ø5 87 D $\operatorname{DE} 16$ 6BE8：A4 85 A6 $86608586845 B$ 6BFØ： 87 AD Øロ A9 $\varnothing \varnothing 9185 \mathrm{CB} 68$ 6BF8：Dø $\emptyset 2$ E6 86 8A Dø 94 C6 64
 6Cø8： 592046494920 3A 4A 7C



# 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 program, 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 descriptive 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 doublestrike printing on and off.

Lines 1200-1231 of the program contain DATA statements with example commands and control sequences. The commands are the words you will type from the DOS prompt to invoke the corresponding features, and the numbers following the commands are the control characters for those commands. Some commands, such as BKSPC (backspace) are very simple, consisting of only a single character. 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 control 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 substituting your commands for the example 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 statements, an executable machine language 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 instance, assuming you included a command named NORMAL, the following invokes PRNCTRL, sending 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 command to turn on compressed and double-strike mode:

PRNCTRL CMP-ON DS-ON

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

## PRNCTRL.COM Filemaker

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

HE 1 øø Printer Contral
6N 11ø P Copyright 1987
FN 111 , Compute! Publications, Inc.
LK 120 . All Rights Reserved.
HH 125 ,
日D 126 CLS: PRINT"Copyright 1987" :PRINT"Compute! Publicati ons, Inc. ": PRINT"All Righ ts Reserved. ": FOR $X=1$ TO 15øø: NEXT
PJ $13 \varnothing$ CLS: DEFINT I:FOR I=ø TD 5 : READ MSG (I): NEXT
BM 131 READ PGM\$, I 1 MAX, I 2 MAX, GRT OTCK, ILOF
ND $14 \varnothing$ IPASS=IPASS+1:PRINT MSG ( IPASS): IF IPASS $=$ = OR IPAS S=3 THEN 1 øøø
B1 $15 \emptyset$ PRINT: IF IPASS $=2$ THEN DPE N PGM AS *1 LEN=1:FIELD \#1,1 AS BYTE\$
BH $16 \emptyset$ RESTORE 5ø1: GRTOT=ø:FOR I $1=1$ TO I 1 MAX:FOR I2=1 TO I2MAX
FP $17 \emptyset$ READ H\$: IBYTE=VAL (" $\& \mathrm{H}^{\prime}+\mathrm{H}$ \$ ) : ITOT=ITOT+IBYTE
PF $18 \emptyset$ IF IPASS=2 AND ICLOF $<I L O F$ THEN LSET BYTE $\begin{gathered}\text { }=\text { CHR } \\ \text { (IBY }\end{gathered}$ TE) : PUT \#1:ICLOF=ICLOF+1
JL $19 \emptyset$ NEXT I2: READ ICHECK: IF IC HECK = ITOT BOTO $21 \varnothing$
JL 2øø PRINT MSG\$(4);5øø+11:IPAS $S=-1$
6H $21 \varnothing$ GRTOT=GRTOT+ITOT: ITOT $=\varnothing \mathbf{N}$ EXT I1:PRINT
6N $22 \emptyset$ IF IPASS $>\emptyset$ AND GRTOTCK $=$ GR TOT GOTO 140
AH $23 \emptyset$ IF IPASS $\langle>-1$ THEN PRINT $M$ SG (5): END ELSE GOTO 14ø
HA 3פø DATA Correct Errors., Chec king DATA Lines., Creating Program.
HB 310 DATA Program Created., Err or (s) On Line -, Check Lin - 5øø.

81 5 Øø DATA "A:PRNCTRL.COM", 24, 1 6,34236,381
MH $5 \varnothing 1$ DATA E9, AC, øø, øD, ø9, øD, ØA , 5ஜ, 52, 4E, 43, 54, 52, 4C, 2ø, 20, 1063
FD $5 \emptyset 2$ DATA 2D, 2ø, 2ø, 4F, 75, 74, 7ø , 75, 74, 20, 59, 72, 69, 6E, 74, 65, 1424


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