The Summer Consumer Electronics Show: Beyond The Shakeout

COMPUTE!'s GAZETTE

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September 1985
Issue 27, Vol. 3, No. 9
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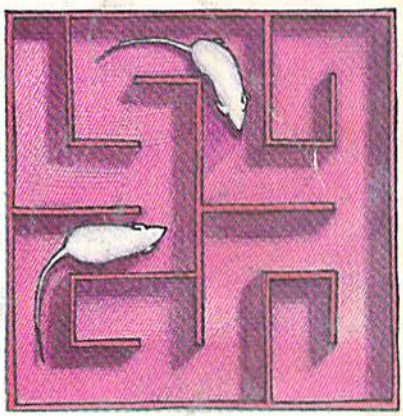
FOR **COMMODORE** PERSONAL COMPUTER USERS

Inside Commodore's New Amiga
A Hands-On Report

Weather Prophet
An amazingly reliable forecaster for the 64 and Plus/4.

Printer Wedge
Create your own custom character sets with this utility for the 64 and 1525, MPS-801, and MPS-803 printers.



Maze-Mania
Mastering this fast-paced game for the 64 is no easy task.

Power BASIC: QuickScan
Reading programs on the screen is simplified with this electronic ruler for the 64 and VIC-20.

Also In this Issue:

Horizons: Programming The 128

User Group Update

Machine Language For Beginners: From Machine Language To BASIC

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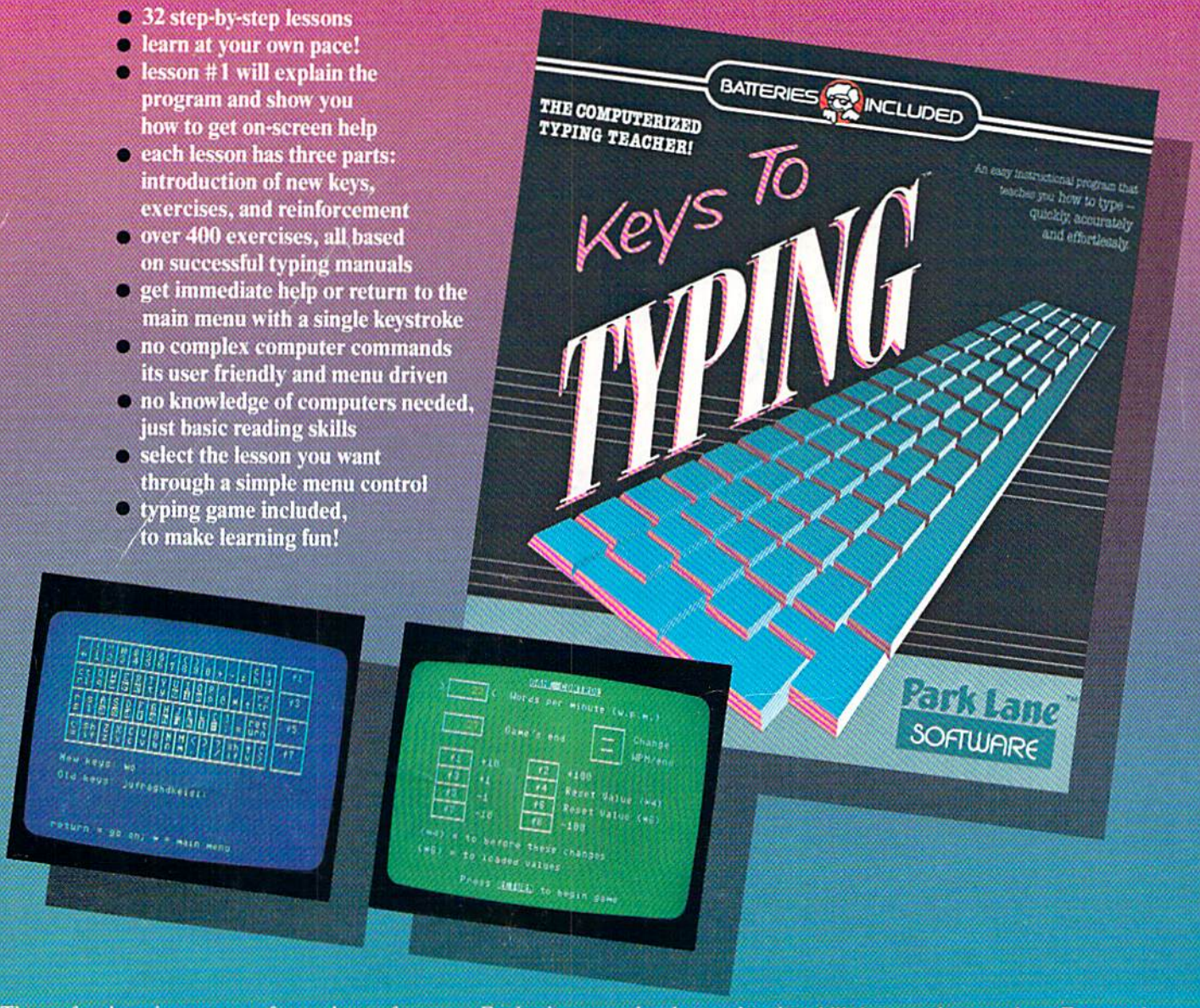

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THE RESULTS ARE IN

We found the printer which has all the features anyone could want. The winner is the Aprotek Daisy 1120, a real heavy-duty workhorse printing at 20 characters per second. The manufacturer is Olympic Co. Ltd., a highly respected Japanese firm.

FEATURES GALORE

This printer has it all. To start with, it has a front panel Pitch Selector button with indicators which allows 10, 12, 15 characters per inch (CPI) or Proportional Spacing. There is a Select (Online) button (with indicator) and a Line Feed button. You can also set Top-of-Form or Form Feed with the touch of the TOF button. Other front panel indicators include Power and Alarm.

To load a sheet of paper, simply place it in the feed slot and pull the paper bail lever. PRESTO! The paper feeds automatically to a 1 inch top margin and the carriage aligns to the selected left margin. In this manner, each page can have identical margins automatically. You can continue to compute while the Daisy 1120 is printing. The built in 2K buffer frees up your computer while printing a page or two allowing you to go to your next job.

To really put your printer to work, the Cut Sheet Feeder option is great for automatic printing of those long jobs. Also available is the adjustable Tractor Feed option. Compare our option prices! Best of all the Daisy 1120 is quiet: only 57 dB-A (compare with an average of 62-65 dB-A for others).

COMPLETE COMPATIBILITY

The Daisy 1120 uses industry standard Diablo® compatible printwheels. Scores of typeface styles are available at most computer or stationary stores. You can pop in a 10, 12, 15 pitch or proportional printwheel and use paper as wide as 14". At 15 CPI you can print 165 columns—great for spreadsheets.

The Daisy 1120 uses the Diablo Hytype II® standard ribbon cartridges. Again universally available.

Not only is the hardware completely compatible, the control codes recognized by the Daisy 1120 are Diablo 630® compatible (industry standard). You can take advantage of all the great features of word processing packages like Wordstar® , pfs: Write® , Microsoft Word® and most others which allow you to automatically use superscripts, subscripts, automatic underlining, boldface (shadow printing) and doublestrike.

The printer has a set of rear switches which allow the use of standard ASCII as well as foreign character printwheels. Page length can be set to 8, 11, 12, or 15". The Daisy 1120 can also be switched to add automatic line feed if required.

THE BEST PART

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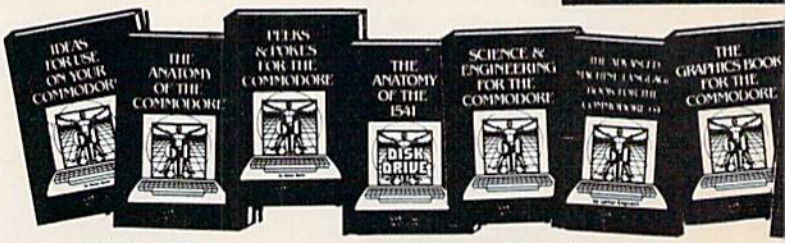

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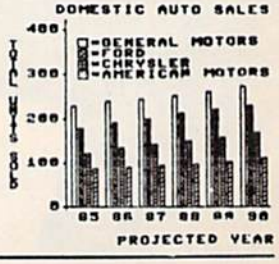

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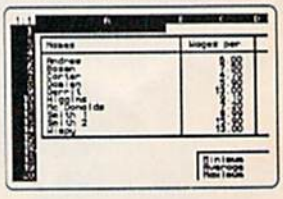

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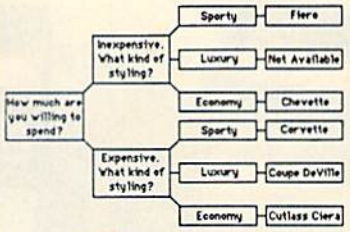

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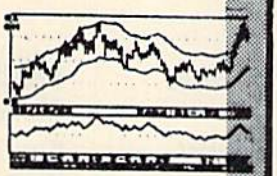

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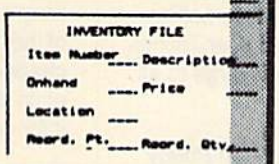

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*=General, **V**=VIC-20, **64**=Commodore 64, **+4**=Plus/4, **16**=Commodore 16, **128**=Commodore 128

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editor's notes

In the most recent issue of COMPUTE!, our sister publication, we chided Commodore for apparently sending Amiga systems to competitors while consciously making a decision to withhold them from us. We're pleased to report that in the interim we've discovered several things. Commodore allowed several competitors access to the Amiga, but did not send them systems. And, more importantly, since we brought the situation to their attention, Commodore's new management team and their assistants have been extremely helpful in rectifying our concerns. Harmony has returned to our editorial halls, and you'll find a rather exciting story in this issue on the new Amiga from Commodore.

It seems likely that the Amiga and the new ST from Atari are going to revitalize the personal computer industry.

These machines represent a leap to a higher level of technology. New, synergistic technologies have been brought together to create a significant advance in power. New microprocessors, new storage devices, and new video screens equal far more than the sum of their parts.

When COMPUTE! first started publishing in 1979, it was called "The 6502 Resource Magazine" because the home computers then available—Apple, Atari, Commodore PET, and others—all contained the 6502 microprocessor chip. The 6502 has been abandoned by the new generation of personal computers in favor of the high-speed, feature-laden, bigger 68000 chip. Among other advantages, this chip can manipulate 16 pieces of information at a time. The 6502 could only work with 8 pieces. By doubling the information size, the computer can do things far faster and can directly access far more RAM memory. So, in general, these new computers "think" faster and "remember" better than their predecessors. And that means they can do *everything* better.

Video, for example. Take a look at page 18. One of the important byproducts of more processor power is greater video resolution—more dots of visual information, more colors, more shades. The new computers offer relief from the relatively crude block-graphics and cartoons which have hitherto served as the visual element of personal computers. We can't show you animation in these pages, but that, too, is far superior. Things can now look round instead of ragged, shadows look like shadows instead of black blobs, and moving objects, instead of lurching, can now glide and revolve.

Pages of print, too, are tight and stable on new, high-definition monitors. You can read these screens like a book. Related to this, Atari and other companies are currently preparing to offer entire encyclopedia-sized databases on a single compact disc. This new peripheral will plug into your computer like a disk drive and in seconds will locate any information you need. You can even ask it questions which contain *and* and *or* relationships: baseball and football in movies or books. You'll have a lot of knowledge only seconds away from your screen. The amount of information that can be packed onto a compact disc is staggering: 550 megabytes. It's the equivalent of nearly 3,400 Commodore floppy disks, 96 million words, 427,000 typed pages, or nearly 2,000 ordinary books.

As for software, the new power will expand the potential of every category, from word processing to games. You'll be able to compose large documents without linking files, check spelling quickly with a huge dictionary, see the text exactly as it will be printed, and maybe even access online grammar checking and thesauri. You'll have the power of the Macintosh graphics programs, but in color. It will be easy to draw titles, graphs, or visual aids and transfer them to other media such as VCRs and slides. Complex music and voice synthesis and sampling will be available.

The larger memories and faster speeds of these new computers will allow many more variables in games. Adventures will have more scenes, more intelligent input analysis, more characters, and a more complex story line. Action games will look real (a videotape can run in the background of computer images) and the sound effects will be astonishing. Games will be able to approach simulation-quality realism and be far richer and more sophisticated than is currently possible.

When you've seen what these new machines can do, you're likely to agree that pessimists reporting the demise of personal computing this past year have been seriously off the mark. No one can tell what the next ten years will bring, but if these computers are any indication, it will be a decade of marvels. Consumer computing is still an industry in its infancy, but no other technology is more likely to enrich our lives in so many unpredictable ways.

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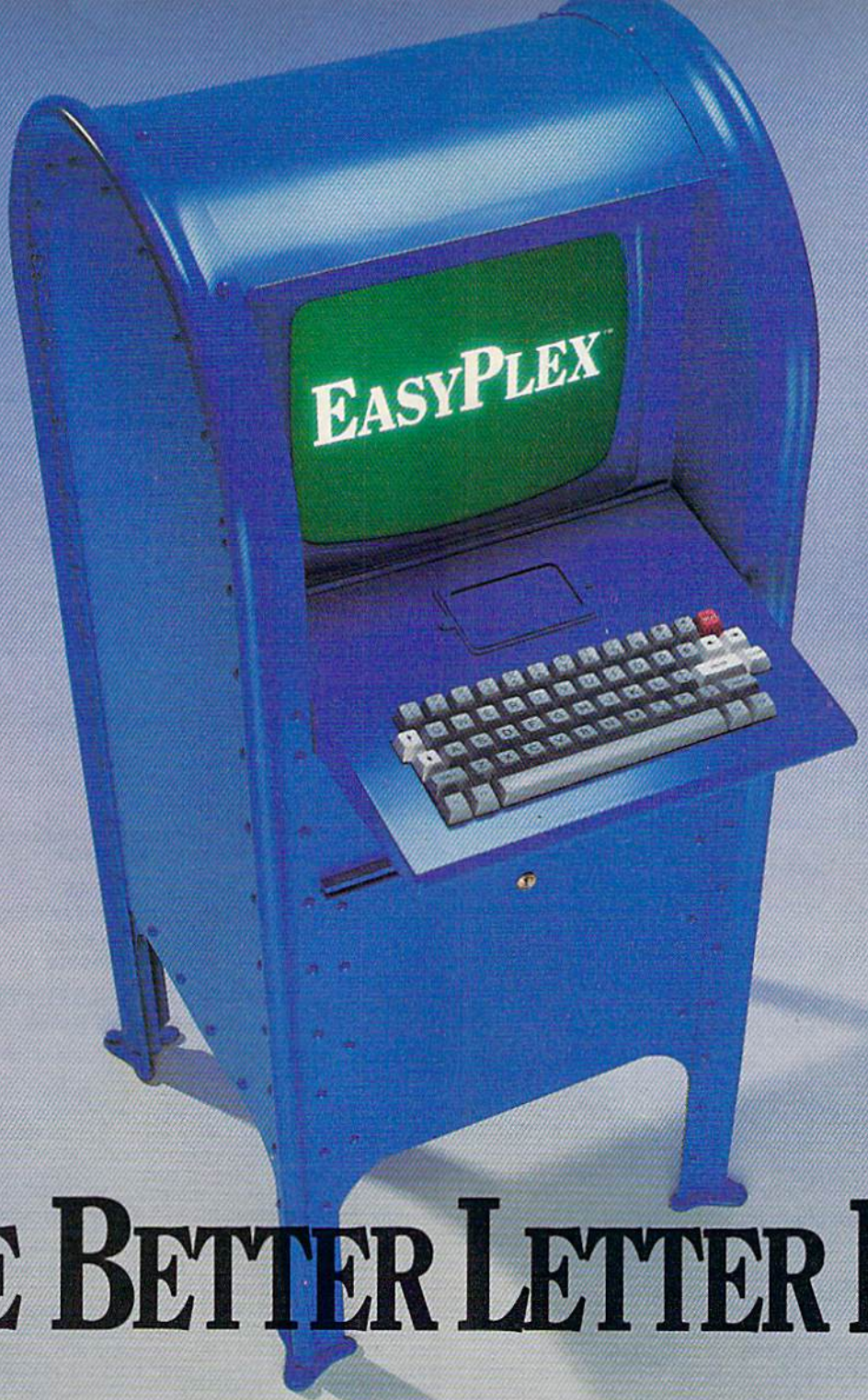

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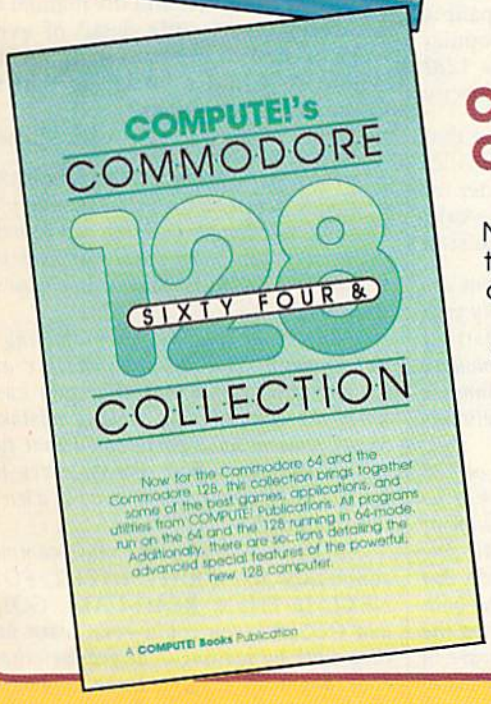

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Speaking The Same Language

What's an ASCII code? And what's the ASCII code for the MPS-801 printer? I recently purchased a software package that needs to know a printer's code to work.

K. Fuse

ASCII is short for "American Standard Code for Information Interchange," a kind of common language used to send information from a computer to printers, disk drives, or other computers.

It's like Morse code for computers. Each character is assigned a unique series of on and off bits—ones and zeros—so data can be traded back and forth. The ones and zeros are commonly expressed as their decimal equivalents (for example, 01000001 is ASCII 65, which is the letter A).

The BASIC functions ASC and CHR$ allow you to find out which characters are assigned to which ASCII numbers. Try typing **PRINT ASC("A")** *or* **PRINT CHR$(65)**.

Commodore owners need to know about two different types of ASCII codes. Standard or "true" ASCII uses seven bits to create 128 numbers: 96 printable characters and 32 control codes. An eighth bit is sometimes used as a parity bit, a checksum. Commodore ASCII is not the same as true ASCII, and has 256 numbers (eight bits), some of which are unused or duplicated.

If you send Commodore ASCII codes to a non-Commodore printer that expects standard ASCII, the upper and lowercase letters will be switched (lIKE tHIS, fOR eXAMPLE). You can fix this through software or hardware. The software solution is to have the program make the conversion to standard ASCII before sending the characters to the printer or other peripheral. The hardware solution is an interface that intercepts the Commodore characters and changes them to standard ASCII before they reach their destination.

The program you're using apparently gives you the option of sending either kind of ASCII (Commodore ASCII or a software translation to true ASCII, if you need it). The MPS-801 you own is a Commodore printer and uses Commodore ASCII. So, when your program asks what type of ASCII, you should answer Commodore ASCII rather than standard ASCII.

Commodore 128 Compatibility

I am considering upgrading from my 64 to a 128 and I have a few questions about compatibility. Is the 128 compatible with the 1541 disk drive? Is it compatible with the 1650 Automodem? What about the Connection interface and a BMC printer? Is it compatible with GAZETTE programs? Will popular commercial software work on the 128?

Kerry Konecny

I've read about new 128 software that would not fit on a 64 due to its smaller memory. If you buy a 64K expander for the 64, would the 128 programs work?

Scott Colston

The answers to the first five questions are yes, yes, we don't know (but probably yes), yes, and yes. There are three distinct computers inside the 128: a Commodore 64 (40 columns), a 128 (40 or 80 columns), and a CP/M 3.0 computer (80 columns only).

The 1541 works with both 64 or 128 mode, but you'll need the newer disk drive to run CP/M programs. A television or composite monitor will work in 40 columns for either 64 mode or 128 mode. But 128 mode (80 columns) and CP/M both require an RGB monitor. We've tested the 1650 Automodem with Vidtex software in 64 mode and it seems to work fine (as of this writing, there is no telecommunications software for 128 mode).

In 64 mode, the computer runs all 64 software we've tried. In other words, it's not just 64-compatible, it is a 64.

So if you already own a 64 and have invested in software and hardware for it, you can buy a 128 and continue to use your peripherals and programs.

The answer to the final question—adding 64K to a 64 to make a 128—is no. A 128 in 128 mode is more than a Commodore 64 with extra memory. There are many new keys, including ESC, ALT, HELP, 40/80 (columns), and a numeric keypad. And there's an improved BASIC.

A 128 in 64 mode is a 64, but it would be difficult if not impossible to upgrade a 64 to act like a 128 in 128 mode.

Learning BASIC

The manual that came with my computer has a list of BASIC words in the appendix, but it doesn't go through them one by one and explain how to use them. The definitions are very short and don't include useful examples. For example, the DATA statement "...is followed by a list of items to be used by READ statements."

My grandmother has a Texas Instruments computer and the manual for it explains every little detail of every word needed to program in TI BASIC. Where do I find a book like that for Commodore computers?

Bo Michelli

There are many books that explain BASIC in simple terms, with a lot of examples. The ones written for children can be helpful even if you're an adult (for example, COMPUTE!'s Kids and the Commodore 64*).*

But reading about programming is not enough. You should practice and experiment; remember that you can't harm the computer by making mistakes. Many readers have commented that typing in programs from the GAZETTE *has helped them learn more about programming.*

Start by learning the most common commands like PRINT, INPUT, FOR-NEXT, IF-THEN, READ-DATA, GOTO, and GOSUB. (You could even learn how they work by reading your grandmother's book about TI BASIC; these commands work much the same in different versions of BASIC.) You don't have to learn all of the commands at once, some of them you may never need in the programs you write.

It also helps to be able to ask questions about problems you encounter. If you can't find a friend or neighbor who knows how to program, contact a local users group; many offer classes for

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beginners. Or call local schools and ask if they have night or weekend classes in programming.

Putting Information Into Lists

I've had my computer for two years and can write programs for it, but I just can't seem to understand the DIM statement.

Chris Davis

DIM is short for DIMension, and it sets up a list of variables called an array. Let's say you're a teacher meeting new students for the first time. You know ahead of time that there will be 15 students, so you write the numbers 1–15 on separate lines down the lefthand side of a sheet of paper. As each student comes into the room, you ask for his or her name and write it on one of the numbered lines. Numbering the list before putting anything into it is the equivalent of the DIM statement—you're preparing a list that will be a certain size.

You can do the same thing (create a numbered list of names) on a computer with a string array:

```
10 DIM N$(15)
20 FOR J=1 TO 15: PRINT "STUDENT";
   J
30 INPUT N$(J): NEXT
40 PRINT "STUDENT FIVE IS"; N$(5)
```

The DIM statement in line 10 tells the computer to set aside some memory for a list of strings (for a list of numbers, you would leave off the dollar sign). It's like writing numbers down the side of a piece of paper, except that the computer starts counting at zero, so the list actually has room for 16 names rather than 15. Lines 20–30 ask for 15 names, ignoring name number zero.

The example above is a one-dimensional array, meaning there's only one number (dimension) in parentheses. You can create complex multidimensional arrays by using more numbers separated by commas. For example, DIM B$(15,3) would create a 64-element two-dimensional array 16 strings wide (0–15) by 4 strings deep (numbered 0–3). This array could keep track of 16 students, with separate variables for first, middle, and last name (plus one more entry like favorite food or shoe size). Three, four, five, or more dimensions are also possible, although you don't see them used very often.

Once an array is dimensioned, it cannot be redimensioned—you'll get a REDIM'D ARRAY error. You have to stick with the dimensions you assign at the beginning of the program.

Arrays are useful because, for one thing, they allow you to alphabetize and sort lists of words and numbers. They're also quite common in database and spreadsheet applications.

The Koala Pad

As an owner of the KoalaPad, I would like to be able to use it for other things, such as menu selection and game design. I've tried PEEKing to no avail. Any information you could give me would be helpful.

David Bradley

The KoalaPad is read like paddles. Each paddle can have a value from 0 to 255, depending on which direction it is turned. The KoalaPad gives back two numbers in the range 0–255, corresponding to the pen's horizontal and vertical position. On the 64, peeking location 54297 gives the horizontal coordinate, and 54298 gives the vertical position. Reading the KoalaPad is more accurate in machine language, because these two locations are also used by the keyboard scan routine.

Use these statements in your program to determine which button is pressed:

IF (PEEK(56321)AND8)=0 THEN the right button is pressed
IF (PEEK(56321)AND4)=0 THEN the left button is pressed

The following BASIC program uses the KoalaPad to move a sprite around the screen. Pressing the right button will change the color of the sprite, while pressing the left will toggle the sprite's size.

```
10 PRINT"{CLR}":FORA=832TO896:
   POKEA,255:NEXT:POKE2040,13:
   POKE53269,1
20 POKE53248,PEEK(54297):POKE5
   3249,PEEK(54298)
30 IF(PEEK(56321)AND8)=0THENPO
   KE53287,(PEEK(53287)+1)*-(P
   EEK(53287)<255)
40 IF(PEEK(56321)AND4)=0THENPO
   KE53277,-(PEEK(53277)=0)
50 GOTO 20
```

The 64 Lockup Bug

I have encountered an extremely annoying and aggravating problem with my 64. When I'm typing a line at the bottom of the screen and go over the 80-character limit (two screen lines), I start to delete the excess characters. As the cursor hits the 40th column on the previous line, the words LOAD and READY appear. And BASIC crashes. I have to turn the computer off, losing the program in memory. Is there any solution?

David Schuster

Nearly all 64s suffer from this bug. Readers who haven't seen it before can make it happen quite easily. Turn on your 64, move the cursor down to the last line, and hold down the space bar until the cursor passes the right edge of the screen twice. Hold down the DELete key until the cursor goes back to the far right column. You'll see the word LOAD, and if there's a program in memory, it will run. But when the program ends, your computer will lock up.

The bug does not affect the portable 64 (SX-64), and newer models of the 64 have been revised to eliminate the problem.

The lockup will occur only when the cursor color is red, cyan, blue, yellow, light red, dark gray, light blue, or light gray. Safe colors are black, white, purple, green, orange, brown, medium gray, and light green. To avoid the problem altogether, change the cursor color to a safe color before you start programming.

Also, you can defeat the lockup if you own a Datassette. After the computer freezes, simultaneously press the left SHIFT key and 3, or X and 5, or V and 7, and so on (every other key from left to right). The screen will display PRESS PLAY ON TAPE. Press PLAY on the Datassette and then RUN/STOP. Disk drive owners can totally avoid the bug if the first line in the program in memory is OPEN15,8,15: INPUT#15,A$.

Disk Limits

I am learning how to use relative files on the 64. I've read that more than one disk file can be open simultaneously, but whenever I try to open a second relative file, I get an error 70, NO CHANNEL. I don't understand where the error comes from.

Don Arnett

Relative files are fast and flexible, but you cannot have more than one open at any time. It's possible to open a sequential file while a relative file is open, however, and you may be able to modify your program accordingly. For more about programming relative files, see "Relative Files: Speed and Economy" in the June 1985 GAZETTE.

Don't Jump Out Of Loops

I've been programming the 64 for about nine months, and recently I got an OUT OF MEMORY error during a program. PRINT FRE(0) showed that there was plenty of memory left.

I've read that this error can be caused by a full stack, which can come from jumping out of FOR-NEXT loops (which I did excessively). So I POKEd zeros into the stack area, but that didn't work. How can I get my memory back?

William J. Moses

POKEing zeros to the stack doesn't clear it, it just changes all the information on the (still) full stack to zeros. It's possible to write a machine language program that clears leftover FOR-NEXT information from the stack, but jumping out of FOR-NEXT loops is only asking for trouble. The best solution is to avoid doing so.

BASIC programs put important information about subroutines and FOR-NEXT loops on the stack. Loops and subroutines may contain one line or a thousand, so the program has to keep the information safe until it eventually reaches a NEXT or a RETURN. Jumping

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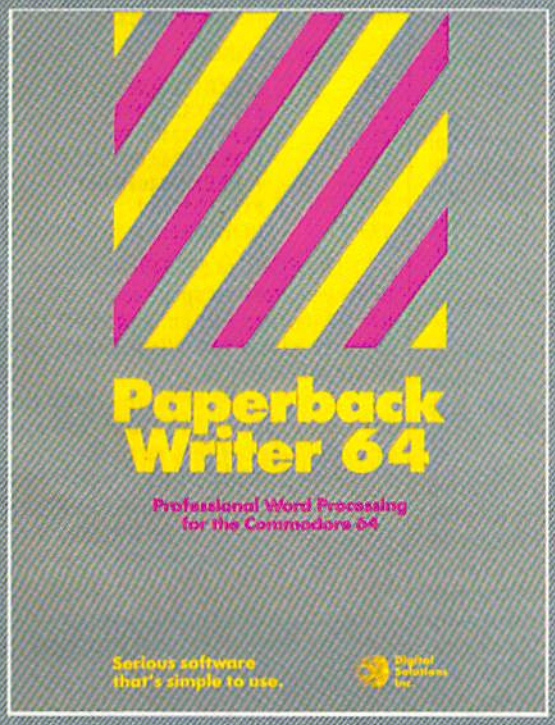

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out of a loop or subroutine leaves "garbage" on the stack, leading to the error you described.

If the logic of your program requires jumping out of a loop, don't use FOR-NEXT. Instead of **FOR M=1 TO 20**, *start the loop with* **M=1**. *Replace the* **NEXT** *with* **M=M+1: IF M<21 THEN GOTO XXX** *(XXX should be the line that follows M=1). The FOR-NEXT loop has been replaced by IF-GOTO, which will not fill up the stack or lead to an error.*

Triple-VIC/64

Your April issue contained a machine language program that divides a 64 into three 12K areas. I have a VIC with 16K expansion and would like to know if it's possible to write a version of Triple-64 for the VIC.

Neil J. Schneider

Several VIC owners have requested a version of Triple-64. Reader Richard Goodman sent us a Triple-VIC program for a VIC with 32K expansion. We modified it somewhat to make it work on either the 64 or a VIC with any memory expansion. Also, if you've moved the start or end of BASIC to protect a utility program like "MetaBASIC," or to keep BASIC away from hi-res screens or custom characters, the protected area is still safe.

Whatever memory is free is divided into three roughly equal sections of memory. Section three may be slightly larger than one or two. To move back and forth, SYS679 and press 1, 2, or 3.

```
10 FORA=679TO733:READB:POKEA,B
   :NEXT
20 N=PEEK(44):M=INT((PEEK(56)-
   N)/3)
30 FORA=0TO2:POKE741+A,N+A*M:P
   OKE738+A,N+A*M:POKE743+A,N+
   A*M:J=256*PEEK(741+A)
40 FORK=0TO2:POKEJ+K,0:NEXT:PO
   KE735+A,3:NEXT:POKE2,1:POKE
   746,PEEK(56):NEW
50 DATA 166,2,165,45,157,222
60 DATA 2,165,46,157,225,2
70 DATA 32,228,255,41,15,240
80 DATA 249,201,4,176,245,170
90 DATA 134,2,189,222,2,133
100 DATA 45,133,47,133,49,189
110 DATA 225,2,133,46,133,48
120 DATA 133,50,189,228,2,133
130 DATA 44,189,231,2,133,56,9
    6
```

Cassette Woes

I own a 64 and a Datassette. Sometimes it does not record right, and the program doesn't completely load. I believe I need to buy a new Datassette, but would like to read through the problem tape and find out what's going wrong. Any suggestions?

Tom Appell

You probably don't need to buy a new Datassette—you may be able to fix it yourself. Here are some suggestions for troubleshooting cassette problems:

1. Sometimes the problem is simple magnetic interference. Move your Datassette away from the television or monitor. And watch where you keep your cassettes; don't store them next to the TV.

2. If certain tapes are unloadable, try fast forwarding and then rewinding them once or twice. This removes slack from the tape, which can make it slip and slide when loading or saving.

3. Use ferric oxide rather than the more expensive chromium tape. Ferric tape records programs better.

4. The read/write head can become magnetized and/or dirty after heavy use. Demagnetizers, sometimes called "degaussers," and head cleaning kits are available at audio and electronics stores, and will solve this problem.

5. Tape drives can become misaligned. If you're having trouble loading commercial tapes, try adjusting the screw next to the tape head. The newer Datassettes (the ones where RECORD is next to PLAY) have a small hole through which you can insert a screwdriver to align the head.

Spaces Look Like Shifted Spaces

I am writing a graphics program for the 64. I want to plot an initial block but nothing appears with this line: **380 POKE 1064,96: POKE 55336,2**. Changing the background color doesn't affect anything. I used character 96 because the User's Guide says it's the reverse for character 32. Can you help?

David Easterday

When you POKE characters to the screen of a Commodore computer, you must use screen codes, which are listed in an appendix in the User's Guide. They're not necessarily the same as ASCII codes. In addition, you have to POKE to color memory. Each letter has a foreground color (the character you see) and a background color. The foreground is taken from color memory, while the background is the same as the screen color.

If you forget to POKE color memory, you may get a character that's the same color as the screen, like writing with blue ink on blue paper, or white ink on white paper.

You have the right idea—location 1064 in screen memory matches up with 55336 in color memory. But character 96 is not the reverse of character 32. Character 32 is a space. Character 96 is a shifted space, which looks exactly like a regular space (no foreground, because it's a space, and spaces are all background). At the end of the screen code table is a note that says "Codes from 128 to 255 are reversed images of codes 0–127," so to get a reversed space, POKE a 160 (space 32 + reverse 128) to 1064. A 224 (SHIFT-space 96 + reverse 128) could also be used.

Moving Across The Sprite Seam

I'm not able to move two sprites, in tandem, through the 255 blockade. I would like them to enter the left side of the screen and exit to the right.

Sid Seiferlein

There are two memory locations that determine the X and Y position of each of the eight sprites:

53248	Sprite 0	X-position
53249	Sprite 0	Y-position
53250	Sprite 1	X-position
53251	Sprite 1	Y-position
and so on...		
53262	Sprite 7	X-position
53263	Sprite 7	Y-position

But 16 registers, two for each sprite, are not enough to cover all positions on the screen. Each memory location can contain a number from 0 to 255. This is enough for the possible Y (vertical) positions, but there are more than 256 X (horizontal) locations. One more register is needed, for the high bit of the X-position:

Location 53264 (8 bits)

	x	x	x	x	x	x	x	x
Sprite/Bit #	7	6	5	4	3	2	1	0
Value	128	64	32	16	8	4	2	1

To move sprites across to the right of the seam (where **SP** *is the sprite number between zero and seven),* **POKE 53264, PEEK(53264) OR (2↑SP)**. *To go back to the left side,* **POKE 53264, PEEK(53264) AND (255−2↑SP)**.

At the same time that you set the bit in 53264, you'll have to lower the number in the X-position. For sprite zero, for example, here are the POKEs:

X-position	POKEs
253	POKE53248,253
254	POKE53248,254
255	POKE53248,255
256	POKE53248,0:POKE53264, PEEK(53264)OR1
257	POKE53248,1
258	POKE53248,2

The POKE to 53264 is necessary only when you cross the sprite seam. It's best to use OR to turn bits on, and AND to turn them off, so you don't disturb the positions of the other sprites.

To move two or more sprites across the seam, OR or AND with the appropriate number. If they're sprites zero and one, **POKE 53264, PEEK(53624) OR 3** *to move right,* **POKE 53264, PEEK(53264) AND (255−3)** *to move left. You'll have to POKE the registers for the X-position as well.*

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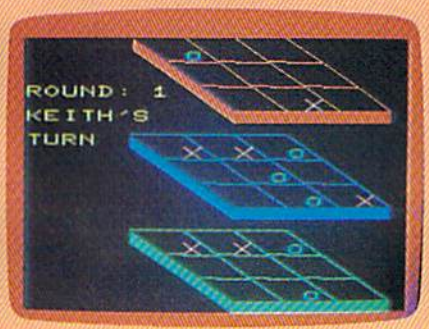

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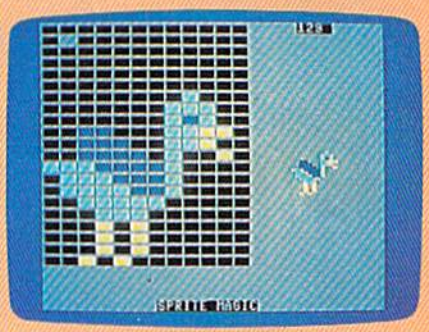

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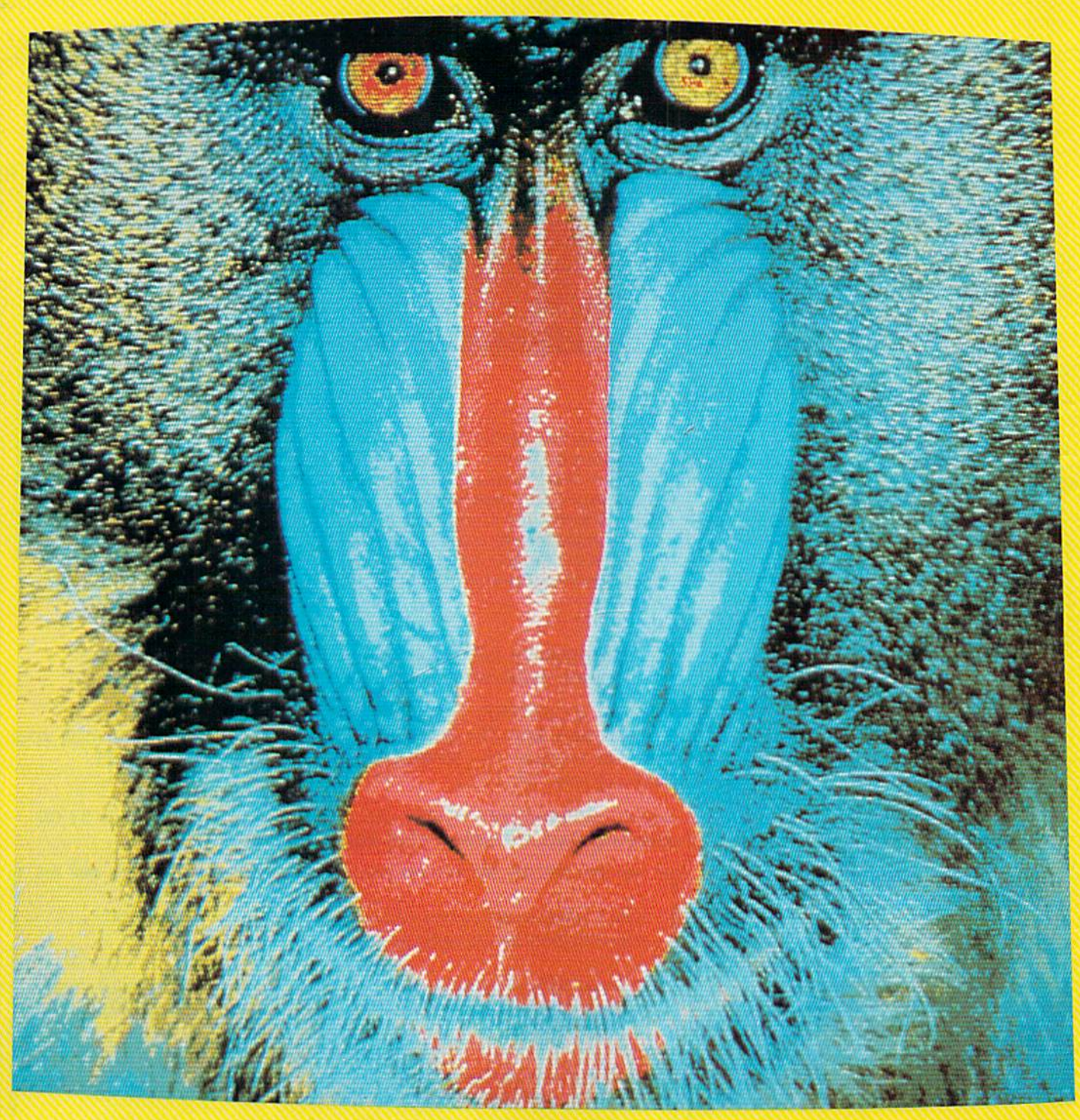

A stunning example of high-resolution graphics on the Amiga. The image of this mandrill was digitized and displayed on the computer's 640×400 graphics screen. With 4096 shades of color available, the Amiga can accurately reproduce almost any image.

Inside Commodore's New Amiga

A Hands-On Report

Charles Brannon, Program Editor

The long wait is over. The Amiga computer from Commodore has arrived, combining the multitasking power of a minicomputer, the color graphics of a computer design station, the stereo sound of a sophisticated synthesizer, and much more. Here's an overview of this astounding new personal computer.

The VIC and 64 both represent considerable computing power, bringing the true power of a computer within almost any consumer's reach. These computers, now referred to as low-end machines, had their origin in the first affordable $1000 computers: the venerable PET, the Apple, and the Atari 400/800. The 64 was instrumental in bringing the price of all computers down, while giving us the graphics formerly possible only on large-scale arcade machines. We're still seeing the evolution of the low-end home computer with the Plus/4, the 128, the Atari 130XE, and even the Japanese MSX computers. In the meantime, there's a segregated market of IBM and IBM compatibles—high-end machines which carry high-end price tags.

We're now seeing the cycle repeat itself: new, powerful computers bringing Promethean computing power from the world of minicomputers and mainframes. These truly unique machines, the Apple Macintosh, the Atari ST, and the Amiga, can finally satisfy the needs of a broad range of users, from home, educational, and recreational computing to small business and corporate data processing. The price of these machines is somewhat more than many people are used to paying for a home computer, but these are complete machines. You don't need to add memory or disk drives—they're built in.

How can the Amiga possibly fulfill these broad expectations? Picture your ideal computer. Taking the 64 as the base, it would be nice to extend the memory, ideally without limit. The 64 graphics are great, but wouldn't 80 columns, more resolution, and much more variety of color be even better? The ideal computer should be able to display near-photographic quality pictures.

The 64's SID chip was the first sound device to rise above mere bleeps and tones, but our ideal computer should have the quality of a musician's stand-alone synthesizer.

Although much of today's software is useful and friendly, the ideal computer would truly fulfill the promise of user-friendliness. You should be able to learn and use software without thick manuals or extended training sessions. You should have the convenience and features of professional software while retaining straightforward ease of use.

Given a library of powerful software, wouldn't it be even better if all your software could work together, or—outrageous as it sounds—for many programs to run simultaneously? Indeed, our ideal computer should be more than a personal microcomputer. It should offer to a single user the flavor and features of a personal mainframe.

The computer we've described is the Amiga. The smallest Amiga comes complete with 256K (four times the memory of the 64) and built-in 3.5 inch microfloppy that stores 880K (about five Commodore 1541 disks) for $1100–$1500. The $2000 (approximately) Amiga offers 512K and includes a super-high-resolution monitor. If 512K of memory isn't enough, the Amiga can be expanded up to 8 megabytes (that's 8 million bytes) of RAM. Indeed, you can already buy a two-megabyte memory expansion board that includes a battery-powered clock/calendar and an additional communications port. You

The Amiga computer from Commodore, with built-in 3½-inch disk drive, detached keyboard, two-button mouse, and optional RGB monitor, and external drive.

can attach up to four external 880K disk drives, or a 20-megabyte hard disk drive. (The 2M RAM board and 20M hard drive are available from Tecmar, not Amiga.)

The Amiga's graphics are simply outstanding, far surpassing the graphics available on any computer sold for less than $10,000. While the 64 has a 160 x 200 multicolor mode, the Amiga can display 320 dots across and 200 down, and can display one of 32 colors in any dot position. You can fill these 32 color registers with any of 4096 colors: 16 luminance levels each of red, green, and blue, combined as you wish, as if you were an artist mixing paints on a palette. This many colors permit incredibly subtle shading and color selection. Almost any color you can think of can be displayed realistically. The pictures (actual screen photos) accompanying this article show only some of the graphics capabilities.

The Amiga can also display a 640 x 200 display, but only 16 colors can be displayed simultaneously. Each of these 16 colors can still be picked from a total of 4096 color combinations. There's a 320 x 400 mode (twice the vertical resolution) and a 640 x 400 mode. These modes are fully supported by the operating system. To comprehend this figure, remember that the 64's screen would fit in one quadrant of the 640 x 400 mode, and this Amiga mode also has 16 times the color resolution of the 64. The 640 x 400 mode has pixels so fine that they are not easily seen, no matter how close you get to the screen. Pictures drawn in this mode are hard to distinguish from actual paintings, cartoons, or even photographs.

These are impressive graphics, but a still image is lifeless compared to one filled with ricocheting objects, growing forms, flashing colors, and all manner of motion. The Amiga hardware includes special microprocessors that run *simultaneously* with the main 68000 CPU (the 68000 has been referred to as a "minicomputer on a chip"). One chip called the *copper* (for coprocessor) runs in tandem with the video beam, tracking and capable of changing graphics on the fly. The more powerful *blitter* chip can draw lines on its own, fill areas, and move large sections of the screen around. It can move blocks of memory of any size and shape to any other place in memory. It does all these things without significantly slowing the 68000. The blitter is responsible for much of the Amiga's speed. Along with the copper, it takes care of graphics (including animation), freeing the 68000 to run as a pure turbocharged computing engine.

The blitter can simulate sprites with all the speed and capability of 64 sprites, including collision and proximity (nearness) detection and multiple display priority—all this—with 32 colors. The icing on the cake is the hardware sprite system which can be used in addition to blitter objects. The Amiga supports eight primary sprites. Each sprite is 16 dots wide (compared to the 64's 12-pixel multicolor sprites) and up to the full screen's height. Each sprite can display four of the 4096 colors simultaneously, and can be quickly and easily moved anywhere on the screen. Sprites can be attached (overlayed) to allow 16 color combinations. The sprites can be reused automatically in different areas of the screen permitting many more than eight simultaneous objects. And the Amiga operating system will even substitute blitter objects when it runs out of sprites. Sprites can be made to move automatically.

There's more. Any screen can be finely scrolled both horizontally and vertically. A special mode permits you to create two separate screens, as if each screen was in a dimension of its own. The screens are overlayed, and can include transparent portions so that you can view through one screen to see another. It's as if you had one huge sprite to display on top of the primary screen. You do lose some color capabilities with dual screens. But if it's color you want, a *hold and modify* mode permits you to display any of the 4096 colors in every pixel position in the 320 x 200 mode.

An optional video board (about $200) allows video mixing and frame grabbing. Video can be mixed from any video source, such as a color video camera, laser disc, or a VCR. The Amiga's text and graphics can be superimposed on the external video, then re-recorded. The frame grabber freezes and digitizes the video image in color, permitting you to convert real-world video into computer graphics that you can edit with a drawing program.

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Even low-resolution graphics on the Amiga are impressive. Island Graphics of Sausalito, California, which is designing graphics software for the Amiga, copied this ballerina from a famous painting by Edgar Degas. This graphics mode offers the same resolution as a Commodore 64—320 × 200 pixels—but the wider variety of colors lets the Amiga more closely duplicate the feel of the original.

The Amiga doesn't shortchange the audiophile. Its sound system rivals the quality of commercial music synthesizers. The 64's SID chip has been called a synthesizer, but few would mistake its sound for the real thing. The Amiga does sound like actual instruments. We've heard the Amiga simulate a piano, a flute, a pipe organ, an electric guitar, snare drums, cymbals, tom-toms, and more. Instead of piano-like tones or white-noise drums, what you hear sounds much like a recording of the real thing. In fact, the Amiga sound system is capable of playing back digitized sound with uncanny accuracy, approaching the sound quality of the new compact disc audio technology.

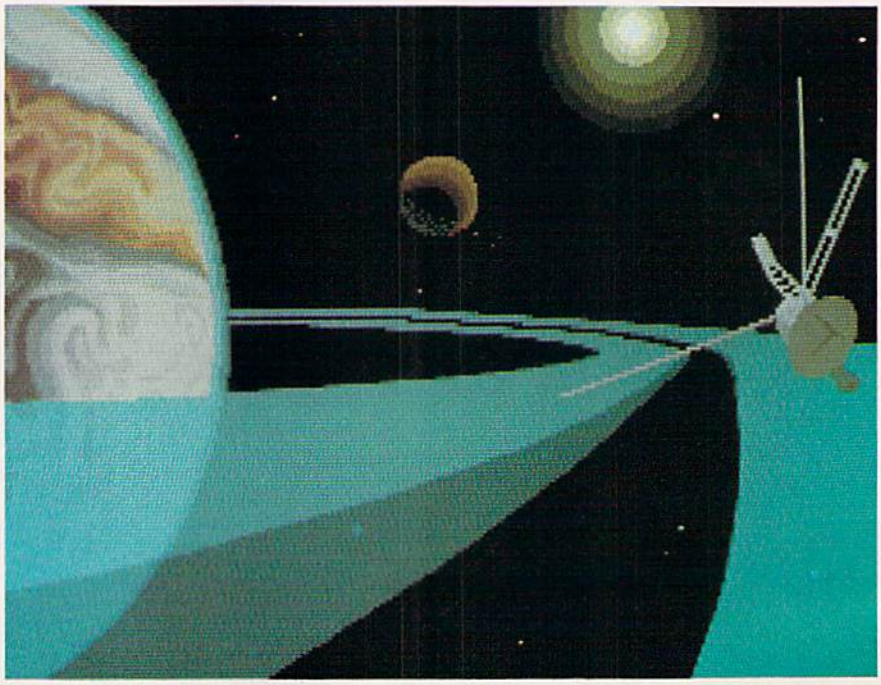
The sound system has four voices—two of which are sent to each sound channel, permitting stereo depth as well as stereo imaging. Each voice plays a digital waveform in memory that is defined either by your program or by a previously recorded actual sound. Almost any sound can be approximated closely. In fact, each voice can play chords of multiple instrument waveforms, permitting more than four levels of sound layering. The volume level can be controlled automatically, permitting realistic high-resolution sound envelopes, similar to the 64's attack/sustain/decay/release cycle. The sound system has direct access to system memory, requiring very little processor time to keep the sound going or to change notes or instruments, again freeing the 68000 for pure computing tasks.

The Amiga comes with a built-in voice synthesizer capable of simulating male or female voices. The voice is somewhat metallic and seems to talk with a strange accent, but is still quite understandable.

Most importantly, because the voice synthesis is built in, software developers are sure to exploit it. The educational value of speech is undeniable. You may or may not prefer your computer to talk to you while you're word processing, but it could be an option. Voice synthesis is most useful when text on the screen may be overlooked. This should open up completely new concepts for software developers.

The operating system supports extremely sophisticated programming. You need never resort to PEEKs and POKEs, *not even from machine language*. There's a routine to access every feature of the hardware, from automatic line drawing routines to pulling in huge amounts of data from the disk. Even the disk drive can operate simultaneously with direct access to memory, while the 68000 is busy with something else. The core operating system, the equivalent of the 64's Kernal, is more than a bag of tricks. It provides a firm foundation for the higher level operating system.

The next level up in complexity is *AmigaDOS*. It is comparable in features to IBM's DOS, but is closer to Unix in design. AmigaDOS not only provides for the command line interpreter where you can execute commands to rename, delete, list, and create files, but provides these functions to other applications and operating system routines. AmigaDOS also includes a powerful batch language which lets you create your own custom disk routines.



This space scene is another example of what can be done with the Amiga and Pro-Paint. *Island Graphics also has prepared a slightly less powerful version of the program called* GraphiCraft.

Unlike most DOSs for other computers (except Concurrent CP/M), AmigaDOS permits its own commands to run simultaneously. You can list a directory in one window while sorting a file in another. Programs can be run under AmigaDOS in the background. Each program has its own "virtual" access to all machine features, but does not interfere with any other programs running simultaneously. (No single computer can actually do more than one thing at once, but

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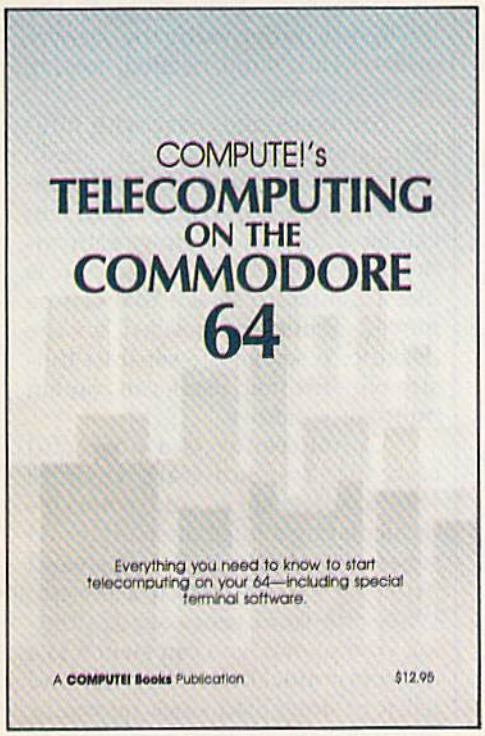

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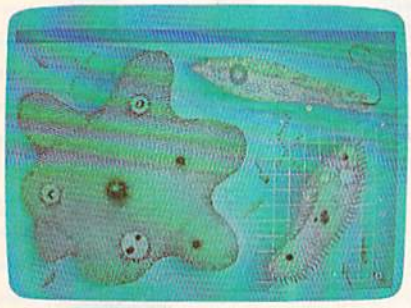
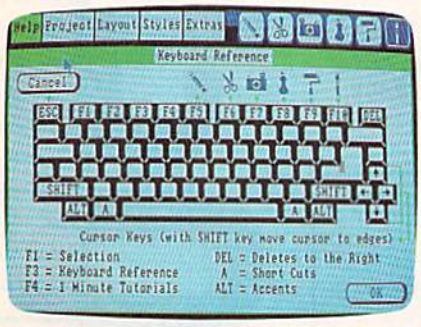
A picture within a picture. This image and all of the graphics screens accompanying this article except the mandrill were created in the low-resolution mode by Island Graphics. The pictures were drawn with a mouse controller and Island Graphics' ProPaint *software, which will be marketed under the Amiga brand name.*



This screen shows some of the educational possibilities of the Amiga. These microbes are reproduced nearly as accurately as a textbook illustration.



A help screen from TextCraft, *an icon-based word processor developed by Arktronics. This screen shows a keyboard map; other screens provide animated tutorials on everything from creating a file to printing out a finished document.*

can seem to, by quickly switching between tasks, giving each program a small slice of processor time. Hence, too many concurrent programs can slow things down.)

Programs can also be set up to reside concurrently without executing. You can even run AmigaDOS simultaneously with itself, permitting many DOS windows and DOS programs to be running at once. This realizes the true power of minicomputers and mainframes. With terminals and the proper software, you can even attach multiple users to the same machine, a capability formerly available only on the most expensive microcomputers.

You don't have to be a keyboard wizard to use the Amiga. AmigaDOS will probably be the preferred environment for many programmers and expert users, but most beginners and occasional users of the computer will want some buffering between them and the intimidating power and sophistication of this DOS.

Amiga's "Intuition" operating system permits the use of Macintosh-like features such as multiple windows, pull-down menus, dialog boxes, and mouse control. (The mouse is a small box that relays direction and speed as you move it on a flat surface.) This user interface concept originated with Alan Kay and the Xerox Star. It relies extensively on the use of pictures (icons) to symbolically represent commands and files as objects. The work environment is represented by a graphic desktop, called the *WorkBench*. Computer operations mimic familiar real-world tasks. Instead of typing OPEN 15,8,15, "S0:FILENAME":CLOSE 15, you just point to the file with the mouse, hold down the mouse button, and drag the file into a picture of a trashcan. Drag a file into the window of another disk, and you've copied it. Instead of trying to remember the name of a command, just point to the top of the screen and then point the command you want from a list of commands (a menu) that magically drops down from the top.

If you've ever used Commodore's *Magic Desk*, you've seen an extremely simplified, but similar, concept. And if you've used a Macintosh, you'll find the same straightforward and intuitive style, but with true multitasking. Unlike the Macintosh, most programs fully support keyboard control. In fact, Amiga claims that you can unplug the mouse, pitch it across the room, and still take *full* advantage of the machine. The detached keyboard includes ten special function keys, a cursor pad, and a numeric keypad. The keyboard has a very light touch and good spacing, layout, and tactile feedback, with a nonglare textured surface. You can slide the keyboard underneath the system unit when it's not needed, freeing up desk space.

Multitasking is easy with Intuition and Workbench, the "desktop" that's similar to the Macintosh finder. Each application you run can have its own window or an entire screen of its own. A window is like a miniature screen that can be moved about and resized on the desktop. A screen is a separate full-size window that, itself, can contain multiple windows.

Concurrency is a powerful concept. You can start working with a spreadsheet, and while it's recalculating a huge interconnected series of formulas, switch to a word processor to jot down a memo. While the word processor is printing your memo, you can switch to a telecommunications program and tell it to download stock quotes or research data, or send some files to the office computer. While the computer is juggling these three tasks, you can go to another word processing window to write some more, or access your database for a mailing label or bibliography. While writing you may need to switch to a drawing program to prepare a figure to insert in your text. You may need to refer to your outline stored in the outline processor. It's easy to copy data between these programs by using a common area of memory called the *clipboard*. As long as you've got the computer doing all your work for you, you might as well play an adventure game until it's finished.

Programmers will love the Amiga. The operating system supports so many routines that a programmer needs only to concentrate on his or her algorithm, not on looking up which bit controls the priority of playfield versus sprites. Most of the operating system was written in C, a language unique in its high-speed performance, permitting system-level access to the machine while providing high-level language constructs. C can be described as a systems-level Pascal, but with so many

continued on page 28

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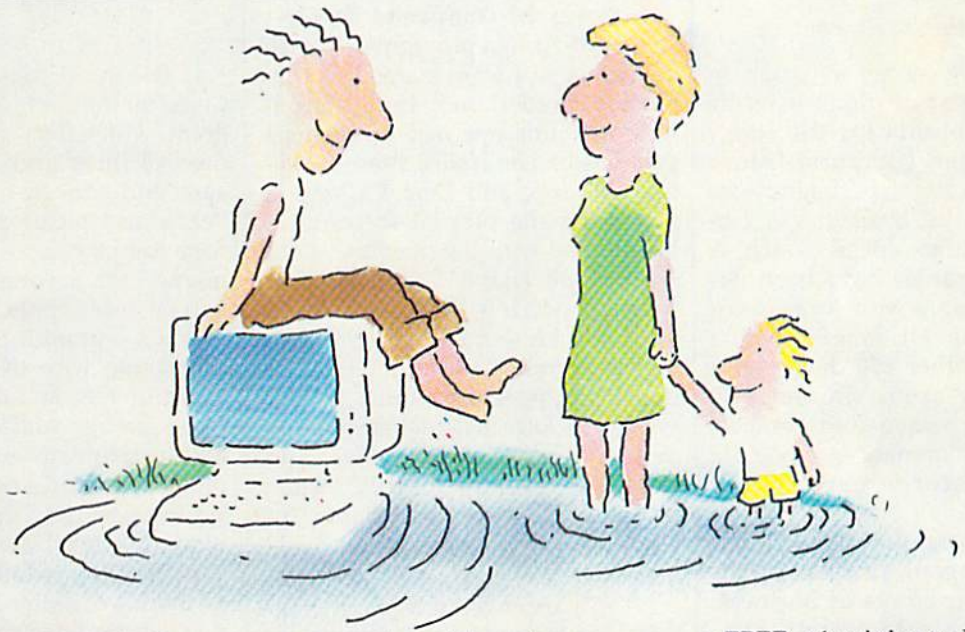

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Amiga Software: Something for Everyone

Selby Bateman, Features Editor

Question: *What sort of software do you create for a computer as powerful and versatile as the Amiga?*

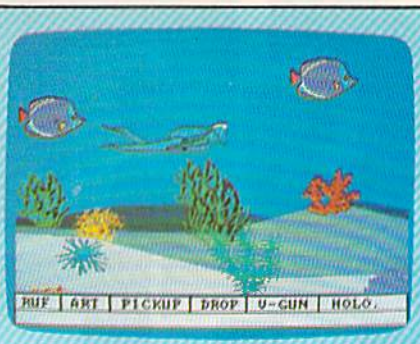
Answer: *Anything you want.*

That's the happy situation in which Commodore finds itself as momentum builds for the long-awaited Amiga computer. More than 20 applications packages were scheduled to be available in late July at the Amiga official launch. A score of companies have been developing software with Amiga prototypes—some for longer than a year. And another 150 developers, representing approximately 80 companies, crowded into Amiga's software development symposium held in Monterey earlier this summer.

Commodore officials point out that these companies include developers and distributors of business, education, entertainment, language, personal productivity, graphics, music, and utility programs—in short, the entire spectrum of computer software.

With an Amiga advertising budget of approximately $25 million for the latter half of 1985, Commodore is pushing its marketing efforts for the machine (and the initial software) toward two targets during the first six months: small business and in-home users. In early 1986, Commodore will begin to go after the corporate and education markets as software titles in both areas become available in quantity. While the first software products are expected to be weighted toward the consumer and small business markets, Commodore is confident that powerful business programs from major manufacturers will begin to appear in early 1986.

A "videogram" created by Electronic Arts' Video Construction Set.



Electronic Arts' Return to Atlantis *is an undersea adventure with three-dimensional graphics and digital sound effects.*

Among the companies developing Amiga programs are such consumer software names as Activision, Brøderbund, and Electronic Arts. Mindscape will offer Amiga versions of *The Halley Project, Keyboard Cadets,* and *Deja Vu,* and is producing the tutorial software to be bundled with the machine. Others include Island Graphics; Arktronics, which has developed *TextCraft,* an entry-level word processor carrying the Amiga brand name; Chang Labs, which is converting its *Rags to Riches* accounting series—*Ledger, Receivables,* and *Payables*—from the IBM-PC format to an Amiga version; Batteries Included, and SubLogic Corp. (*Flight Simulator II* and *Jet*).

"We are making a major commitment to develop programs for the Amiga," says Trip Hawkins, president of Electronic Arts, a leading software company which has been creating programs on the Amiga for the past ten months. "I believe this machine, marketed and supported properly, should have a very significant impact on the personal computer industry. We will probably have more programs for the Amiga than any other software firm."

The first dozen programs announced by EA include several new packages as well as enhancements of software already existing for other computers—all to be introduced within the last six months of 1985. Prices will range between $35 and $50, Hawkins says. Not surprisingly, EA's Amiga titles take full advantage of the stunning graphics and sound capabilities of the new machine.

The new packages are *Video Construction Set,* a graphics program which lets you create your own pictures and incorporate images and sounds from a library of "click art" pictures and sound effects to make sophisticated "videograms" for a variety of consumer and business applications; *Return to Atlantis,* a graphic undersea adventure game with three-dimensional video images and digital sound effects; *Instant Music,* a music creation program which uses real digitized sound and can emulate a synthesizer and a variety of musical instruments; *Deluxe Music Construction Set,* an advanced version of the EA's earlier *Music Construction Set,* for even more sophisticated music creation; and a strategic action game (untitled at press time) which pits players in a flying supertank against invading aliens.

Existing Electronic Arts' packages to be made available for the Amiga initially include *Adventure Construction Set, Archon, Archon II: Adept, Seven Cities of Gold, SkyFox, Financial Cookbook,* and *Julius Erving and Larry Bird Go One-on-One.*

For over a year, Island Graphics of San Francisco has been developing advanced graphics software for the Amiga. Although not well known to the public, Island Graphics has established itself as a leading computer graphics OEM (original equipment manufacturer). The company has designed programs ranging from *Micro Illustrator* and the software for the Atari Touch Tablet to minicomputer

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Island Graphics will initially have several packages for the Amiga, with more to follow. The first two, both of which will carry the Amiga brand name, are *GraphiCraft*, a graphics creation program for the home market, and *ProPaint*, an advanced graphics program for the professional artist. An advanced business graphics package will also be among the first releases for the Amiga from Island Graphics. Entitled *BPGS* (Business Presentation Graphics System), the package will reportedly surpass the combined capabilities of Microsoft *Chart* and Apple's *MacPaint* and *MacDraw* for the Macintosh. *BPGS* is an *object-oriented* system. Any part of the display can be moved and edited as if it were an independent shape. The program uses vectored text—characters and letters drawn with lines—so that the text can be finely scaled without blockiness. The created image can be copied to various printers with no effective limit on resolution. The system is also ideal for use with the Polaroid Palette slide capture system, providing an entré to crack into the $11.8 billion per year business presentation slide market.

continued from page 24

functions available in its standard function package and in the Amiga operating system, it's a uniquely powerful language.

C is available as an alternate language for developers, but there are also two versions of BASIC. No BASIC is built into ROM (nor is one likely to be in the future), but a new version of Microsoft BASIC, reportedly more powerful than either the IBM or Macintosh versions, will be bundled with the machine, along with AmigaDOS and a self-paced tutorial program. Another BASIC called *ABasiC* is available as an option. Both BASICs are extremely fast and support all Amiga functions. PEEK and POKE are functionally obsolete, but they're supported if you want them. Full access to all Amiga Kernal routines is also included.

Other languages available are Logo, LISP, and a 68000 Macro Assembler. Soon to come are Forth, Pascal, and possibly FORTRAN. A programmer will have an enormous range of options, including advanced symbolic debuggers. Any program written properly will also be able to run concurrently, and will be compatible with future versions of the Amiga.

We've mentioned the capability to add the frame grabber, external disk drives, a hard disk drive, and a clock/calendar with 2 megabytes of RAM and RS-232 serial port. Add-on boards attach via the expansion port, which brings out every line of the system, and even supports additional coprocessing capabilities. Amiga engineers will not rule out the possibility of an MS-DOS IBM PC compatibility cartridge. Other ports are a Centronics parallel printer port (which can be reprogrammed to act as a parallel input port); a high-speed RS-232 serial port for 1200- or 2400-baud modems or serial printers; and two control ports that support the mouse, two joysticks, two analog joysticks, four paddle controllers, or a high-resolution light pen. A configuration program permits full use of the Amiga with most popular printers including letter-quality, dot-ma-trix, ink-jet, and laser printers. The Diablo color inkjet printer can copy the screen graphics and colors almost exactly, and there are rumors of a pending color laser printer.

As you can see, the Amiga is the first truly general-purpose computer, capable of doing everything well. It can support the most demanding business needs while offering staggering power to the home user. The astounding graphics are ideal for CAD/CAM, art production, cartoon design, presentation graphics, and the best games seen in or out of the video parlor. The sound rivals midrange commercial synthesizers. The operating system combines the best of MS-DOS, Unix, and the Macintosh operating system, and brings multitasking to the consumer. And the wide range of software, available immediately (see "Amiga Software: Something for Everyone") means that you can start using it the minute you plug it in. Welcome to a new generation.

Amiga At A Glance

CPU: Motorola 68000, a 16/32-bit microprocessor; three separate custom integrated-circuit chips controlling animation, graphics, and sound.

Operating System: Macintosh-style with pull-down menus, windows, multiple screens, and icons. Unix-like DOS. Capable of true multitasking (able to run several programs simultaneously).

Memory: 256K RAM standard, 512K optional. Expandable up to 8 megabytes. 192K ROM.

Disk Drive: Built-in 880K 3½-inch microfloppy drive; can daisy-chain up to four external drives; third-party 20-megabyte hard disk available.

Video: Outputs for composite color or monochrome monitors, analog RGB color monitor, and built-in RF modulator for ordinary TV; 80-column text standard, with option to use 40 or 60 columns with ordinary TV. 4,096 possible colors.

Graphics: Four graphics modes: 640 × 400-pixel maximum resolution (up to 16 simultaneous colors); 640 × 200 (up to 16 simultaneous colors); 320 × 200 (up to 32 simultaneous colors); and 320 × 400 (up to 32 simultaneous colors). Custom graphics chip controls background graphics, screen handling, and eight four-color sprites; custom animation chip.

Sound: Advanced four-voice sound chip with stereo output and optional digital sound sampling; built-in speech synthesis.

Interfaces: Centronics-standard parallel port, RS-232 serial port, three video outputs, two stereo sound outputs, two control ports for mouse or joysticks, keyboard jack, and expansion port with full system bus for unlimited expansion (such as add-on coprocessors).

Printers: Supports letter-quality, dot-matrix, ink-jet, and laser printers—including color printers. (Drivers for most popular printers are standard.)

Price: Between $1,100 and $1,500—256K entry-level unit. About $2,000—512K system with RGB color monitor.

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The Summer Consumer Electronics Show

BEYOND THE Sta

Lance Elko, Editor

The personal computer section at this year's Summer CES attracted less attention than in past years, but a closer look revealed a pleasant surprise.

As Mark Twain once said to the press, "The reports of my death are greatly exaggerated." In recent months, stories about the demise of the personal computer industry have, too, been gravely premature. The Summer Consumer Electronics Show (CES), held this past June in Chicago, provided strong evidence that there's plenty of life in this infant industry.

Both low-end computer manufacturers, Commodore and Atari, as well as many established software publishers, had a healthy showing. Although the number of software publishers has declined, the strongest and most dedicated remain. The shakeout of the past year has victimized both computer manufacturers and software companies—Coleco (Adam), IBM (PCjr), Futurehouse, and Microlab, to name a few. But the tone of the survivors is that of optimism seasoned by experience. And the quality of many of the newest products shows a mature, positive approach to the marketplace.

Report

Signs of renewed life for the industry have appeared in a variety of places. A recent survey based on marketing research by CBS, Louis Harris, A. C. Nielsen, Dataquest, and others indicates that the personal computer industry appears to have a healthier future than many have predicted. According to the study, 15 percent of U.S. households currently have a personal computer. By year's end, the report indicates that this will climb to a hefty 21 percent, or 16 to 18 million machines in U.S. homes.

What market share Commodore will have remains to be seen. At this writing, it's too early to tell how the public will respond to the Commodore 128 and Amiga, or the impact of the new Atari ST computers.

At the Commodore CES press reception, Marshall Smith, president and chief executive officer, was openly ruffled by the pessimistic press reports of the past few months concerning the future of Commodore. Despite the slowing sales of Commodore 64s and the steady decline of Commodore stock in the past several quarters, Smith and other company executives stressed their optimism for the success of the 128 and promised continued support for the 64. Thomas Rattigan, the new Commodore North America president, announced that 100,000 advance orders for the 128 had been received by June 1. He also noted that Commodore was expecting to sell the 128 "to over 15 percent of the nearly three million plus U.S. owners of Commodore 64s and to hundreds of thousands of first-time computer buyers."

In an effort to demonstrate that its market includes much more than the U.S., Commodore displayed its two IBM PC compatibles, the PC10 and PC20, available in Europe and Canada. They will not appear in the U.S. Also on display was the Commodore 900 Business Computer, a Unix-compatible machine designed for multitasking and networking. Commodore plans to market this machine in Europe this fall, and it could later appear in the U.S.

While underscoring its position as an international company, Commodore was touting its newest market entry, the 128. Unlike the ill-fated Plus/4 and 16 computers, the 128 seems to be getting stronger support from Commodore.

New hardware for the 128 from Commodore includes the 1572 disk drive, the MPS 1000 printer, and the 1670 modem/1200. The 1572 is a dual drive version of the 1571 and offers up to 820K of data storage. The price will be announced later. The MPS 1000, an Epson-like dot matrix printer, features three operating modes: high-speed draft (100 characters per second), near letter quality (16 cps), and graphics mode with a print density of 50 to 240 dots per inch. The new printer also offers a choice of four character sizes: 80, 96, 132, or 160 characters per line. Price is expected to be under $300. The 1670 Modem/1200, originally announced at the Winter CES, is now available. This 300/1200 baud unit uses "AT" Hayes command protocol and includes a built-in speaker for monitoring dialing (Touch Tone or rotary phones), auto answer, auto dial, auto baud, and auto mode selection. As with earlier Commodore modems, a user ID, password, and one-hour subscription to CompuServe are included with the purchase. Suggested retail price is approximately $200. Although the 1572 dual drive is designed for use with the 128, the MPS 1000 is compatible with the 128 and 64, and the 1670 modem with the 128, 64, Plus/4, SX-64, and VIC-20.

Also on display at the Commodore booth was the previously announced Commodore mouse controller. It is now available at a suggested retail price of $49.95.

Commodore is pledging full software support for the 128. According to Paul Goheen, director of software development, the 128 will be supported both by Commodore titles and by third-party developers.

Available for the 128 this summer from Commodore are *Jane 2.0*, the Perfect Series, and *Micro Illustrator*. *Jane 2.0*, an impressive icon-based three-disk package, developed for Commodore by Arktronics Corporation, was introduced at the Winter CES, but has since been revised. The package includes three integrated programs: *Janewrite*, a word processor, *Janecalc*, a spreadsheet, and *Janelist*, a file manager. The enhanced version includes some new features designed to appeal to both novice and seasoned users. It works with the mouse or a joystick. Suggested retail price is $49.95. A 32K ROM cartridge version for the 64 is expected to be available for approximately the same price.

The Perfect Series—*Perfect Writer*, *Perfect Calc*, and *Perfect Filer*—also announced at the Winter CES, is now available. Each of these programs can be used separately or share files when used together. The series, developed by Thorne/EMI, is designed to operate in the 128's 80-column mode. Each program is expected to retail for $69.95. *Micro Illustrator*, a graphics program previously available for the 64, uses the 128K mode, allowing more features than the original version. Suggested retail price is $39.95. Other 128 titles planned for release are *Typing Professor* and *A Comprehensive Course in BASIC*.

Several major third-party software publishers have also committed support for the 128. Batteries Included is offering versions of three popular 64 programs, *PaperClip*, *HomePak*, and *The New*

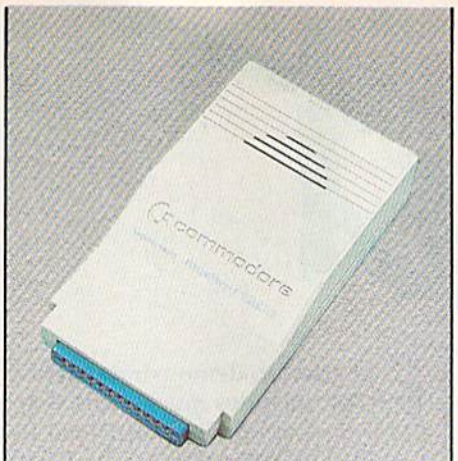
Consultant. The upgraded versions take advantage of the 128's extra memory, processing speed, 80-column display, and larger keyboard. Suggested retail prices for these packages are $89.95 (*PaperClip*), $79.95 (*The New Consultant*), and $49.95 (*HomePak*). A 128 version of Pro-Line Software's popular word processor has been introduced, *WordPro 128*, which also uses the new computer's memory, speed, and 80-column display. Suggested retail is $99.95.

Timeworks announced *Word Writer 128*, *Data Manager 128*, and *Swiftcalc 128*. *Word Writer* includes an 85,000-word spelling checker and five-function calculator. *Data Manager* is a general information storage and retrieval system with report-writing and label-making capabilities. *Swiftcalc*, a spreadsheet, includes a special feature. Through a licensing agreement with Funk Software, Timeworks is including *Sideways*, a best-selling spreadsheet/printer utility previously available for only the Apple and IBM PC. *Sideways* prints an entire spreadsheet report at one time on one page by rotating the spreadsheet 90 degrees as it prints out, thus eliminating the need for cutting and pasting several sections together. It also offers a variety of type sizes and control over line spacing, left and top margins, and spacing between characters. Designed to be used with any other Commodore-specific spreadsheet that can create ASCII files on disk, *Sideways* can be purchased separately for $29.95. A version for the 64 is available also. *Word Writer 128*, *Data Manager 128*, and *Swiftcalc 128*, each carry a suggested retail price of $69.95.

More software for the 128 from Commodore and third-party publishers will be available later this year, noted Goheen.

While the 128 is off to a more auspicious start than the Plus/4 and 16, the venerable 64 is far from abandoned. Dozens of new hardware and software products for the 64 (and the 64 mode of the 128) were introduced.

An interesting product for those who wish to use their 64 as a home control unit is the X-10 Powerhouse. This programmable



The 1670 modem from Commodore features 300/1200 baud, built-in speaker, auto answer, autodial, auto baud, and auto mode selection.

The X-10 Powerhouse, a programmable interface for the 64, allows control of household lights and appliances without tying up the computer. The accompanying icon-based software lets you simulate the layout of your home and program individual rooms or outside lights.

hardware interface, with its own RAM, ROM, and realtime clock, connects to the 64's user port and can control various household appliances, such as TVs, stereos, lamps, thermostats, wall switches, electric hair curlers, and coffee pots. It runs on a standard 9-volt alkaline battery and controls lights and appliances using existing house wiring. After installing and programming the interface, it may be disconnected, thus freeing your 64 while the X-10 runs the program you've entered.

The accompanying software features icons you can arrange to simulate various rooms in your home. You can then graphically display up to nine rooms on a single screen and program any lights or appliances in each of them. The software also has on-screen instructions. The X-10 Powerhouse can store up to 128 timed events and will control up to 95 screen icons inside or outside your home. A programmer's guide will be available for those wishing to write their own software. Price for the interface, software, and cable is $150. Separate lamp and appliance modules—which plug into outlets—are required for use with the system. X-10 has these available for $8–$30 each (or less if purchased in larger quantities).

Cardco announced *S'More* (Super Memory Optimized RAM/ROM Expansion) *BASIC*, a cartridge utility for the 64 that provides over 60K RAM for programming and adds 60 new commands, many of which eliminate the need for PEEKs and POKEs. With *S'More BASIC*, the function keys have specific assignments (f2 runs a program in memory, f3 reads and displays the disk drive error channel, f5 lists a program in memory, f7 displays the disk directory, and so on). Suggested retail price is $69.95. Cardco is also planning a fall release of the *S'More BASIC Compiler*. The price is $39.95.

Abacus Software introduced *Super C*, a C compiler for the 64. It features a full-screen editor with horizontal and vertical scrolling. It allows source files up to 41K long, and is compatible with most other versions of C. Price is $79.95. Abacus was also showing its new *Super Pascal System*, which includes a

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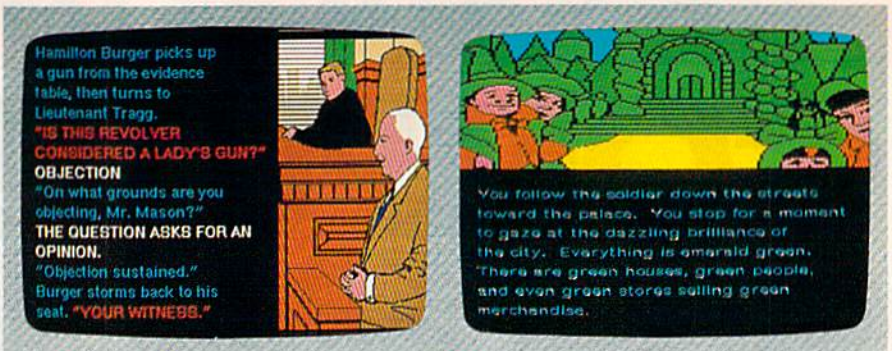
Another C compiler announced for the 64 is the *C Power* compiler from Pro-Line Software. The $99.95 package includes all programming tools for the C language, including the source code, and will be packaged with a 531-page introductory book on C.

Access Software debuted *Beach-Head II*. This sequel to the best-selling *Beach-Head* features more graphic violence than its namesake but is brilliantly programmed. Unlike *Beach-Head*, it offers the player a choice of roles (Allied Forces Commander or the evil Dictator) and a choice of foe (the computer or a human opponent). The game also improves on the not-so-shabby graphics of its predecessor. The realistic human animation is based on a study of videos of humans running, jumping, climbing, and falling. The authors, Roger and Bruce Carver, then broke down these movements into digital format and translated them into data for the game. *Beach-Head II* also has impressive voice synthesis. Suggested retail price is $39.95.

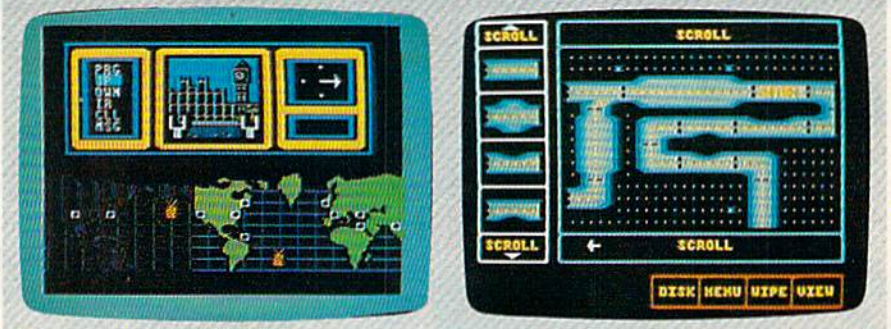
Spinnaker Software announced several interesting new products. Two carefully designed educational offerings, *Homework Helper Math Word Problems* and *Homework Helper Writing*, are for students in grades 7–12. Both are positioned to help in two of the most difficult areas of homework. Spinnaker also augmented its two graphics-and-text adventure series, Telarium and Windham Classics. The new Telarium products are *Perry Mason: The Case of the Mandarin Murder* and *Nine Princes in Amber*. The latter is based on the popular Amber book series by Roger Zelazny. Both packages retail for $32.95. Spinnaker also announced three new Windham Classics titles—*The Wizard of Oz*, *Treasure Island*, and *Alice in Wonderland*. Each is priced at $26.95.

Infocom announced *Wishbringer*, a clever and intriguing fantasy game designed for newcomers to the world of text adventures. Price is $34.95.

Several new titles for the 64 were announced by Activision. *Hacker*, an open-ended computer mystery, begins with "LOG ON PLEASE." The rest is up to you. All you know is that you've accidentally broken into an unknown computer system with no information, rules, or clues. *Fast Tracks: The Computer Slot Car Construction Kit* lets you design your own courses and race. The program has a number of interesting features, one of which allows you to save a course you've designed and upload it to a friend to try. *GameMaker*, a full-featured game design kit, allows you to select commands and characters from menus to create your own arcade-style games. *Alter Ego* puts you into real-life situations and asks you to make choices—thus building a unique personality to experience life as someone other than yourself. The three-disk package was designed by psychologist Dr. Peter Favaro. Each of the new Activison packages will be released this fall or winter. Prices will be announced.



Two of Spinnaker's newest offerings are Perry Mason: The Case of the Mandarin Murder *(from the Telarium Series) and* The Wizard of Oz *(from the Windham Classics line).*



"Log on please" is the only clue you're given in Hacker, a new computer mystery game from Activision. Fast Tracks: The Computer Slot Car Construction Kit, *also from Activision, lets you design and race on your own courses.*

MicroProse announced three new simulation games for the 64: *AcroJet: The Advanced Flight Simulator, Silent Service: The Submarine Simulation*, and *Gunship: The Helicopter Simulator*. Each carries a suggested retail price of $34.95.

Although much more software for the 64 was announced (see "CES Perspective: The End of the Tap Dance," following this article), there was little new hardware at this CES. However, Atari was showing what could be a major technological breakthrough for the personal computer market: a CD-ROM (Compact Disc-Read Only Memory) peripheral. This is an audio compact disc player modified for data storage with a computer. Atari demonstrated a 23-volume, nine-million word encyclopedia which, remarkably, fit onto only one quarter of the space of a compact disc (550 megabytes can be

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stored on a CD, about the same as 3,400 disks on the 1541). Articles can be read into an Atari 520ST's memory in a matter of seconds, and search time for any subject is less than four seconds. The CD-ROM should be available late this year or in early 1986. (For more details on the CD-ROM, see the August issue of COMPUTE!.) While Atari will be the first to offer such a product, look for this technology to be available for the Amiga and virtually all future personal computers.

The long-awaited Amiga computer was not a popular topic with Commodore representatives at CES. Although the machine was said to have been ready, Commodore was putting full emphasis on the 128 at the show. The Amiga was scheduled to be introduced in late July. (See a full report on the Amiga elsewhere in this issue.)

For more information about the products mentioned here, please contact your local dealer or write:

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CES Perspective:

The End Of The Tap Dance

Kathy Yakal, Feature Writer

As the crowds began to thin the second and third days of this summer's Consumer Electronics Show, you could see the question in the eyes of the exhibitors in McCormick West, the building that housed the home computer industry's booths. *How are we doing?*

The question was different this time. No more, *Who is going to survive?*, but *How can those of us who survived best support each other until things pick up again?*

"I'm glad to see they're here," said one educational software publisher—of his competition.

The sentiment voiced most often at the winter show six months before had been this: It's time to start moving from the manic pace of a new business to the more measured strides of a young, evolving industry.

That movement was evident at the summer show. Many companies chose not to exhibit, sending representatives to meet individually with the press and to see what new products were showing. Others exhibited, but chose to keep their costs down by having a smaller booth, or sharing booth space with other companies. And even those companies which had rented large booths kept their new product offerings down to a minimum.

The main reason for all of this frugality, of course, was to keep costs down during this lean period. But software developers have not been sitting idle, waiting for the next generation of home computers, the Commodore Amiga and Atari ST. They've continued to wrestle with the untapped capabilities of existing hardware, and provide richer software packages for the Commodore 64 in the areas that consumers want:

Entertainment

Several new adventure games were introduced at CES. *The Alpine Encounter* ($29.95) is Random House's first text/graphics adventure. As an undercover agent, you have 12 hours to uncover a political conspiracy being played out in a ski resort.

To coincide with this fall's paperback release of Frederick Forsyth's *The Fourth Protocol*, Bantam Electronic Publishing announced an adventure game of the same name. In *Protocol*, you take the role of John Preston, a high-ranking British Intelligence Officer who must stop a plot to smuggle and detonate a nuclear device in England. The game is *icon-driven;* it uses a Macintosh-type interface for accepting commands. Suggested retail price is $34.95.

Software prices in general have continued to fall from the $40–$50 range to $30 and under. Several entertainment publishers at the show introduced products for under $20. BCI Software offered a line of trivia games for $4.99, and a number of other computer games for $9.99, including *Super Black Belt Karate, Hydrax,* and *Mummy's Tomb.* Every product in Green Valley Publishing's Load 'n Go, a line of traditional board, adventure, and maze games, sells for under $10. And ComputerEasy has begun producing Commodore games for $19.95.

Epyx brought out two sequels

Super C Compiler

This is most advanced C development package available for the C-64 or C-128. **Super C** comes with a very complete source editor; a full K&R compiler (without bit fields); a program linker (binds up to 7 separate modules); and a set of disk utilities. All components are available from single menu. Supports single and double precision integer and float, arrays, structures, strings, more. Very complete editor handles search/replace, 80 column display with horizontal scrolling and 41K source files. The I/O library supports standard functions like printf and fprintf. Free runtime package included. For C-64/C-128 with 1541/1571 drive. Includes system diskette and user's handbook. **$79.95**

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SUPER SOFTWARE

to its successful *Summer Games*. *Winter Games* and *Summer Games II* will be available this fall for around $30. They have also released two games developed by the Lucasfilm Games Division, *The Eidolon* and *Koronis Rift*, in the $30 price range.

Another sequel is First Star Software's *Spy vs. Spy: The Island Caper* ($29.95). Based on the popular comic strip in *MAD* magazine, the game uses First Star's proprietary Simulvision and Simulplay techniques, which allow both players to play and watch each other's actions at the same time.

Carriers at War ($50), a World War II historical simulation game, and *Reach for the Stars* ($45), a science fiction strategy game, will be distributed by Electronic Arts.

Datasoft has acquired the licensing rights to Steven Spielberg's latest movie, *The Goonies*. In its action/strategy game by the same name, players must work their way through eight increasingly difficult screens, trying to reach pirate's treasure while avoiding various pitfalls. Available in early September, it will retail for $29.95. Other offerings in Datasoft's fall line-up include *Zorro* ($29.95), a game based on the legendary character; and *Alternate Reality*, a series of seven fantasy/role-playing games ($39.95 each).

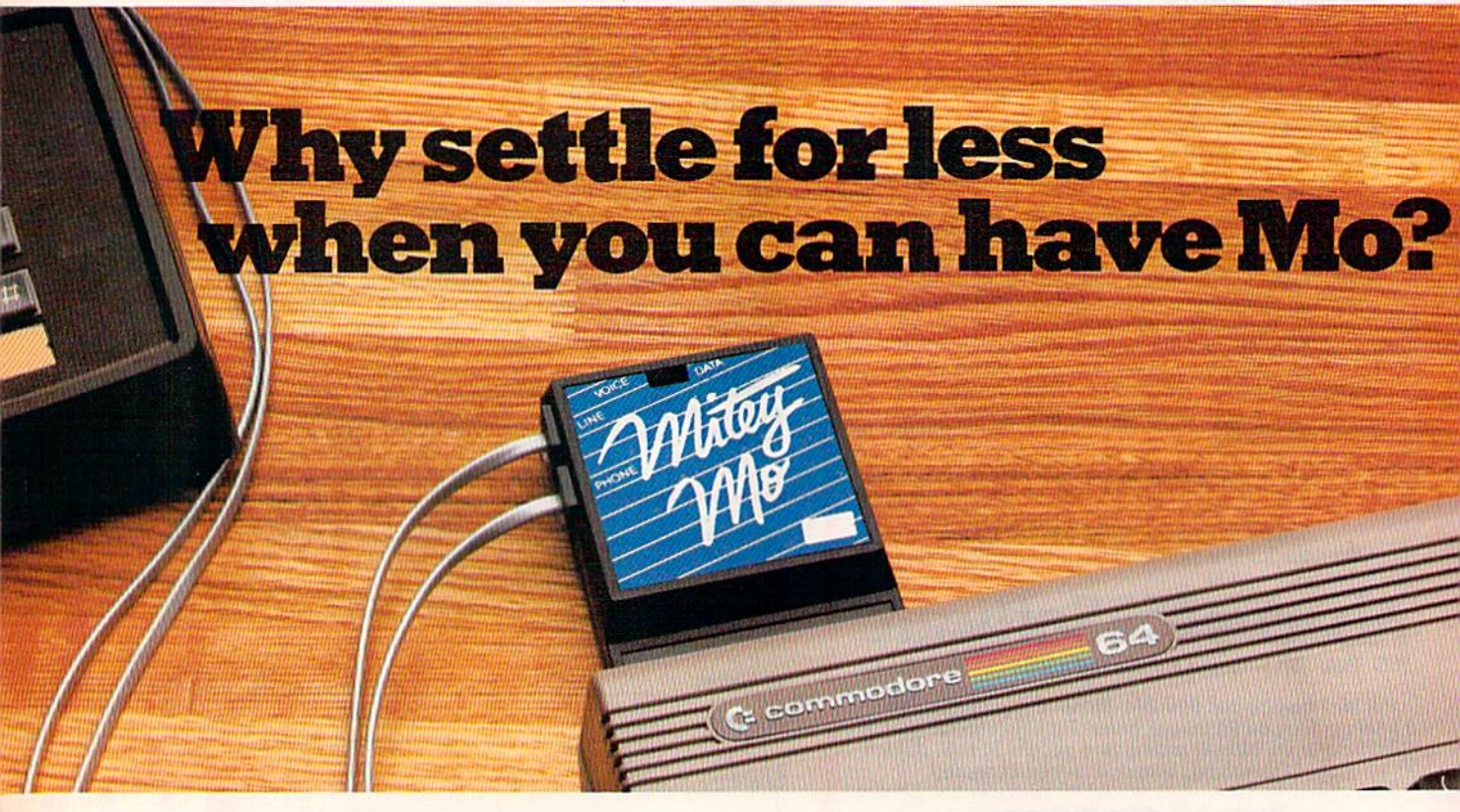
Education

Educational software publishers have also begun to draw on the name recognition of familiar entertainment characters. Random House's line includes several. *Charlie Brown's 1-2-3's* calls on Snoopy and the rest of the Peanuts gang to help teach counting and number recognition. *Snoopy Writer* encourages creativity while instructing children in the fundamentals of word processing. Garfield, the wise-cracking comic strip cat, helps build vocabulary skills in *Garfield Double Dares*. And *Mr. and Mrs. Potato Head* tests memory and concentration skills, while letting children create and animate myriad variations of the two characters. All retail for $29.95.

Spinnaker's Fisher-Price series features familiar faces and *voices; Peter Rabbit READING* and *Jungle Book READING* are some of the first educational programs to use voice synthesis. In *Prokofiev's Peter and the Wolf MUSIC*, children can learn about music theory while playing listening games with characters in the story. And *First Men in the Moon MATH*, based on the H.G. Wells novel, teaches math functions in an outerspace atmosphere. Each program in the line retails for under $20.

Fine art is coupled with intense intellectual challenge in *The Dolphin's Rune: A Poetic Odyssey* from Mindscape. Designed by British artist John O'Neill, it's a quest for understanding—both ancient dolphin lore, and the meaning to the verse that the dolphin seeks. Suggested retail price is $29.95.

Play Together, Learn Together ($24.95) is a combination book/software package from Grolier Electronic Publishing. It encourages children and adults to work together in developing computer skills while teaching fundamental reading skills to children. It retails for $24.95. Grolier also introduced a new series of curriculum-related programs, featuring Miss Mouse and her Forest Friends. The first six



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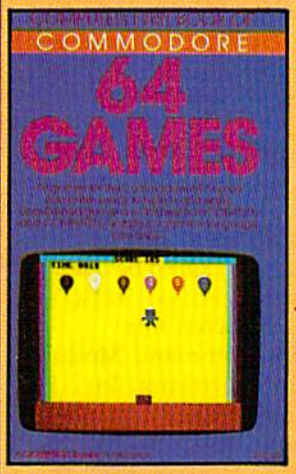

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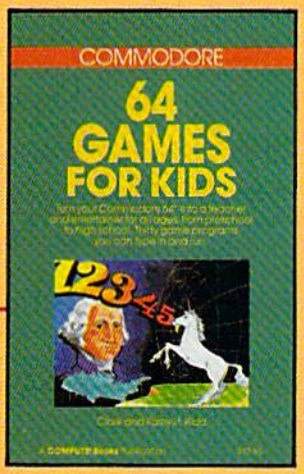

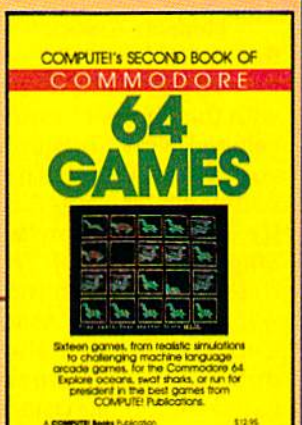

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pieces in the line promote reading skills, and introduce children to concepts like weather and the world around them. Each program retails for $29.95.

Gessler Educational Software, which specializes in foreign language versions of educational programs, introduced French, Spanish, and German versions of Davidson & Associates' *Word Attack!*. *Bataille de Mots, Batalla de Palabras,* and *Wortgefecht* are available for $49.95 each. Gessler has also obtained exclusive rights for foreign rights translations of several Spinnaker programs.

Arrakis Technologies announced that it would produce educational software under the auspices of *OMNI* magazine. First in this MagazineWare group is *The Cosmic Cookbook,* a series of programs dealing with scientific topics. Arrakis has also reached an agreement with *Sail* magazine to produce tutorials. Arrakis' software development system, Socrates, makes it easy for nonprogrammers who are experts in a given field to be very instrumental in a program's design.

Henson Associates announced that several publishers have adapted educational products for use with the Muppet Learning keys, developed with Christopher Cerf Associates. These include CBS Software's *Dr. Seuss Fix-Up the Mix-Up Puzzler,* Simon & Schuster's *Muppet Institute of Technology* series, and Brøderbund's *Welcome Aboard.* Henson Associates and CBS Software will also be co-producing Fraggle Rock software, based on the television series.

Personal Productivity

Personal productivity software, as the industry has come to define it, encourages personal growth and helps manage home matters. Though it may be enjoyable and entertaining, that is not its main function. Many new products in this category were introduced at summer CES.

The Works!, from First Star Software, includes 13 different programs in four categories: organizers, tools, learning, and arts. The programs include *Typing Teacher, Music Composer, Letter Writer, Stock Portfolio,* and *Graphics Painter.* Suggested retail price is $49.95.

QRS Music Rolls, Inc. has begun selling *MIDI Magic,* an interface that connects a Commodore 64 to synthesizers and musical instruments equipped with a standard MIDI (Musical Instrument Digital Interface). Cost, including a six-song demo disk, is $49.95. QRS also offers a line of Music Disks featuring the works of artists like Liberace and Gershwin. Each is $19.95.

Know Your Own IQ/Know Your Own Personality helps computer owners do just what the title says. Published by Bantam, it's based on the works of psychologists H.J. Eysenck and Glenn Wilson, authors of books by the same names. The package contains four IQ tests, each with 40 questions, and three personality tests with 210 questions each. It retails for $34.95. Another new product in their Selfware line is *The Complete Scarsdale Medical Diet,* an electronic version of the bestselling book, priced at $39.95.

Scarborough Systems released a Commodore version of another popular diet plan, *The Original Boston Computer Diet.* Suggested retail price is $49.95.

Third-party hardware manufacturers were in attendance with some new product announcements, too. The Comtel Group introduced the Enhancer 2000, a Commodore-compatible disk drive. It retails for $219.

Simplified programming was offered by Search Consultants International. Their new DOS board for the Commodore 64 and 128 combines a numeric and macro-function keypad along with a new disk operating system. RAM is left untouched. The keypad connects to the cartridge slot through an interface cable. Expected price is $99.95.

Research In Speech Technology, Inc., announced that its Easy Speech 64 ($29.95) could be used to make selected games "talk"—including the Infocom line.

The Voice Command Module, from Eng Manufacturing, Inc., allows you to use spoken commands to control compatible software. The package includes a microphone, command module, connector and cables, and software for $49.95.

Six months of tap-dancing—of waiting for new hardware announced at Winter CES—had worn on everyone. And though the atmosphere may have been more subdued than usual, and the exhibitors and products more sparse, there was a more upbeat—almost surprised—feeling among those people remaining at CES on the final day than had been felt for a while:

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For more information about the products mentioned here, please contact your local dealer or write:

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C-9

Drawing Lines And Borders

Michael S. Tomczyk

Michael S. Tomczyk is a former Commodore marketing executive and product designer. His recent book, The Home Computer Wars, *describes the rise of Commodore and is published by COMPUTE! Books.*

Did you ever try to print a character in the bottom right corner of the screen? That's just one problem you have to solve if you want to draw a border all the way around the screen. This month we're going to solve this problem, and learn how to draw lines and borders as well. All of these examples work with the Commodore 64, VIC-20, Plus/4, 16, and the 128.

Before we begin, find the ASCII and CHR$ codes appendix in the back of your owner's manual. You'll be using these codes throughout this lesson.

You can print a CHR$ code just like any letter, character, or command. There's even a CHR$ code for inserting characters and changing colors, as you'll see in a moment.

To show you how it works, the CHR$ code for clearing the screen is CHR$(147) and the CHR$ code for the heart symbol is CHR$(115), so if you want to clear the screen and print a heart, type the following:

```
10 PRINT CHR$(147) CHR$(115)
```

Type RUN and press RETURN. For your convenience, here's a handy chart showing the CHR$ codes we'll be using in this lesson:

CHR$ Code Function or Symbol

17	Cursor down
18	Reverse on
19	Home
29	Cursor right
32	Space
96	Horizontal line
115	Heart graphic
146	Reverse off
147	Clear
148	Insert
157	Cursor left
173	Lower left corner
174	Upper right corner
176	Upper left corner
189	Lower right corner

Drawing A Horizontal Line

We begin by drawing a horizontal line across the screen. Type the following line as shown and press RETURN (if you have a VIC, substitute the number 22 for 40 in all of these examples):

```
10 PRINT CHR$(147);:FOR H=1 TO
   40:PRINT CHR$(96);:NEXT
```

We begin by clearing the screen. The FOR-NEXT loop is used to repeat actions. Everything between the FOR and NEXT portions of the command will be repeated the number of times shown. In this case, we PRINT CHR$(96) 40 times. The semicolon causes the 40 graphics symbols to be printed next to each other (otherwise they'll be "stacked" down the screen on different lines).

Drawing Lines With Reverse Spaces

Did you ever notice your keyboard does *not* have a solid block graphics symbol? That's because you can use a reverse space as a solid block. To do this, you must print the RVS ON command followed by a space. In this example, we're going to use CHR$ symbols:

```
10 PRINT CHR$(147) CHR$(18);:FOR
   H=1 TO 40:PRINT CHR$(32);:NEXT
```

Type RUN and press RETURN. This line clears the screen, then prints 40 reverse spaces across, which appears as a thick solid horizontal line. CHR$(18) turns on the reverse function. CHR$(32) is the space character. Notice that CHR$(18) is needed only once, before the 40 spaces are printed. Turning on the reverse function makes all succeeding characters print in reverse, until you either turn off reverse or print a carriage return.

Drawing A Vertical Line

Now let's print a vertical line:

```
10 PRINT CHR$(147);:FOR V=1 TO
   18:PRINT CHR$(18) CHR$(32):NEXT
```

This line looks the same as our previous example, except we left out the semicolon after CHR$(32). Without the semicolon, the computer automatically puts every PRINT statement on a different line. It adds a carriage return, which moves the cursor to the beginning of the next line down, to each item printed. Here, there are 18 PRINT statements—and 18 solid blocks—and they each get printed on a different line, which makes them look like one solid vertical line. Because a carriage return turns off the reverse function, we have to put the CHR$(18) between FOR and NEXT, to make sure the spaces are printed in reverse.

Now let's start building our border. Enter and RUN this program (for the VIC, use C=22:L=18 in line 5):

```
5 C = 40:L = 20
10 PRINT CHR$(147);:FOR H = 1
   TO C:PRINT CHR$(18)
   {SPACE}CHR$(32);:NEXT
20 FOR V = 1 TO L:PRINT CHR$(1
   8) CHR$(32):NEXT
30 FOR H = 1 TO C:PRINT CHR$(1
   8) CHR$(32);:NEXT
```

Well, we *almost* have our border. How do we get a vertical line on the right side of the screen? In this case, we'll modify the "vertical" section of our program (line 20) so instead of printing 20 vertical blocks (18 on the VIC), we'll print 20 lines and each will contain one reverse space, 38 blank (empty) spaces, and another reverse space. The final reverse space will create

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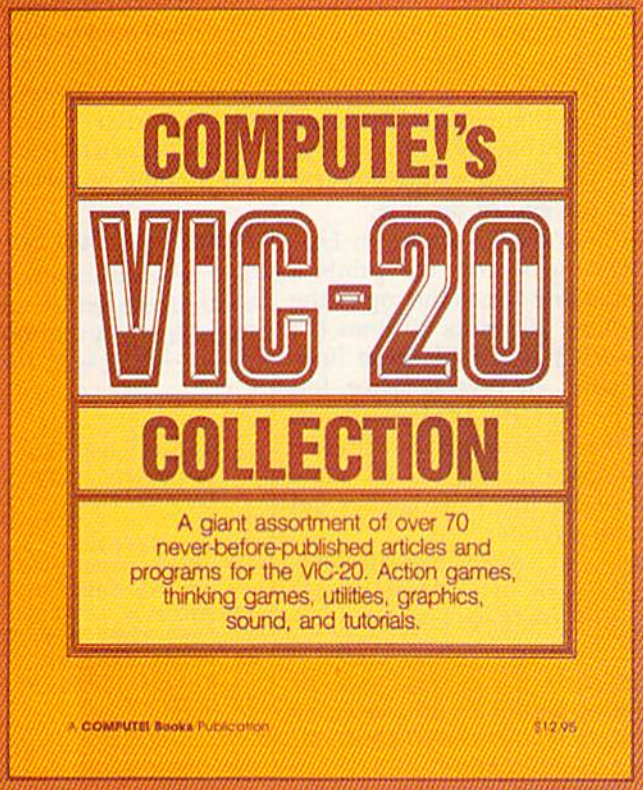

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the vertical line on the right side of the screen. (Again, use C=22:L=18 if you have a VIC.)

```
5 C = 40:L = 20
10 PRINT CHR$(147);:FOR H = 1
   [SPACE]TO C:PRINT CHR$(18)
   [SPACE]CHR$(32);:NEXT
20 FOR V = 1 TO L:PRINT CHR$(1
   8) CHR$(32);
25 PRINT CHR$(146) SPC(C-2) CH
   R$(18) CHR$(32);:NEXT
30 FOR H = 1 TO C:PRINT CHR$(1
   8) CHR$(32);:NEXT
```

Line 20 starts out the same as the previous line 20. Then in line 25 we PRINT CHR$(146) which turns *off* the reverse function (RVS OFF). Then we use a special command—the space command (SPC)—to put spaces across the screen. Because we turned off the reverse function, these are regular spaces which appear as empty blanks on the screen. Finally, we add a single reverse space at the end of the line.

So here's what we have: Line 10 clears the screen and prints a horizontal line across the top of the screen. Line 20 prints 20 lines (18 on the VIC)—each of these lines begins with one reverse space, followed by 38 (40−2) blank spaces (20 on the VIC), and ends with one reverse space. Line 30 is the same as line 10. Put them all together and you have a border.

You can change the up-and-down length of the border by changing the value of L in line 5 to a smaller number.

However, if you want to make a complete border around the edge of the screen, you need to know another trick because printing a character on the *last line* of the screen automatically causes the screen to scroll up, and printing a character at the bottom right corner is especially difficult.

Printing Titles In The Border

Before we tackle our most difficult problem—the bottom right corner of the screen—let's see how to insert a title or other information inside the border.

Add the lines below to your existing program. To do this, just type each line and press RETURN. They will be automatically added to the program shown above.

```
40 PRINT CHR$(19);:PRINT:PRINT
50 FOR M=1 TO 10:PRINT CHR$(29);
   :NEXT:PRINT"COMPUTER"
```

To properly position our title inside the border—and leave the border on the screen when we print the title—we start by using PRINT CHR$(19) to HOME the cursor. HOMEing the cursor doesn't change or erase anything else on the screen. It simply sends the cursor to the HOME position, which is the top left corner of the screen. Next, we use two PRINT commands to move two lines down the screen. A FOR-NEXT loop then repeats 10 cursor right commands. This positions the title 10 spaces from the left edge of the screen. Finally, we print our title, which in this case is the word COMPUTER. The title could be longer, on several lines, or other information or graphics can be presented inside the border. Use HOME and PRINTed cursor commands for positioning or centering.

Printing A Full Screen Border

The program below prints a border around the entire screen—including the tricky bottom right corner (use C=22:L=21 for the VIC).

```
5 C = 40:L = 23
10 PRINT CHR$(147);:FOR H = 1
   [SPACE]TO C:PRINT CHR$(18)
   [SPACE]CHR$(32);:NEXT
20 FOR V = 1 TO L:PRINT CHR$(1
   8) CHR$(32);
25 PRINT CHR$(146) SPC(C-2) CH
   R$(18) CHR$(32);:NEXT
30 FOR H = 1 TO C-2:PRINT CHR$
   (18) CHR$(32);:NEXT
40 PRINT CHR$(18) CHR$(32) CHR
   $(157) CHR$(148) CHR$(32);
50 GOTO 50
```

Line 10 draws a horizontal line across the top of the screen; lines 20–25 set up the next 23 lines (21 for the VIC)—each screen line contains a solid block at the beginning and end with spaces in between; line 30 draws a horizontal line 38 spaces long on the bottom line of your screen (20 spaces long on the VIC).

But the key that makes a full border possible, by placing a character in the bottom right corner of the screen, is line 40. Line 40 begins by printing a reverse space on the bottom line at the second to the last position. We then cursor left one time, with CHR$(157). This positions the computer on top of the reverse space just printed. Next, and most important, we use an INSERT editing command, CHR$(148), to push the character one space over to the right—into the last (bottom right) position on the screen! The inserting action pushes the reverse space character over to the last position and leaves the computer positioned in the second to the last position. PRINT a CHR$(32) space here and the border is finished. Now we can HOME the cursor and position it to display a title, or even a series of titles, instructions, or educational problems inside the border.

Line 50 is a GOTO to "hold" the border display. If you don't have a FOR-NEXT time delay loop, a GOTO, or a continuation of the rest of your program, the program will END and the "READY" message will mess up your border.

A Thin-Line Border With Custom Corners

Here's a variation on the border, using "thin-line" graphics. The key difference here is that we have to put corner graphics in all four corners of our border (use C=22:L=21 for the VIC).

```
5 C = 40:L = 23
10 PRINT CHR$(147) CHR$(176);:
   FOR H = 1 TO C-2:PRINT CHR$
   (96);:NEXT
20 PRINT CHR$(174);:FOR V = 1
   [SPACE]TO L:PRINT CHR$(125)
    SPC(C-2); CHR$(125);:NEXT
30 PRINT CHR$(173);:FOR H = 1
   [SPACE]TO C-3:PRINT CHR$(96
   );:NEXT
40 PRINT CHR$(189) CHR$(157) C
   HR$(148) CHR$(96);
50 GOTO 50
```

A Rainbow Border

You can set the color of the border however you like, either by using the CHR$ codes that determine color, or by using standard CONTROL color commands inside quotes, where appropriate. This border is used a lot by software developers. It prints reverse spaces in different colors, using a random number formula to pick the colors. You can also vary this by "shrinking" it down and making a smaller border, perhaps in the center of the screen. Here it is (use C=22:L=21 for the VIC):

```
5 C = 40:L = 23
10 PRINT CHR$(147);:FOR G = 1
   [SPACE]TO C:GOSUB 500:PRINT
    C$ CHR$(18) CHR$(32);:NEXT
```

```
20 FOR G = 1 TO L:GOSUB 500:PR
   INT C$ CHR$(18) CHR$(32);
25 PRINT CHR$(146) SPC(C-2);
30 GOSUB 500:PRINT C$ CHR$(18)
    CHR$(32);:NEXT
40 FOR G = 1 TO C-1:GOSUB 500:
   PRINT C$ CHR$(18) CHR$(32);
   :NEXT
50 GOSUB 500:PRINT C$ CHR$(18)
    CHR$(157) CHR$(148) CHR$(-3
   2);
60 GOTO 60
500 R = INT(8*RND(1))+1:G$ = "
    {BLK}{WHT}{RED}{CYN}{PUR}
    {GRN}{BLU}{YEL}":C$ = MID$
    (G$,R,1):RETURN
```

REM: *If you have a Commodore 64, Plus/4, 16, or 128, you can include up to 16 colors instead of 8. Change the number 8 in the random number formula to 16 and type all 16 colors in line 500, in quotation marks. To get the first eight numbers, hold down the CONTROL key and press each color key in order, then hold down the Commodore key and press those same keys, to get the next eight colors.*

Also, to make the display look better, eliminate the color of the background screen. For example, if the screen is colored blue, eliminate blue from the colors in quotation marks and type a 7 instead of 8, or 15 instead of 16 if you use 16 colors. This helps because if you use the same color as the background in your rainbow border, those cyan blocks may look like "empty" spaces.

The key to this program is the GOSUB in line 500. Line 500 selects a random number from one to eight, then defines the variable G$ as a group of eight color commands, and finally uses the MID$ function to define C$ as one of those colors selected at random. For example, if the third color is red and the random number is 3, then C$ will equal the color red. This means if you print C$ it will be the same as printing CTRL-RED—in other words, wherever you see a GOSUB 500 in the program, it tells the computer to jump down to line 500, pick a color, then jump back to where it left the main program and keep going. The RETURN command in line 500 sends the program back to its previous position. The result is that every GOSUB 500 in this program resets the color of the characters being printed at that point.

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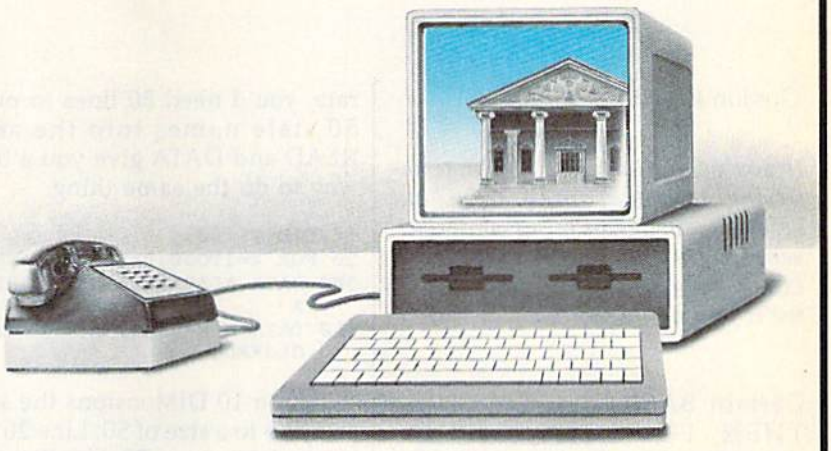

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hints & tips

Recycling Selected DATA Statements

Gordon J. LeVee

If you've discovered a clever time-saving technique or a brief but effective programming shortcut, send it to "Hints & Tips," c/o COMPUTE!'s GAZETTE. If we use it, we'll pay you $35.

Certain BASIC commands—IF-THEN, FOR-NEXT, GOSUB-RETURN—travel in pairs. The first word starts a series of actions, the second wraps things up. READ and DATA are another such pair. The general idea is to put some information into DATA statements and then use READ to do something with that information.

READ and DATA are often explained with an example like this:

```
10 READ A,B,C
20 PRINT A*B*C
30 DATA 2,3,4
```

In line 10, values 2, 3, and 4 are assigned to variables A, B, and C. Line 20 multiplies them. This isn't a particularly good example, however—**10 A=2: B=3: C=4** is a shorter, simpler way to accomplish the same thing.

Two cases where READ-DATA is the best method for handling a lot of information are arrays and machine language (ML) programs.

Information In Bulk

Arrays are designed to handle long lists of information. You need only two steps to set up an array. First, tell the computer how big the list will be—its dimension. Second, fill out the list. Here's an example:

```
10 DIM S$(50)
20 S$(1)="ALABAMA"
30 S$(2)="ALASKA"
40 S$(3)="ARIZONA"
```

Unfortunately, the variables are defined rather clumsily. At this rate, you'd need 50 lines to put all 50 state names into the array. READ and DATA give you a better way to do the same thing:

```
10 DIM S$(50)
20 FOR X=1TO50:READS$(X):NEXT
500 DATA ALABAMA,ALASKA,ARIZON
    A
510 DATA ARKANSAS,CALIFORNIA,C
    OLORADO
```

Line 10 DIMensions the string array S$ to a size of 50. Line 20 then loops from 1 to 50, reading state names from the DATA statements (a comma separates each item, so you can put more than one on each line).

If you run this program, you'll get an OUT OF DATA error because there are only six items in the DATA statements and line 20 is trying to READ through 50 of them. The computer keeps track of which DATA statements have been used, and each entry in a DATA statement is read only once. We'll see in a moment how you can READ them more than once.

Another common use for DATA statements is POKEing ML programs into memory. ML programs can be set up via a BASIC "loader" program like this:

```
10 FOR X=828TO838:READ Y:POKE
   {SPACE}X,Y:NEXT
20 SYS828
30 DATA 169,72,32,210,255,169,
   73,76,210,255
40 DATA 999
```

When you type SYS 828, this short ML program prints the word HI. But once again there's an error. If you run it, you get an ILLEGAL QUANTITY error in line 10. Numbers POKEd into memory have to be in the range 0–255. Anything higher or lower, like the 999 in line 40, leads to an error.

The error message is somewhat misleading because the problem is caused by the 999 in line 40, but the computer says the error is in line 10. The READ worked fine; it gave Y a value of 999. It's the POKE that led to an error. The computer doesn't know when you READ whether you're going to try to put the number into memory or not (READ-DATA can be used for a variety of purposes besides POKEing ML programs).

Most BASIC loaders have long lists of DATA statements full of numbers. If you've made a mistake, like the 999 in line 40, one obvious way to find it is to search through all of the numbers, looking for one not in the 0–255 range. But there's a quicker and simpler way.

Checking The Pointer

DATA statements are read only once, and the computer knows which ones have been read (or not). As you may have guessed, there's a pointer in memory that can tell you how far into the DATA the program has gone.

Run the program above; it stops with an ILLEGAL QUANTITY error. The problem in line 10 is that it's READing and POKEing, and has reached a number which can't be POKEd. Now type **PRINT PEEK(63) + 256*PEEK(64)** and you'll see a 40. Locations 63 and 64 point to the DATA line most recently read. LIST 40 reveals the problem: 999 is too big. Change it to 0 and the program will run.

PEEKing 63–64 can save a lot of time if you've made an error in DATA statements and need help pinpointing it. You can zero in on the offending line, rather than searching tediously through a long list of numbers.

You could also add the PEEKs to your program to see which DATA statement is being read, a useful technique when you're debugging a program with several sets of DATA statements.

Rereading The DATA

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melody to be played at certain points in a program. You translate the notes to the correct numbers and put them into DATA statements. A FOR-NEXT loop then reads through them and plays the tune.

But items in a DATA statement are used only once. To play the music again, the program has to be able to go back and reread the DATA. The solution? Insert a RESTORE command before the loop. RESTORE tells the program to forget about which DATA has been read and return to the beginning of the list.

RESTORE To A Selected Line

With the exception of relative files, all tape and disk files are sequential. This means information is read in the same order as it was written (first in, first out).

As we've seen, DATA statements are essentially sequential files stored in memory rather than on tape or disk. They're read from beginning to end. RESTORE sets a pointer to the beginning.

With a few PEEKs and POKEs, we can transform the READ-DATA combination from sequential to random access. This method allows us to choose which DATA statements will be used next.

Why would you want to RESTORE to a certain line? Say you have a program containing several different types of DATA statements: an array or two, custom characters, sprites, an ML routine, and music. If you wanted to use the music more than once, RESTORE might not be enough. It only sets the pointer to read from the beginning of the DATA (which could be the information for sprites or arrays).

The improved BASICs in the Plus/4, 16, and 128 have the ability to RESTORE to a certain line number. RESTORE 200 sets the pointer to line 200, for example. The VIC and 64 can't do this directly, though. You need to add this line to your program (change the line number to put this line right before the READ):

```
300 FOR X=0 TO 3: A%(X)=PEEK (63+X): NEXT
```

Locations 63–64 hold the line number of the last DATA statement to be read and 65–66 keep track of where in memory the line begins. By keeping this information in an integer array, you can later POKE the values back and reset the pointers. (To save a little memory, add DIM A%(3) at the beginning of the program.) Perform the PEEKs *before* you start READing the section of DATA statements you'll be returning to.

To go back to the selected section, insert this line before starting to read the DATA:

```
490 FOR X=0 TO 3: POKE 63+X,A%(X): NEXT
```

You can repeat this for other sets of DATA in the program by changing the variable name (B% or C%, for example). Or use a two-dimensional array to keep all of the pointers together.

These four PEEKs and POKEs give you a choice of where to start reading information you've already looked at—random access to DATA.

User Group Update

When writing to a user group for information, please remember to enclose a stamped, self-addressed envelope.

Please note that COMPUTE!'s GAZETTE will no longer publish telephone numbers of user groups or bulletin board systems.

Send additions, corrections, and deletions for this list to:

COMPUTE! Publications
P.O. Box 5406
Greensboro, NC 27403
Attn: Commodore User Groups

User Group Notes

Those interested in astronomy and/or the space program might want to contact a new special interest group (SIG), which is forming now. For more information, write to Astro 64, 9 Lynda Rd., Portland, ME 04103.

Also, those living in Alberta who are interested in starting a user group can contact Randy R. Coutts, Box 1584, Slave Lake, Alberta, Canada T0G 2A0.

The Fresno 64 Users' Group has a new address: c/o Greg Edwards, 689 W. Santa Anna #102, Clovis, CA 93612.

The Pasadena Commodore Club in Monrovia, CA, has asked to be deleted from our listing.

The Ft. Walton Beach Commodore Users Group has a new contact person and phone number. Information may be obtained by writing the group in care of Chris Poole.

A users' group is forming in Bloomfield, NJ. For information, contact Eric Williams, P.O. Box 1874, Bloomfield, NJ 07003.

The Suncoast 64s have a new address: c/o Ray Crisp, P.O. Box 5112, Palm Harbor, FL 33563-9512.

The former C-64 U.S.E.R.S. of Rochester, NH, are now 64 Users, and may be contacted at Box 878, Rochester, NH 03867-0009.

RAM ROM 84, a user group in Englewood, FL, has a new address: P.O. Box 1369, Englewood, FL 34295-1369.

Both the Monmouth and the Galesburg chapters of the Western Illinois Commodore Users Group (WICUG) have dissolved, and their memberships have been absorbed by WICUG. Information about WICUG may be obtained by writing to the club in care of Robert Cokel, president, 906 West 6th Ave., Monmouth, IL 61462.

The Decatur Commodore Computer Club (DC3) has a new contact person and address. Inquiries should be sent in care of Eric F. Martin, 664 W. Grand, Decatur, IL 62526.

There has been a name and address change for the Rancocas Valley User Group. It is now the Rancocas Valley Commodore Users Group, P.O. Box 505, Mt. Laurel, NJ 08054.

The Folklife Terminal Club also has a new address: Box 555-R, Co-op City Station, Bronx, NY 10475.

The Western Indiana Commodore Users (W.I.C.U.) has a new contact person and address. For information, write to Steve Han, W.I.C.U., P.O. Box 1898, Terre Haute, IN 47808.

Another new address is for the Montgomery County Commodore Computer Society. Contact Dave Menaker, P.O. Box 2689, Silver Spring, MD 20902.

Persons trying to contact the Brooklyn, New York, Commodore Users Group by phone should note that the number published in the June issue is a voice phone, not a bulletin board system. Please call the number only between 6:30–9:30 p.m. on weekdays, and from 10:00 a.m.–1:00 p.m. on weekends. No modems, please.

The Albany-Corvallis (OR) C64 Users Group has changed its name to the Albany-Corvallis Users Group. The address remains the same: c/o Nellie Stratton, 800 S. 19 St., Philomath, OR 97370.

The Newport Computer Club, in Newport, RI, has a new zip code. Correspondence should be sent to: Newport Computer Club, P.O. Box 1439, Newport, RI 02840-0997.

The bulletin board number published recently for the World Wide User Group in Tacoma, WA, was incorrect. The correct number for the 24-hour, seven days a week board is (206) 535-0574.

User Group Support From Commodore

User groups interested in joining "Commodore World," Commodore's new support network for user groups, should contact the company for further details: Commodore Business Machines, Inc., 1200 Wilson Dr., West Chester, PA 19380, Attn: User Group Coordinator.

New Listings

ALABAMA

Sequoyah Users Group (S.U.G.), Larry Henderson, 2301 Godfrey Ave. NE, Lot 4, Ft. Payne, AL 35967

East Alabama Users' Group, P.O. Box 249, Jacksonville, AL 36265

ALASKA

Sitka Commodore User's Group, P.O. Box 2204, Sitka, AK 99835

ARIZONA

User Group 64, Jeff Miller, 4937 W. Townley Ave., Glendale, AZ 85302

ARKANSAS

Commodore Computer Club of Pine Bluff, Paul Harper, president, 2811 Belmoor, Pine Bluff, AR 71603

Ark-La-Tex Commodore Users Exchange (CUE), P.O. Box 6473, Texarkana, AR-TX 75503

The Personal * Touch Commodore User Group of Hoxie and Walnut Ridge, Larry Simmons, c/o General Delivery, Walnut Ridge, AR 72476

CALIFORNIA

The 20/64 Group, 2170 W. Broadway, Suite 529, Anaheim, CA 92804-2446

Oceana-64 Commodore User Group, Sam Brooks, 1004 Plover Way, Oceanside, CA 92056

Civic64 User Group, Nathan Okun, P.O. Box 2442, Oxnard, CA 93034-2442

Computer Users Group of Ukiah (CUGU), Glen Glass, 9500 West Rd., Potter Valley, CA 95469

San Francisco Commodore Users Group, Roger Tierce, 278 27th Ave. #103, San Francisco, CA 94121

Commodore Users Group of Santa Cruz, ElliGould, P.O. Box 8068, Santa Cruz, CA 95061-8068

COLORADO

Rocky Mountain Commodore Club, Ray Brooks, P.O. Box 377, Aspen, CO 81612

Colorado PET Users Group, 676 S. Quentin St., Aurora, CO 80012

Ft. Collins C³, Judy DiFrancesco, 1625 Centennial Rd., Ft. Collins, CO 80525

CONNECTICUT

The Naugatuck Valley Commodore Users Group, James Thompson, Ray St., Waturbury, CT 06708

DISTRICT OF COLUMBIA

C-64 Commodore Club, 1947th HSG-MWR AF Rec SVCS, Pentagon, Washington, DC 20330

FLORIDA

Clearwater Commodore Club, Janice Steffens, pres., 1250 Cleveland, Clearwater, FL 33516

Commodore Users Group of SW Florida, P.O. Box 6399, Ft. Myers, FL 33911

St. Lucie Users Group (SLUG), attn: Fred Brock, P.O. Box 1298, Ft. Pierce, FL 33454

Suncoast Bytes Commodore Computer Club, George R. Stoll, pres., 3413 Scarsdale Trail, New Port Richey, FL 33552

64 Society, 4071 Edgewater Dr., Orlando, FL 32804

Commodore Stuff, Wade A. Guggino, 2260 17th St., Vero Beach, FL 32960

GEORGIA

Commodore Craze International, 1284 Lynn Dr., Waycross, GA 31501

HAWAII

Makai Commodore User Group (MCUG), P.O. Box 6381, Honolulu, HI 96818

IDAHO

GEM-64, Ken Rosecrans, 407 N. DeClark, Emmett, ID 83617

The Blackfoot Users Group (B.U.G.), Curtis Smith, pres., 417 S. 1200 West, Pingree, ID 83262

Best Western User Group (B.W.U.G.), Greg Edgar, Rt. 2, Box 285, Rupert, ID 83350

ILLINOIS

Tri-County Commodore Users Group, Kenneth Hall, pres., P.O. Box 564, Erie, IL 61250

IOWA

The Commodore User's Group of Clinton, Terry Voss, P.O. Box 743, Clinton, IA 52732

Crawford County Commodore Users Group, Kenneth Haydon, 519 N. 19th St., Denison, IA 51442

Iowa City Commodore Users Group (ICCUG), Phyllis J. Stumbo, P.O. Box 2412, Iowa City, IA 52244

KANSAS

Lawrence Commodore User's Group, P.O. Box 2204, Lawrence, KS 66045

KENTUCKY

Capital City Commodore Club (4*C), Terry Haines, Rte. 8, Jones Lane, Frankfort, KY 40601

Commodore Users Group of Madisonville, (C.U.G.O.M.), c/o Richard Byrd, P.O. Box 849, Madisonville, KY 42431

LOUISIANA

Lake Charles 64 Users Group, P.O. Box 226, Lake Charles, LA 70602

Commodore Users Group of Slidell (CUGS), Ed Burow, 1326 Sunset Dr., Slidell, LA 70460

MAINE

COM-VICS, P.O. Box 1541, Auburn, ME 04210

Your Commodore Users Group, Brunswick Chapter, Peter O'Brien, 20 Columbia Ave., Brunswick, ME 04011

Your Commodore Users Group, Mike Procise, P.O. Box 611, Westbrook, ME 04092

MARYLAND

Federation of Commodore User Societies, Inc. (FOCUS), P.O. Box 153, Annapolis Junction, MD 20701. *(Note: This is a federation consisting of 15 user groups in the VA/MD/DC area, not a club offering individual memberships.)*

Southern MD Commodore User Group, Tom Helmke, 6800 Kilarny St., Clinton, MD 20735

Commodore Users Medium—Baltimore Area Computer Club (CUM-BACC), P.O. Box 479, Reisterstown, MD 21136

MICHIGAN

Battle Creek Commodore and VIC Enthusiasts, David McKay, 1299 S. 24th, Battle Creek, MI 49015

Columbia Commodore Computer Club (C⁴), Barbara Herron, 133 Ernest, Brooklyn, MI 49230

Commodore Kids, Jason Shuster, 124 E. Maple St., Gladwin, MI 48624

Commodore Users Group of Durand, MI, Marla Romine, sec., P.O. Box 188, Lennon, MI 48449

O.C.U.G., Box 342, Rockland, MI 49960

MINNESOTA

Commodore Bemidji User Group, Gerald Manley, Rt. 3, Box 392, Bemidji, MN 56601

MISSISSIPPI

Marion County 64 Users Group, Todd Pounds, P.O. Box 709, Columbia, MS 39429

MISSOURI

Carthage Commodore Computer Club, Gary Baird, P.O. Box 842, Carthage, MO 64836

Commodore Hannibal Area Users Group (C.H.U.G.), Lynn Uhl Baumgartner, 3400 Geronimo, Hannibal, MO 63401

Joplin Commodore Computer User Group, R.D. Connely, 422 S. Florida Ave., Joplin, MO 64801

Association of Commodore User Groups (ACUG), Tony Ott, 10378 Coburg Lands, St. Louis, MO 63137

MONTANA

Cascade County Users Group, Jerry Spurbeck, P.O. Box 739, Great Falls, MT 59403

NEBRASKA

Platte Valley Commodore Users Group (PVCUG), Jim Parks, 1720 O St., Gering, NE 69341

Lincoln Commodore Users Group, P.O. Box 30655, Lincoln, NE 68503, attn: Secretary

NEVADA

C.A.T. F.U.N., P.O. Box 2155, Fallon, NV 89406

Silver State Computer Users Group, P.O. Box 81075, Las Vegas, NV 89180

NEW JERSEY

South Jersey Commodore User Group, Fred Herrmann, P.O. Box 4205, Cherry Hill, NJ 08034

C-64 East Brunswick Users' Group (C.E.B.U.G.), Brian Serle, 346 Ryders Ln., East Brunswick, NJ 08816

NJ Commodore 64/Computer Users Group, Emilio A. Garcia, 11 Cheerful Pl., Highlands, NJ 07732

L & L Commodore 64 User Group, Austin J. Levine, One Longstreet Rd., Manalapan, NJ 07726

Commodore Software Exchange, Box 281, Pompton Plains, NJ 07444

Jersey Shore Commodore Users Group, Bob McKinley, 89 Stratford Rd., Tinton Falls, NJ 07724

NEW YORK

Astoria Commodore Users Group, Brian Kuhn, 26-23 Crescent St., Astoria, NY 11102

Bay Shore Users Group, Mowbray St. Cafe, 82 W. Main St., Bay Shore, NY 11706

B.N.Y. Commodore User Group, Kyle Slovensky, 71 Head of Neck Rd., Bellport, NY 11713

Bay Shore/Brightwaters Commodore 64 Users Group, c/o Bay Shore/Brightwaters Public Library, 5 South Country Rd., Brightwaters, NY 11718

Commodore & VIC Enthusiasts (CAVE), Bob Frost, P.O. Box 10, Holcomb, NY 14469

Commodore Users Group of Massena (C.O.M.A.), Massena Computer Center, Harte Haven Plaza, Massena, NY 13662

The New York City VIC-20/C-64 User Group (Citigroup), Joycelyn Woods/Allen Hobbs, 436 E. 69th St., New York, NY 10021

Frisco's Users Group, Frisco Baum, 41 Sunset Dr., Ossining, NY 10562

Riverhead Commodore Club, Marge Lawrence, 330 Court St., Riverhead, NY 11901

Commodore SIG, Computer Club of Rockland, Peter Bellin, P.O. Box 233, Tallman, NY 10982

Commodore User Group of Westchester, Ben Weyer, P.O. Box 1280, White Plains, NY 10602

NORTH CAROLINA

Unifour Commodore Users Group, P.O. Box 9324, Hickory, NC 28603-9324

OHIO

Bowling Green State University User Group, Chris Hunt, 519 Ridge #18, Bowling Green, OH 43402

Commodore Preference Users Connection (C.P.U. Connection), Danni Hudak, P.O. Box 42032, Brook Park, OH 44142

The Cincinnati Commodore Computer Connection, Ted Stalets, 816 Beecher St., Cincinnati, OH 45206

Southwestern Ohio Commodore Users Group (S.W.O.C.U.G.), P.O. Box 46644, Cincinnati, OH 45246

UCOM-64, 340 Tangeman University Center, Mail location 136, University of Cincinnati, Cincinnati, OH 45221

Youngstown C-64 User's Group, Charles Longbottom, 209 N. Pearl, Columbiana, OH 44408

The South East Cleveland Commodore Crazies User Group (S.E.C.C.C.U.G.), Jim Hersh, P.O. Box 37116, Maple Heights, OH 44137

C.A.M. Area Users Group, Loren Hines, 334 Fairview SE, North Canton, OH 44720

OKLAHOMA

Greater Oklahoma Commodore Club, P.O. Box 96751, Oklahoma City, OK 73143

Stillwater C-64 Users Group, 3124 N. Lincoln, Stillwater, OK 74075

OREGON

Lane County C-64 User's Group, P.O. Box 11316, Eugene, OR 97440

Springfield Commodore User's Group, 4400 Franklin Ave., Ste. #1443, Eugene, OR 97403

Springfield Commodore User's Group, Mark Joerger, 5324 B St., Springfield, OR 97478

PENNSYLVANIA

Butler Commodore 64 User Group, P.O. Box 2408, Butler, PA 16001

Environmental Protection Agency (E.P.A.) Commodore Users Group, Edward H. Cohen, 1712 Aidenn Lair Rd., Dresher, PA 19025 *(Note: Open to all federal government employees and their families)*

Blue Juniata Commodore Users-Group, Clifton H. Bell, Jr., 107 Washington Ave., Lewiston, PA 17044

P.C.U.C., C. Rhoads, 1338 Lynn Dr., Pottstown, PA 19464

RHODE ISLAND

Burrillville Commodore Users Group, David Migneanlt, 28 Cherry Farm Rd., Harrisville, RI 02859

SOUTH CAROLINA

Commodore Computer Club of Columbia, P.O. Box 2775, Cayce-West Columbia, SC 29171

CAZZUG 64, 100 Oak Park Dr., Mauldin, SC 29662

TENNESSEE

Clarksville Commodore Users Group, P.O. Box 67, Clarksville, TN 37040

Dungeons and Dragons User's Group, Glenn Halliburton, Rt. 1, Box 28A, Cumberland City, Erin, TN 37050

Greeneville Computer Home Users Group, Harry J. Porter, Rte. 8, Box 138-T, Greeneville, TN 37743

Tri-Cities Commodore Club, Vickie Davis, c/o Computer Corner, 114 Springbrook Dr., Johnson City, TN 37601

TEXAS

Abilene Cursor Control, Roman Reynolds, P.O. Box 6261, Abilene, TX 79608

El Paso Commodore User Group (EPCUG), Jesse Moore, 1736 Dean Martin Dr., El Paso, TX 79936

Meadows User Group (MUG), David Whittington, 11923 Scottsdale, Meadows, TX 77477

Middand Commodore Users Group, Dave Taylor, P.O. Box 7355, Midland, TX 79708

Commodore User's Group of Odessa (CUGO), Charlotte Holley, 2904 N. Alleghaney, Odessa, TX 79764

Society of Computer Owners and P.E.T. Enthusiasts (SCOPE), Allen Yoder, P.O. Box 3095, Richardson, TX 75083

Interface Computer Club, Christopher Bordovsky, pres., 7532 Triple Oaks, San Antonio, TX 78263

UTAH

Cache Valley Commodore Users Group, Cecil Claspell, 380 W. 550 North #4, Logan, UT 84321

Payson Area Commodore 64 Users Group (PAC 64), Mark Shepherd, P.O. Box 525, Salem, UT 84653

VIRGINIA

Dale City Commodore Users Group, Inc., P.O. Box 2265, Dale City, VA 22193-0265

Piedmont Users Group, David Gray, 135 Beverly Rd., Danville, VA 24541

Capitol Area Commodore Enthusiasts, c/o M. Yoder, 6512 Truman Ln., Falls Church, VA 22043

Commodore User Group, Douglas A. Mullins, Box 625, Richlands, VA 24641

Commodore 64 Computer Users Group of Richmond, Virginia, R.S. Armstrong, Jr., sec., P.O. Box 9078, Richmond, VA 23225

NASA Commodore Users Group, c/o Harris Hamilton, 713 York Warwick Dr., Yorktown, VA 23692

WASHINGTON

Pacific Northwest Commodore Club, Jeff Jones, 17214 3rd Ave. SE, Bothell, WA 98012

Longview Commodore Users Group, Stephen Jones, 626 26th Ave., Longview, WA 98632

Spokane Commodore Users Group, P.O. Box 13201, Spokane, WA 99213-3201

WEST VIRGINIA

Elkins Area Commodore Users Group, Chris Lester, P.O. Box 2381, Elkins, WV 26241

Lewisburg Commodore User Society, David L. Haynes, 17 Silo Sq., Lewisburg, WV 24901

WISCONSIN

Milwaukee Area Commodore Enthusiasts (M.A.C.E.), P.O. Box 183, Greendale, WI 53129

Fond du Lac Area Commodore Users Club, Dick Lendl, 1504 Shelley Ct., North Fond du Lac, WI 54935

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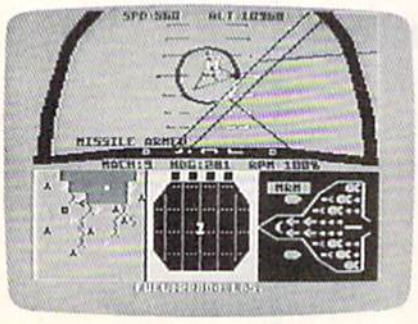
F-15 Strike Eagle

One of the problems with flight simulators as a whole is that, no matter how good they are, they tend to be unexciting. This is not their fault; it simply reflects the fact that nothing much happens in a simulated airplane. Microprose Software's *F-15 Strike Eagle* for the Commodore 64 solves this problem by putting you in the cockpit of an F-15 jet fighter, then threatening your life with enemy aircraft, radar-homing missiles, SAM (surface-to-air missile) sites, and the ever-present danger of crashing while trying to avoid them all.



The screen display is a realistic view from the cockpit. Pitch lines indicate your rate of climb or dive, as well as your degree of turn. Fine-lined grids—"reticles"—show the location of enemy aircraft and also allow you to set up bombing runs. Other indicators on the many-featured display include altimeters, heading indicators, a missile-designation box, and a mach indicator, to name just a few. As in any detailed flight simulator, flying the aircraft takes practice, but in *F-15 Strike Eagle* flight is not frustratingly complex. More importantly, it seems to feel just right.

The rest of the controls take more time to master, but this is as it should be since these are the heart of the program. Flight is handled by joystick, but weapons and speed controls are sensibly laid out on the keyboard. Pressing B arms your F-15 for a bombing run (a real challenge, by the way); E activates electronic countermeasures to jam and decoy radar-homing missiles; F releases a flare, which can fool a heat-seeking missile; S arms your craft with a short-range missile (1/2- to 10-mile distance), and M with a medium-range missile (10–40 miles). There is even a bail-out option if the mission goes badly, with a message telling you how you fared after landing.

F-15 Strike Eagle contains seven missions of increasing difficulty. In "Libya 1981," the introductory mission, you bomb several SAM sites, airfields, and a command center, all the while avoiding a MiG-21, a MiG-23, and an Su-22 with a heat-seeking missile. Mission 3, "Haiphong 1972," is a night bombing mission against a SAM site, this time against the threat of radar-homing missiles. Mission 7, the most demanding scenario, asks you to bomb several targets while evading a MiG-23, an Su-22, and several high-performance radar-homing and heat-seeking enemy missiles. All the scenarios are extremely challenging, and your skill as a pilot must increase if you are to succeed at each successive mission.

F-15 Strike Eagle is an excellent package for anyone interested in learning about flying a modern fighter under the threat of being shot down any number of ways. More intense than a straight flight simulator, it combines the basic realism of a flight simulator with the tension of a good arcade game. I highly recommend it for anyone with an interest in either.

—Neil Randall

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On-Court Tennis

Tennis fans can now serve, volley, lob, and even double fault in this fast-paced computer game for the Commodore 64, *On-Court Tennis* from Gamestar. You'll be surprised at the flexibility and subtleties of this colorful and challenging program.

On-Court Tennis is not an easy game to master at first. The joystick controls such a variety of shots that you'll need to play a few games before you begin to feel comfortable with the action. Once you learn the moves, however, you'll find them easy to use and remember. You'll also discover that this is one of the most enjoyable games in your computer collection. As with most sports simulations, game play is more fun against a human opponent. But *On-Court Tennis* is better than many programs of this type in letting you have a fair chance against the computer. The program supports two-player and human-computer choices. You can even pick up pointers watching two computer-directed players battle it out.

Your options for different types of players, shots, and strategies are extensive. Choose from among four different players—who bear strong resemblances in names and playing styles to real-life pros Bjorn, John, Jimmy, and Ivan. Play on a fast grass court, a predictable hard surface, or the slower clay court. Move your shots around, fire a hard serve down the line, and hit slices, flat shots, topspins, lobs, drop shots, and smashes. All of these variations are accomplished with joystick movements and the fire button.

Your computer controls the movements of both players relative to the position of the ball. But you're in charge of all the shots. Timing is crucial as you watch the movement of the ball and its changing shadow. Appropriate sound effects and impressive three-dimensional graphics add to the game as well. Another nice touch is the way in which your computer opponent will vary its playing level to give you a good match. If you're weak, your opponent develops some weaknesses of its own.

Only NRI teaches you to service and repair all computers as you build your own 16-bit IBM-compatible micro

As computers move into offices and homes by the millions, the demand for trained computer service technicians surges forward. The Department of Labor estimates that computer service jobs will actually *double* in the next ten years—a faster growth than any other occupation.

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- ☐ Industrial Electronics
- ☐ Basic Electronics
- ☐ Telephone Servicing
- ☐ Small Engine Servicing
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—Kevin Martin

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Cave of the Word Wizard

Schools today, at least those which use computers, are filled with instructive software. But there seems to be a sense that students will find it delightful simply because it appears on a computer. This just isn't so, as anyone with a school-aged child knows; thankfully, teachers and software designers alike are beginning to realize it as well.

Cave of the Word Wizard is one program which delights as it instructs. The game is a romp through several levels of a dungeon-like cave, with ladders to climb up and creatures to avoid. Your goal is to find four crystals and get back out of the cave. You begin the game by choosing a character (either Becky or Mark) and one of four levels of difficulty, then you move through the cave by jumping over holes, rocks, and such things as spiders and snakes. If you trip over a rock or allow a creature to touch you, you use up a bandage. You start the game with five bandages, and receive one periodically if you spell the words correctly. If you run out of bandages, the game is over. The game plays much like *Pitfall*, except that it's easy enough for children as young as kindergarten age. The graphics are colorful and entertaining.

No matter how fun the game itself is, though, the spelling portion is even more enjoyable. This game talks to you! As you walk and jump through the cave, every so often the Word Wizard will appear out of nowhere, freezing you in place and commanding you to spell a word. He booms out his request in a deep, remarkably clear voice, and you must spell the word (by typing it). If you didn't hear the word, he repeats it for you. If you spell it correctly, he responds with "Fantastic," "Keep up the good work," or one of several other phrases, and his voice even sounds enthusiastic. If you're wrong, he gently informs you of the error, displays the word on the screen, and asks you to type it in before continuing. There's nothing at all frustrating about the procedure, and next time you see the word you're likely to spell it correctly. In game terms, correct spellings give you extra bandages, while incorrect spellings consume energy in your flashlight.

Since *Cave of the Word Wizard* is an educational product, it must be judged for its ability to educate. I can attest to its excellence in three ways. First, my seven-year old daughter plays it frequently, and she almost never spells the same word incorrectly twice. Second, when she showed it to her class, her teacher immediately bought a copy for the school, and currently all the grades are using it.

Third, I decided late one night to try my hand at the game's most difficult word list (there are ten lists), confident that I would have no problems since spelling has always come easily to me. The Wizard led off with three words I handled easily (although "supercilious" caused me a moment of thought), then downed me on three straight wrong answers. (Naturally, I denounced the game as ridiculous, claiming that no one really cares if "inoculate" only has one "n.") *Cave of the Word Wizard* is sensational if only for the Wizard himself. Many educational products hide the lesson inside the game; Timeworks has managed to make the student play the game in order to get to the lesson.

—Neil Randall

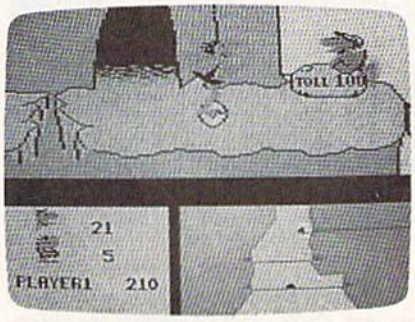
Timeworks, Inc.
444 Lake Cook Rd.
Deerfield, IL 60015
$24.95 (disk)

B. C. II: Grog's Revenge

With the notable exception of only a few movies, sequels are seldom as good as the original—and usually they're not even close. The same holds true with software sequels, again with certain exceptions and those usually in the fantasy and adventure game genre. However, on rare occasions, a truly good arcade game is succeeded by an equally good sequel. Sierra On-Line has provided just such an occasion with the release of *B. C. II: Grog's Revenge*.

B. C.'s Quest for Tires was one of the first graphically exceptional games that didn't rely solely on graphics to carry it, having a simple but challenging game format to go along with its cartoon-like animation. Thor, the hero of *Quest for Tires*, has returned in *B. C. II: Grog's Revenge* and is now searching not for Sweet Chick, but for the meaning of life. An easy task, considering that the only things standing in his way are wheel-munching Tiredactyls, greedy attendants collecting tolls, dangerous caves, twisting mountain paths—and the clam-loving monster, Grog.

Grog's Revenge brings with it not only the central character of its predecessor, but also the delightful graphics and animation that made the first B. C. game so notable. Further similarities exist in that the game presents the player with a single objective that is, at first, deceptively simple. You must maneuver Thor, transported by his unicycle vehicle, up three multileveled



mountains, collecting clams (which are used to pay the tolls required to advance to the next mountain) as you go. However, it just isn't as simple as it appears. Plenty of sound strategy is required in order to outwit Grog and get him off your track, and an equal amount of hand-eye coordination is necessary to manipulate Thor over, under, and around the various obstacles that litter the mountain trails and fill the dark caves.

To reveal too much about the little delights that add to both the play and the aesthetics of *Grog's Revenge* would be to deprive the buyer of some of the enjoyment of playing a game for the first time. Suffice it to say that *Grog's Revenge* leaves the gamer hoping for a sequel to the sequel.

—James Trunzo

Sierra On-Line, Inc.
Coarsegold, CA 93614
$34.95 (disk)

Legionnaire

Chris Crawford's *Legionnaire* for the Commodore 64 is, as computer war games go, very unusual. First, it is a realtime simulation. Second, it takes less than 20 minutes to play. Third, its subject is tactical warfare in the age of Caesar. Realtime map-oriented war games are rare in themselves, 20-minute wargames even more so, and tactical war games from the Roman era practically unheard of.

Despite its uncommon features, or perhaps because of them, *Legionnaire* is a very good game. You begin by specifying how many legions you wish to control (between one and ten), and then select the two barbarian tribes who will oppose you. The tribes are fictional, but each possesses characteristics appropriate to the historical era. The computer then puts your legions and their enemies on the map. Using only the joystick, you scroll around the map (it occupies several screens in total) and formulate an overall plan for the battle. The two enemy tribes begin separated, with your legions somewhere between.

Trees and multilevel slopes are the only terrain features, but they are as vital to your defense as they were historically. You must make full use of the height advantage offered by the slopes, and the strategic location of the trees. As the battle progresses, you must try to keep your legions in combat formation, with infantry in the middle and cavalry—the main offensive force—on the flanks. You represent the legion commanded by Caesar, and if Caesar dies, the game is over. Otherwise, the game ends when all the units on one side are eliminated.

As Caesar, you command your legions to march. All play is joystick-controlled and, after a few practice games, very fluid. Using the joystick, you "pick up" a legion with the on-screen cursor, then plot its movement up to eight "spaces." Quickly repeating this for each legion, you then scroll around the map watching the battle develop. After each legion reaches its ordered destination, it will stop and await further orders. Frequently it will be necessary to revise or cancel orders as the barbarian strategy unfolds, or as the legions become fatigued and losses mount. Enemy units automatically fight each other when they try to enter the same "square."

The manual is well-written and informative, with tactical hints, descriptions of the strengths and weaknesses of each tribe, and historical notes. The program is true to its objective of a fast-moving game which forces you to

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combine your own strategic thinking with historical legionary tactics. With terrain, battle formations, and the enormous effects of fatigue as your main considerations, *Legionnaire* is a true learning experience. And with its short playing time and smooth action, it is highly entertaining as well.

—*Neil Randall*

Microcomputer Games
The Avalon Hill Game Company
4517 Hartford Rd.
Baltimore, MD 21214
$25 (cassette), $30 (disk)

Adventure Writer, Dialog, And *The ELF System*

The Codewriter Corporation (formerly Dynatech) literally made its name with its product called *Codewriter*. That master product has now spawned smaller products, each designed for a specific type of program. We'll look at three of them here, each of which allows you to design a program without a knowledge of programming. After you've designed it, the master program generates your specific program, which you can then load and run independently.

Dialog allows you to design interactive screens, to carry on a dialog with the reader. Primarily, it's useful for creating educational programs geared towards a specific class or a particular student. In addition, though, it can be used to create any type of program in which the reader must respond, such as quizzes and trivia-type games. In fact, to test the program, I redesigned *Trivial Pursuit* so the reader could choose categories without rolling dice and would score a varying number of points depending on the difficulty of the question.

Each screen either instructs the reader to do something or asks a question. The questions are of three types: true/false, multiple choice, or fill-in-the-blanks. When you create a dialog, you instruct the program how to respond to the reader's answers. For instance, in a true/false question, you may want something different to happen depending on which answer the reader chose. *Dialog* lets you do that and much more.

Each dialog you design consists of an unlimited number of chapters. Each chapter contains 15 pages, and each page has two parts, the parameters page and the text page. On the text page you write whatever the user is to read—instructions or questions. After filling in the chapter's 15 pages (you don't have to use all 15), you save that chapter and design the next (if needed). By linking chapters, you can create a dialog of unlimited size.

The parameters page is the heart of *Dialog*. Here you tell the program what you want it to do. You choose the type of page you are designing (true/false, etc.), how many points (if any) you want awarded for a correct answer and subtracted for a wrong answer, the messages which will accompany each answer, and even prompt and help messages to guide the reader along. More importantly, you guide the program from one page to another. For example, you might specify that a correct answer will send the reader to page 14, while an incorrect answer will send him to page 15 (perhaps a less difficult new question). *Dialog* also allows you to send the reader from the current chapter to a different one. In this way, you can tailor the quiz to the reader's individual needs, or, if you are creating a game, to his wants.

After you've created the dialog, you save it in a three-step process. First, you save the dialog. Next, you load the boot program from the master disk and save it to your new disk. Last, you load the BASIC compiler from the master and save it to your disk. When this is done, you can load and run your new, compiled program without the master.

The *Dialog* manual is well-written and instructive. It guides you step-by-step through a complete dialog, then gives somewhat more technical details on each of the program's functions. Although there is nothing difficult about *Dialog*, it is open-minded enough to allow a great number of different types of applications. Teachers in particular will find it useful. Of all the Codewriter programs reviewed here, *Dialog* is the easiest to use, and this only adds to its overall excellence.

The ELF System is less easy to use, but it compensates with greater versatility. Its purpose is to let you design a program which, as the manual suggests, "only you and maybe one other person in Alaska" would ever need. It resembles a spreadsheet more than a database (in fact it does not provide the cross-referencing feature of databases), but it is more simply an open-ended data manipulator. The excellent manual contains a tutorial in which you set up an expense report program, the type of program it's designed for. It would be equally applicable for small sales reports and as a small grades program for teachers.

The ELF System allows you to design the screen exactly as you want it. You can choose to work within a *paging* format or a *scrolling* format. *Paging* gives you eight separate screens to work with, each 40 columns by 22 rows. You use *paging* when the program demands several sub-sections. For example, the expense report has one page for each type of expense (travel expenses, miscellaneous expenses, mileage report). A grades program might have a separate page for each assignment. *Scrolling* allows one large report, 80 by 88 columns. It's used for a program needing only one large section rather than several subsections.

Designing a screen will be familiar to anyone who's used a database or spreadsheet, but experience is not necessary. Each field is delineated by a symbol depending on its type. A dollar sign indicates a money field, a number sign a numeric field, and an "@" an open field. These symbols let the program know how you want it to manipulate the information in the fields. An *ELF* program can handle up to 700 fields, 250 which you enter from the keyboard, 200 in which the computer does the calculations, and 250 label and repeat fields.

The program's sophistication shows when it's time to manipulate information. You print out the screens you've designed (a printer is recommended but not essential), and each field is numbered. Then you command the program to perform mathematical calculations by combining fields in several ways. There is even an open window to BASIC for those who prefer to work on the calculations directly. This part of the design is the most difficult, but using it properly will give you a great deal of control over your programs.

Once the program is complete, save it to an applications disk. Doing so is easy, and it's great fun watching the code flash by on the screen. At such moments you can easily justify spending the money on *The ELF System* simply by figuring out how long it would have taken you to write the code.

ELF programs are saved in BASIC. Unlike *Dialog, The ELF System* does not come with a BASIC compiler, but if you use ELF frequently, you'll probably want one to speed up execution. Having the program saved in BASIC is an advantage for anyone familiar with programming, though, as you can alter the program even further to suit your needs. For a nonprogrammer, *The ELF System* does the work for you; for a programmer, it will eliminate much of the tedium of screen and field creation.

Different from both of these products, but also a program generator, is *Adventure Writer*. This product is

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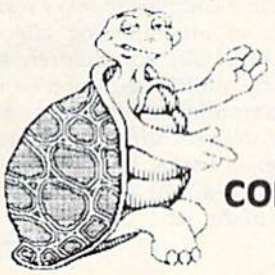

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*Programs will come on 2 disks or 1 double sided disk -- each disk includes COMAL.
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designed for those who enjoy text adventures (such as Infocom's) but want to write their own. Where *Dialog* has the educator in mind, and *The ELF System* the home computerist, *Adventure Writer* appeals to the storyteller and puzzle-maker. In its extensive range of special features, *Adventure Writer* is the most impressive of the three products.

To create an adventure, you construct a database and then tell the computer how to control it. The database contains the descriptions of the locations and the objects, as well as the game's vocabulary and the messages certain actions will invoke. Nicely, all of this is left up to you.

You have complete control of eight separate "tables" (or sections) within the database. One allows you to describe each location (each with up to a screen of information). In another you describe each object, again allowing extensive description. A third is used to establish where each object begins the game (objects can be picked up and carried, if you wish). In the Vocabulary Text Table, you insert the words you want available to the player; the master program provides a good core of vocabulary, but you will want to add to the list. The Message Text Table allows you to create the messages which will follow certain actions, and the Movement Table determines how the locations are interconnected. For example, there may be three exits from the living room (East, West, South) but only one from the torture chamber.

Two other tables, by far the most difficult to create, form the core of your adventure. The Vocabulary Action Table provides the player with the ability to play the game. It controls what happens when the player enters a command. For example, INVENTORY (or a synonym) will list what the player is carrying, TAKE THE FLASHLIGHT will cause the object (flashlight) to become part of the inventory, etc. The program works on the principle of a two-word command (e.g., GET FLASHLIGHT), but the player may type as many words as he wishes; words not in the vocabulary are simply ignored.

The Status Table tells the computer how to handle the player's actions. Each time the player enters a command, the computer checks the Status Table to see if anything is supposed to happen. For example, you may want night to fall on turn 15, or the player to feel the effects of a poison 31 turns after eating the food and die 10 turns later unless he finds the antidote, etc. The Status Table is extremely flexible, and it lets you control the adventure entirely.

Adventure Writer will allow you to create 252 location descriptions, 255 object descriptions, 255 messages, and 254 entirely separate vocabulary entries (a word and all its synonyms count as one word only). The adventures are written in machine language, so they play very quickly.

Once again, an excellent manual guides you through the system by way of a tutorial, which helps you create a mini-adventure, then takes you back into it to add a good deal of sophistication. Once finished, you should be ready to try one on your own.

There is not nearly enough space here to mention all the extra features in *Adventure Writer*. Suffice it to say that you will be able to create some very complex adventures. Your parser will never be as sophisticated as some commercially available text adventures, but you can make up for that if you can write a good story. The story, after all, not the game system, is what adventures are all about.

Codewriter has provided a valuable service to those interested in designing their own programs. If you're a programmer, you can use them to eliminate some of the drudgery of designing, then modify them to suit you. But for nonprogrammers they're even more valuable. The Codewriter products make the computer work for us, rather than the other way around. If you're creative in any way, you can now use your computer to prove it.

—Neil Randall

Codewriter Corporation
5605 West Howard
Niles, IL 60648
$40 each (disk)

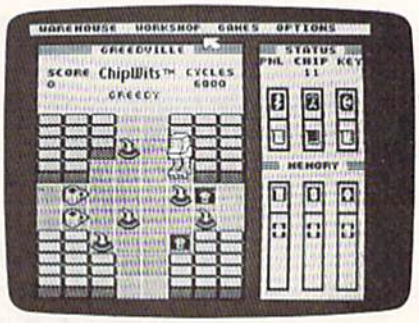
Chipwits

Combining educational value in an entertaining program is a good way to describe *Chipwits* from Epyx. This "edutainment" package is a game in which you program on-screen robots to explore rooms and mazes filled with different kinds of objects. As you train the robots to "think" for themselves, you can sharpen your analytical skills and learn some of the basics of computer programming.

Chipwits lets you create, edit, test, and delete your robots, debugging them as you go along. There are also eight adventure games included which you can play with the robots you've put together. Your options are presented through pull-down menus, and selections are made either by joystick or a Koala Pad.

In each of the mazes, your Chipwits must avoid colliding with walls and stepping on bombs while searching for food to keep energy levels high. Every Chipwit needs a program, or set of instructions, to tell it what to do. A Chipwit's program consists of a set of 40 "chips" on its main panel (a five-by-eight matrix) and nine subpanels. The instruction chips are executed in an order based on their position and connections. Program control is passed from one chip to another through "output wires."

The various actions to be carried out by a Chipwit are represented by symbolic pictures, or what Epyx calls IBOL (Icon-Based Operating Language). A Chipwit can only follow the program created for it, but that set of instructions may be quite sophisticated. Different operators such as Look, Smell, and Feel are used to program each Chipwit, and these operators are used in conjunction with any of ten different parameters. A true-false test is used with the operators to make decisions.



For example, suppose you program the Chipwit to test for an oil can (one of its favorite snacks). If the robot detects an oil can, a branching function could be used to lead the Chipwit to pick it up and eat it. If the original test (to find an oil can) proves false, your next instruction might be to look for a bomb and destroy it before moving to the next square in the game grid.

A Chipwit may also be programmed to move or turn in any direction, sing, go to a subroutine, choose a random direction, and other options. There is an advanced programming feature which allows a Chipwit to remember numbers, moves, and objects.

Chipwits is an excellent game, both in concept and implementation. The use of pull-down menus and icons makes the human-computer interface unobtrusive. There are a number of features that combine to make learning the basics of programming effective and fun, especially for children accompanied by adult supervision or receiving programming instruction. Although Epyx doesn't offer an intended age range, it seems to me that *Chipwits* might be a little too complex for children under ten.

—Arthur Leyenberger

Epyx, Inc.
1043 Kiel Court
Sunnyvale, CA 94089
$29.95 (disk)

also worth noting

White Lightning

White Lightning is a Forth-based development package for the Commodore 64. Although Forth is a low-level language, in some ways closer to machine language than to BASIC, it is *extensible*, meaning programmers can create their own new high-level commands. In effect, you build up your own customized language. In addition to the standard Forth vocabulary, Oasis has included a high-level graphics development system which includes over 300 new commands, offering much of the speed and power of machine language with less effort.

The documentation is excellent if you are an experienced Forth programmer. Newcomers to Forth might find it a bit technical (there are several good introductory books available for those just starting out with Forth). The software developed with *White Lightning* can be used—and sold—independent of this development system. Oasis Software also markets *BASIC Lightning*, a BASIC-level graphics development system, and *Machine Lightning*, an advanced machine language system. Each package comes with software on disk, a manual, and a user supplement of extended explanations and examples. All three are recommended for the serious programmer.

Oasis Software
377 Oyster Point Blvd.
Unit 15
San Francisco, CA 94080
White Lightning—*$49.95*
BASIC Lightning—*$39.95*
Machine Lightning—*$84.95*

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Electronic Arts
2755 Campus Dr.
San Mateo, CA 94403
$32.95

Six-Gun Shootout

It's your gunslingers against the other player's (or computer's) in this strategy game based on the Old West frontier of the late 1800s. An abundance of scenarios—the OK Corral, Billy the Kid, plus eight more—and the ability to build your own characters' capabilities make this a game you can play for a long time without repeating yourself. *Six-Gun Shootout* is as violent as the Old West, but the emphasis is on your strategic planning. Arm your men and set up the various gunfights, battles, and campaigns. Combat rules in the game are realistic—only six bullets in a six-shooter, for example. Documentation is excellent, although it may be a bit complex for youngsters. On the other hand, you can enjoy this game without a complete knowledge of all the rules.

Strategic Simulations, Inc.
883 Stierlin Rd.
Building A-200
Mountain View, CA 94043-1983
$39.95

Wishbringer

This is an excellent all-text adventure game for beginners, providing an easy initiation into the world of adventuring without presenting insurmountable obstacles from the start. Each puzzle becomes progressively more difficult, but no illogical solutions are employed. The game may be played at two difficulty levels—using magic as an aid in solving the mystery, or deciphering the puzzles using logic and deduction. *Wishbringer* includes the usual clear, concise Infocom text. A very enjoyable game.

Infocom, Inc.
55 Wheeler St.
Cambridge, MA 02138
$34.95 (disk)

Competition Karate

This action/role-playing game allows any number of players to create teams of martial arts fighters and develop individual fighters as they train in the dojo, engage in sparring matches, and ultimately face the challenge of real combat in the arena. It can be played against another opponent or against the computer. Individual players begin as awkward white belts and through training and competitive matches improve their abilities until they are awarded the legendary red belt. The heart of *Competition Karate* is, of course, the tournament combat. Here fighters compete against opponents in similar belt classes, throwing kicks and punches through the use of paddles or joysticks (recent versions allow keyboard input).

Competition Karate is a challenging and enjoyable product and one that will be especially appreciated by those with an interest in the martial arts.

Motivated Software Inc.
80 Rancho Dr.
Mill Valley, CA 94941
$34.95 (disk)

Summer Games II

Following on the heels of its successful *Summer Games* arcade-style action package, Epyx has released a sequel every bit as good as the original. Eight new Olympic events are included: rowing, triple jump, javelin, high jump, fencing, cycling, kayaking, and equestrian contests. You can play up to seven opponents in each event, or play against the computer. The crowd noises, smooth and colorful graphics, and carefully designed joystick control help make this an exceptionally good action game. Contests in *Summer Games II* are slightly less difficult than in its predecessor, but playability, animation, and graphics are improved throughout.

Epyx, Inc.
1043 Kiel Ct.
Sunnyvale, CA 94089
$39.95

Tales Of Me

With *Tales of Me*, any child—with occasional help from an adult—can write, edit, print, illustrate, and bind a complete personalized hardcover book. The finished product contains facts about a child and his or her friends, family, pets, and adventures. And what you end up with are very entertaining stories which almost any child—ages 7–14—will enjoy. *Tales of Me* consists of four chapters, with the author choosing who the hero/heroine will be. Not only is the program fun for children, it also reinforces reading, spelling, and writing skills.

Other programs in Woodbury's PlayWriter series include *Adventures in Space*, *Castles and Creatures*, and *Mystery!*. Each set only contains enough material to make one book. If the user wants to create more, a refill kit ($9.95) can be purchased from Woodbury. (In conjunction with Grolier Electronic Publishing, Woodbury will sponsor a national writing contest this fall with entry blanks handled through schools and retailers.)

Woodbury Software
127 White Oak Lane
CN1001 Old Bridge, NJ 08857
$39.95 (disk)

Charles Brannon
Program Editor

By now, many of you have seen or even own a Commodore 128 (for a hands-on review, see "Inside the 128," in the June 1985 issue). This successor to the 64 incorporates a 64 mode that runs all 64 software, and can use virtually all 64 hardware and peripherals, making it easy to upgrade to the 128, and giving first-time Commodore owners instant access to the large 64 software library.

To use the expanded keyboard, full 128K memory, and RGB color 80 columns, you need to run in the true 128 mode. The 128 mode is a real upgrade of the 64, but has a familiar feel to it. The same VIC chip is used to display 40 columns, bitmap graphics, and sprites, so the screen even looks the same, except for Commodore's new power-on color choice—light green text on a dark gray screen with a light green border. You need an RGB monitor (or a monochrome monitor with an adapter cable) to use the full-color 80 column mode, which is entirely independent of the 40-column screen supported by the VIC chip.

The new BASIC 7.0 is one of the most feature-packed BASICs I've seen. To learn about the BASIC, I wrote a simple *Frogger*-type game, taking advantage of the automatic sprite-movement feature supported by BASIC. It seemed that if the game were designed around the special BASIC features, I could get machine-language animation and playability. I was half right. The game, "Litter Patrol," will run only in BASIC 7.0 in the 128 mode, but could be converted to run on the 64 with the Super Expander.

Playing Litter Patrol

Litter Patrol uses a joystick plugged into port 2. A joystick plugged into port 1 still interferes with the keyboard in 128 mode.

The goal of Litter Patrol is quite simple: Pick up all the bits of litter and fill all the trash cans. Your heavy-duty (but sluggish) truck can move in eight directions almost anywhere on the screen. The cars, zooming back and forth on the highway, are constantly throwing out bits of trash, which appear as bright dots (periods) on the road. Move the claw of your truck over the trash bit, and press the fire button. Your truck picks up the litter.

Now move the claw over any trash can (which looks like a hollow circle), and press the button. The trash drops in the can, and the lid closes. Each trash can can only hold one load of trash, so it turns solid to show you not to use it again. After you've filled all 12 trash cans, you proceed to the next level. The cars go faster, and you move more slowly—quite a handicap.

The game would be easy (and pointless) if not for the zooming cars. Dodging them provides the entire challenge for the game. If you get hit, you lose your trash bit—if you're carrying one—and one truck. The game ends when you lose all five trucks. Just to make things more interesting, you have a time limit, represented by a blue bar at the top of the screen. The bar drops by one segment every two seconds, so you have about 80 seconds to complete each level. The game ends instantly when you run out of time.

There are some safe zones for your truck where you can't be hit, medians between each roadway, and at the top and bottom of the screen. There's a secret safety zone, too, but I'll leave its discovery up to you. You must move your truck halfway onto the roadway to fill a trash can, though. This makes a tough game even tougher. The hardest part of writing a game is in making it challenging but not too frustrating. Almost any game gets easier with practice, but an unfair game doesn't encourage you to try.

The Time Eaters

Litter Patrol is fun to play, but a caveat is in order. I didn't intend to program the game for its own sake, but for its educational value. Keeping in mind that the game is in BASIC, you may find it too slow. The main problem is the automatic sprite movement. The cars move by themselves once set up, but they are time eaters, stealing time during the interrupts from the mainline BASIC program. More about this below.

We'll take a walk through the program listing. The program is too big for a line-by-line analysis, so we'll tackle it in chunks. You might find the program listing and put your thumb there for cross-reference purposes.

Lines 100–190: The GRAPHIC 0,1 command switches to the 40-column text screen and clears the screen. The COLOR 0,12 statement sets the background color to dark gray (even though this is the default color), and COLOR 4,6 sets the border color to green. Note that the colors are numbered 1–16, not 0–15 as in POKEs. We GOSUB 760 to fill sprite shape strings from the DATA statements.

The roadways will be the background color showing through other areas printed with reverse spaces. This lets us put yellow and white lines on the road. We'll print green reverse spaces to represent grass, delineating the roadways. To print the median lines and grass, we create 40 character strings within the FOR-NEXT loop. It may be easier for the programmer to just define the literal strings as 40 characters within quotes (like SP$="{40 SPACES}"), but it's easier to type in the program if we use a FOR-NEXT loop. I didn't want any confusion over listing conventions for the first 128 program published in the GAZETTE. For

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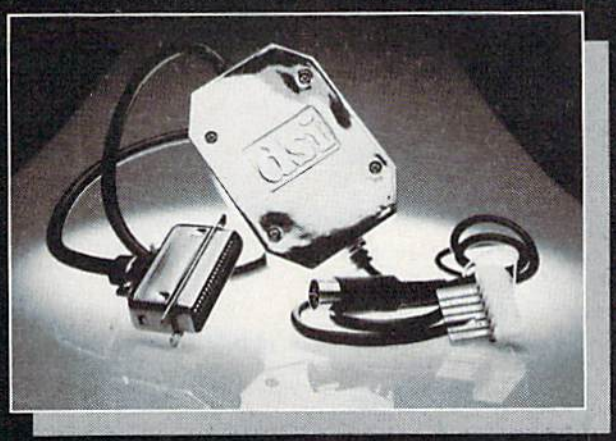

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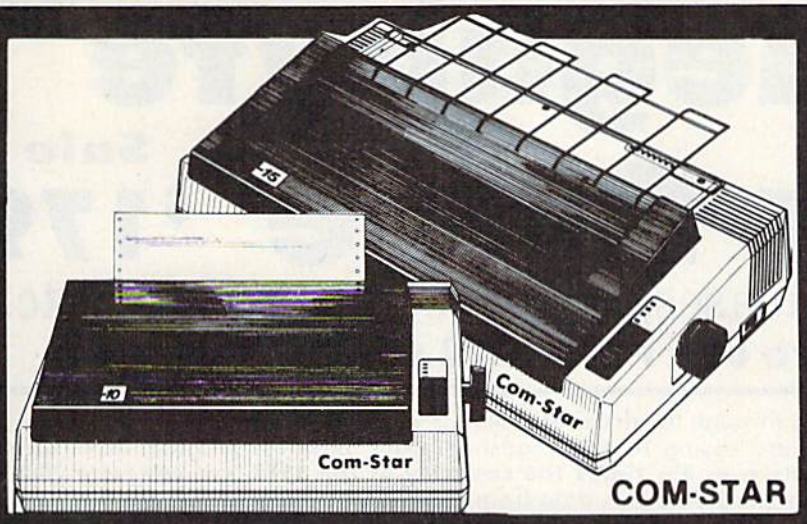

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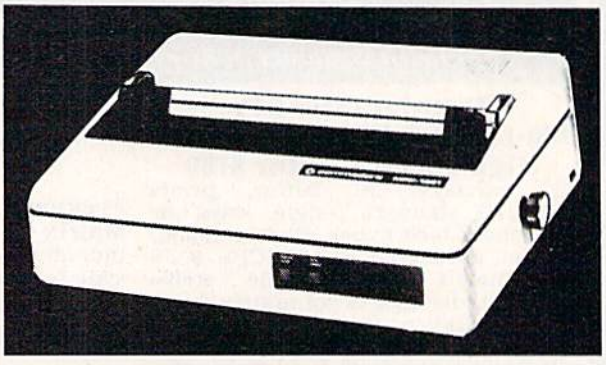

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this reason, you'll find no embedded cursor controls. Everything is done with CHR$ codes. Instead of printing color codes, we use the COLOR command to change the text color. However, you'll occasionally see a {SPACE}. Just type one space instead of the bracketed word.

Line 140 turns off all sprites that may have been active from a previous RUN of the game. We then print the roadways with green bars above the road, white or yellow median bars for the middle of the road, and blank lines for the road itself. The time line is printed in blue at the top of the screen.

Lines 200–250: Line 200 is trying to print a 40-column inverse string at the bottom of the screen. You can't normally do this without scrolling, but it's possible if you print 39 characters, cursor left, use the INST key to insert the thirty-ninth character into the fortieth position, then print another character to fill the gap created by INST.

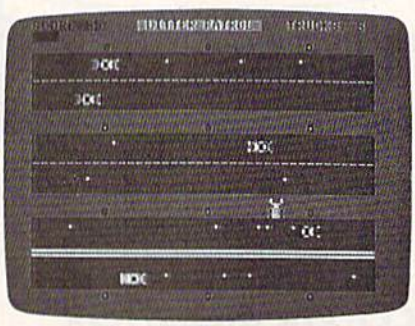
The title of the game is printed with the CHAR command. CHAR is a usable substitute for PRINT AT. It lets you print any string at any X,Y position on the screen, and in normal or reverse field. Combine it with COLOR to change the text color. The subroutines at 720 and 730 are used to display the score and number of trucks ("lives") remaining. The FOR-NEXT loop in lines 220–230 draws all the trash cans, at rows 2, 9, 16, 23, and columns 8, 20, and 32.

We then build a music string. It's a cutesy, happy melody, but all that's important here is to notice the PLAY syntax. The letters CDEFGAB stand for notes. The V1 sets the voice to voice 1, O2 sets the octave to 2 (that's an O, not a zero), and T0 selects a piano-like instrument setting. The letter I sets the note duration to eighth notes; Q is used for quarter notes, with a period for a dotted quarter. The sharp (#) precedes the note it modifies. And R is used as a rest. We'll play the string in line 360.

Lines 260–320: The automatic car sprites are set up. SPRCOLOR sets the sprite multicolor registers to white and black. All sprites share these colors. White is used for the windshield (or the claw on the truck), and black for the tires. I used the built-in sprite editor to design the sprites, then made DATA statements for them. The DATA statements are read into strings, then each string is assigned to a sprite with the SPRSAV command. Sprite strings are 67 characters long, not 64 as you might expect.

For the six sprites (FORI=2TO7), we read the sprite X and Y positions from a DATA statement at line 1110. Notice that you can now RESTORE to any line number. The SPRITE command turns on the sprite, sets its color, and specifies multicolor mode. It can also be used to select sprite/foreground priority, and X/Y expansion. Nonexpanded sprites offer the greatest detail.

The MOVSPR command can move a sprite to any position, up or down by any amount, or automatically at any angle and at 16 speeds.



The crafty truck has dodged the car and rests momentarily on a median strip in "Litter Patrol."

We use the automatic syntax (the two arguments are separated by a # sign instead of a comma). The angle is either 90 (right) or 270 (left). Angle 0 is pointing straight up in the sprite angular system. Whether a sprite goes left or right depends on its sprite number. If (SN=2) is true (−1), then 180 is added to 90, giving us 270. Otherwise, the angle is 90.

The speed, which can range from 0–15, varies from up to 5 speeds from the base speed, DF. This sets the difficulty level. A higher DF gives generally faster cars. We save the angles and speeds in arrays so that we can later pause the game (all speeds go to zero), and restart it from the arrays.

The automatic sprite movement is amazing. Even if you stop the program, the sprites continue. You can LIST your program, and the sprites still whiz by. However, you'd notice a suspicious slowness to the listing. When you use automatic sprites, everything else slows down drastically. The more sprites are moving, and the faster they go, the less time is available for the main program. This made the truck-moving part of Litter Patrol quite sluggish, and explains why the truck moves more slowly as the cars go faster.

While automatic sprites give you smooth, fast motion, this motion is not under your control. Speed is the reason you would use the automatic sprites in the first place, but the time saved by the automation is stolen from your main program. You can achieve a workable compromise if you plan your game around the limitations.

Lines 340–360: We synchronize the truck's position with the character screen so that the claw will cover the dots that represent trash bits. The truck always moves eight notches at a time, as if it were a character. Therefore, it's always synchronized with the character grid.

Line 350 turns on the collision interrupts. Any time a sprite hits a sprite, the program goes to line 580. Since all the sprites are in separate lanes, this can only happen when the truck is smashed. When we RETURN from the subroutine at line 580, the program picks up where it left off when the collision occurred.

We play the tune in line 360 only at the beginning of the first level (IF DF=1). The colon after the THEN is necessary to avoid a syntax error. This is inconsistent with the way BASIC is supposed to work, but is a familiar necessity with many language extensions on the 64. Apparently some of the BASIC 7.0 commands are considered extensions of BASIC.

Lines 370–470: We enter the main loop here. While the car sprites move automatically, we must move the truck ourselves. First, if two seconds have passed (TI−T>120), we erase a character from the time line. If the time line hits zero, we go to the "game is over" routine at line 640. In 380 we check for a keystroke. If a key is pressed, we halt all sprites and wait

for a new keystroke with GETKEY, then turn all the sprites back on.

In line 390, we check for the highly probable: Is the value of RND(1) (which randomly varies between 0 and 1) less than .95? About 95 times out of 100, it will be, skipping lines 400 and 410. Five percent of the time, though, RND(1) will be greater than or equal to .95, so we pick a sprite number, read its X/Y position, translate the sprite coordinates to character coordinates, and draw a white period to represent an empty cola can (or whatever litterbugs throw out car windows). They all look like little dots, though, from your aerial perspective. The random statement controls the timing of litter dropping. Without it, there would be a stream of trashy bits flowing from all cars.

Lines 420–460 move the truck. The JOYstick command returns a number from 0–8, and is greater than 128 if the fire button is pressed. We use the JOY value as an index into the DX and DY arrays. These arrays contain the values −8, 0, or 8 for each position. For example, the southwest position of the joystick is down eight (+8) and left eight (−8). Remember that we're moving eight spaces at a time. We add this displacement to the current X and Y positions of the sprite, then relocate the sprite to the new position. We subtract the displacement if that would put the sprite off the screen.

Lines 480–570: This is the fire button routine, called by line 430 if it's pressed. It first figures out the position of the character underneath the truck claw, then PEEKs screen memory to see what the character is. If it's a period (a trash bit), and if the truck is not carrying a trash bit, we POKE directly into the sprite shape to put a dot in the claw, then POKE a space into the position where the period was. So even in BASIC 7.0, you sometimes need to use PEEK and POKE. One point is added to the player's score, which is redisplayed using the subroutine at 720.

If the character is an empty trash can (hollow ball), and if the truck is carrying a piece of trash, we change that hollow ball to a solid ball, increment the filled trash can counter, and award ten points. If all 12 trash cans are full, we award a 1000 point bonus and increment the difficulty level, without letting the difficulty level exceed 3. The game is restarted at line 140.

Notice the use of BEGIN and BEND. BEGIN starts a block of code that is only executed if a preceding IF was true. BEND ends the block. So BEGIN/BEND lets you extend the statement after a THEN into several lines. I placed a colon on these extended lines to remind myself that they are part of a BEGIN/BEND block.

Lines 580–700: This is the collision routine, called automatically whenever the truck is hit. The function BUMP(1) reads the sprite-to-sprite collision register. The collision routine should only be called when the sprites collide, but I found it was entered twice for every time the truck was hit. The check in line 580 prevents false collisions. I still don't know why this is necessary.

For the collision, we print a silly message, make a high-pitched sound effect, move the truck back to the bottom of the screen, remove any trash bit the truck may be carrying, reset the collision with A=BUMP(1), then decrease the number of trucks. If there are still trucks remaining, we continue with the game by RETURNing from the sprite interrupt.

For the "game over" routine, we play another tune, print the GAME OVER message, and wait for the fire button to be pressed while we redraw GAME OVER in different colors. Before we check for the button press, we first wait for the player to let go of the button in case the player was picking up or dropping a trash bit. Otherwise, the game would instantly restart.

Lines 720–1110: These are simple subroutines. Line 720 updates the score; line 730 updates the number of remaining trucks; 740 stops all sprites; 750 restarts them; and 760–780 read in the joystick displacements and sprite shapes. The rest of the program is DATA statements for the cars and the truck.

The descriptions above can give you an idea of the detail required to program even a simple game. This is not meant to discourage, but to challenge.

See program listing on page 102.

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Maze-Mania

Mark Tuttle, Kevin Mykytyn, And Philip Nelson

It's easy to find your way through this maze, but can you make it within the time limit while avoiding the fast-moving cubots? A ten-level game with two variations (for the stouthearted only) for the Commodore 64. A joystick is required.

Here's a written guarantee that you won't find this game easy or dull. From the start, "Maze-Mania" puts your brain and hand to the test. The object is simple: Travel through the maze and exit. But getting there within the time limit is a rare occasion.

Move Fast And Think Ahead

After entering the program and saving a copy, plug a joystick into port 1. Load the program, type RUN, and select the game you wish to play: Normal, Fade, or Nervous. Start with the Normal Game—it's hard enough. Next, choose a one- or two-player game (more on the two-player game below). Then get ready—the action begins immediately, and the time starts ticking away. You begin at level 1 (there are ten) with three lives. On the left side of the maze, you're represented by the white ball. Using your joystick, maneuver to the exit on the right side of the maze, avoiding the fast-moving cubots. A collision is costly.

The key to succeeding is to move fast and think ahead. The cubots create a lot of traffic, and you have to study their movement to plot your course. But don't study too long, or time will run out.

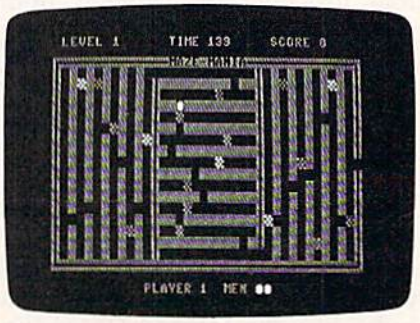
Sitting back and moving carefully and deliberately works well, but you won't succeed this way. You must complete the maze in less than a minute. If time expires or you collide with a cubot, you lose one life. The timer, at the top of the screen, starts at 200 and counts down very quickly. A successful trip through the maze earns points (the level completed multiplied by the time remaining) and an extra life (two is the maximum you can have in reserve). You then enter the next, faster level with a different maze.

As the levels increase, so will your strategy. At the higher levels, you'll have to move so quickly that you'll rely solely on instinct. Be sure to have a good supply of adrenaline on hand.

When you've exhausted your lives or completed level 10 (we've never completed level 9 here at the GAZETTE), you receive a final score, highest level completed, and an invitation to play again.

At Your Own Risk

The game variations, Fade and Nervous, are not for the timid. The rules of the normal game apply, but either variation should be seriously undertaken only if you've mastered the normal game. In the Fade Game, the cubots fade and reappear. Only with careful study can you succeed. The Nervous Game will be familiar to those who have been seasick. The entire maze shakes repeatedly. If you make it through level 10 in this game, consider a career in the Navy.



Starting at the left, this player (the white ball) has made it almost halfway through the maze. In a safe position, he waits for the cubot to move out of the way.

The Two-Player Version

All the rules discussed above apply in the two-player version. Note, however, that both players must share the same joystick. Each player continues until completing the maze or losing all three lives. If one player loses, he receives a "Game Over" message and passes play to his opponent, who may then try for a new high score. Also, the final screen appears only after *both* players have exhausted all lives or completed level 10.

See program listing on page 101.

TRACKER

Ned W. Schultz

Can you help Purple Herbie get home? This game for the Commodore 64, written by a child psychologist, is designed for the whole family: level 1 for children and the higher levels for adults. A joystick is required.

In this strategy game, you're Tracker the robot, and your mission is to lay track across the wilderness so Purple Herbie can get home. If you lay track cleverly, Herbie can collect lots of valuable objects on his way home. But that's only part of the strategy. You must watch out for the Meanies and the Deadly X's they leave behind. They'll destroy your track. And you have to work quickly—your time is limited and the clock is always moving.

With five skill levels, "Tracker" is designed so that it can be played by young children as well as adults. It requires creative solutions, risk-taking, and racing against time. On the lowest level, it has educational value and provides a challenge. On the higher levels, the game can be very difficult for even the most seasoned game player.

Tracker has no "pattern"—each game is designed by the player. And because getting Herbie home even without collecting any prizes provides a sense of "winning," children as young as three or four can have fun with Tracker. Adults will find a different challenge: collecting the maximum number of points while getting Herbie home.

Choosing The Right Skill Level

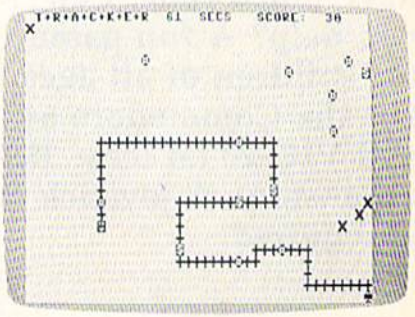
After typing in the program, save a copy to disk or tape, then run the program. First, you're presented with an option (Y/N) for game instructions. These should be read the first time you play.

Next, select a skill level from 1 to 5. Level 1 offers the fewest Meanies and Deadly X's (and no penalty points). The prizes increase in value across the five levels, as do the number of points for getting Purple Herbie home. A higher skill level, then, is important if you're playing competitively for high score. The level you select remains the same through each round of the game.

Move Tracker with a joystick (port 2), and press the fire button to lay track as you move. Wind a trail of track through as many objects as you wish and direct Tracker "home" (the pink square at the lower right). Only when Tracker is home will Herbie start out to follow the track and collect points. Be careful not to linger—the Meanies are constantly on the move, and the timer (at the top of the screen) ticks away without pause. Herbie must be home before it reaches 0.

If track is laid in a disorderly fashion (by creating branches rather than a single, continuous route, for example), you may confuse Herbie, so you should design your track efficiently, going through as many objects as possible if you're playing for points. If Herbie dead ends or stalls (runs into a Deadly X, for example), move Tracker quickly to Herbie's area (he can move diagonally if the fire button is not pressed) and erase any track you don't want by moving over it without the fire button pressed. Press the fire button again to lay new track if necessary. Also note that Tracker can "wrap around" the screen (right edge to left edge and vice versa) and lay track. You might need to use this feature occasionally, such as when a Meanie leaves a Deadly X in a strategic position.

You begin each game with three Trackers (lives). If time runs out before Herbie is home, or if Tracker runs into a Deadly X, you lose one life. The game ends when you've lost all three Trackers.



Purple Herbie follows the track you've placed.

A Competitive Challenge

If you're playing competitively for highest points, you can risk going for *all* the points and a special bonus. Be sure to capture at least half the available points or you'll receive a penalty (except in level 1). It's a good idea to get Tracker home as fast as possible and let Herbie start moving—the longer you wait, the more Meanies and Deadly X's appear. You can modify your track when Herbie is closer to home. The best strategy is to collect as many prizes as you can while still leaving enough time for Herbie to make it home.

No one has ever captured the perfect round bonus above level 2, so this is a goal to aim for. The record at level 5 is 16,900 points.

See program listing on page 91.

Friendly Alien

Cal Overhulser

A stranded visitor from another galaxy needs to get home and doesn't have much time. Can you help? A fun game for children of all ages. For the Commodore 64 and VIC-20 (at least 3K expansion). A joystick is required.

Designed especially for children, "Friendly Alien" is a nonviolent game which requires strategy and a little dexterity with a joystick. The object is simple: You must guide a stranded visitor to a phone from which he can call home, then lead him to the ship when it lands. That's easy enough, but what presents a challenge is the visitor's sweet tooth and his susceptibility to human viruses.

Candy, Cola, And The Two-Minute Flu

When you first run the program, you're given game instructions and asked to choose one of five skill levels. First-time players should start with level 1 (the easiest) and move up as each level is mastered. After the screen is drawn, the game begins immediately. Using a joystick (port 2 on the 64), move the visitor around the screen. You'll see three kinds of randomly placed objects: candy (the small dots), cola (red cans), and flu bugs (blue and yellow stars).

The object is to eat all the candy while avoiding the cola and, of course, the flu bugs. Drinking the cola causes an allergic reaction, making the alien's movements a bit unpredictable (you may have to drink some of the cola at the higher skill levels to get to the candy). The flu bugs are more serious threats—they're fatal. Avoid them at all costs. Be particularly careful around the moving (yellow) bugs. They often hover near pieces of candy.

After you eat all the candy, a phone appears at the upper left, and the visitor reappears at the bottom right. You must guide him to the phone so he can call "home" for a spaceship, again avoiding the cola and the flu bugs. After hearing the phone ring three times, the visitor again appears at the bottom right and the spaceship arrives. A ramp is lowered for the friendly alien to board. Move him to the ramp without allowing him to drink a cola or catch the flu, and he's home safe.

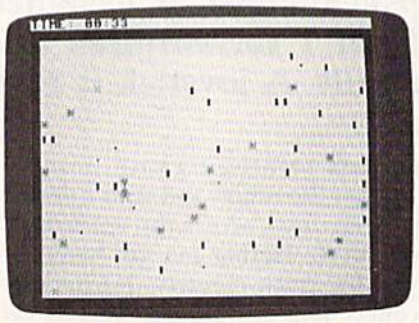
You must work quickly—especially at the higher levels, where there is more candy (and more obstacles, too). In the Commodore 64 version, you have two minutes to get the visitor to the spaceship ramp; in the VIC version, one minute and 30 seconds. Be sure to keep an eye on the time.

Typing It In

If you have a Commodore 64, type in Program 1 and save a copy before typing RUN. The VIC version is approximately 5.5K, so you'll need at least a 3K expander to type in the program and run it. Don't add any spaces as they could cause some lines to go beyond the allowable 88-character limit on the VIC. Again, be sure to save the program before you run it.

Two short loaders (Programs 3 and 4) for the VIC are included to allow an automatic check for sufficient memory, automatic adjustment for any memory expander, and automatic loading of the main program. Program 3 is for disk users, Program 4 for tape users. If you use tape, first type in and save Program 4, then type in and save Program 2 immediately following the loader. With tape you can name either program anything you wish since the tape loader loads the next program regardless of the name.

VIC disk users may type in and save Program 2 and Program 3 in any sequence. However, the main program (2) must have the same name as found in line 60009 of the loader program. (I've used "VICFRIENDLY"—with no spaces. You can change this if you like.)



Avoid the flu bugs while you help the friendly alien collect candy pieces (64 version).

Notes To Programmers

Descriptive REM statements are included before each major program segment to aid those interested in understanding how the program is written. None of these REMs are the destinations of GOTOs or GOSUBs, so they can safely be removed.

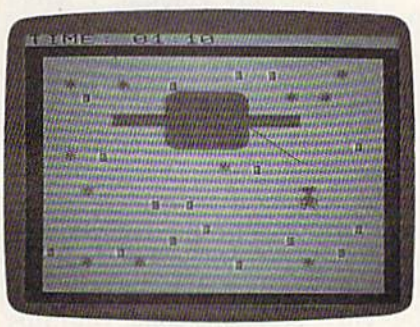
Joystick movement in the VIC version is checked with a machine language routine contained in DATA statements. The routine is POKEd into the cassette buffer in line 94. The SYS in line 1000 calls the routine and puts the joystick direction in address 830. The 64 version uses a more conventional BASIC joystick reader in line 1000. In both versions, the variable AA is made equal to the joystick direction in line 1000. The ON-GOSUB in

line 1050 checks this variable and adjusts the alien's location by choosing one of the subroutines in lines 11–18.

In both versions, custom character information is found in the DATA statements. Any typing error here could be critical and difficult to find. I've included a DATA statement checksum checker in line 70 (64 version) and line 95 (VIC version). The checksum is calculated after each READ in the preceding lines. This will greatly reduce the chance of typing errors in the DATA statements.

When there is more than one moving flu bug (skill levels 2–5), not only is their direction random (line 1510), but also selected randomly is which flu bug moves (line 1500). This adds suspense to the game and, more importantly, keeps it from running too slowly at the higher skill levels. Notice that the movement subroutines in lines 11–18 are also used to move the selected flu bug by the ON-GOSUB in line 1515.

The game screen has a solid frame (border). This makes



A phone call brings the spaceship which will carry the alien home (VIC version).

programming simpler by allowing the programmer to keep the moving characters on the screen with a simple check for collision with the border character code rather than using lengthy position checking calculations.

Custom Characters

The custom characters are created by first moving the normal uppercase and numeric characters (screen codes 0–63) into RAM. This is done in lines 20 and 40. Line 20 protects the upper part of memory by changing the top-of-memory pointer. Line 40 moves the characters into the protected area. In the 64 version, lines 36 and 48 are also needed to switch in and out the character ROMs. Beginning in line 50, the custom character information replaces some of the normal characters. The numeric and most of the alphabetic characters are not replaced, thus allowing readable error printouts should you have custom characters enabled while debugging your program. The switch to the new character set is in line 515.

The time limit can be changed if you want the game to be even more challenging. (The best time I've managed on skill level 5 is 1 minute, 15 seconds on the VIC and 1 minute, 45 seconds on the 64.) To change the time limit, change the value of TU$ in line 830. For example, to change it to 1 minute, 15 seconds, change the value of TU$ to 000114 in line 830. The value should be one second less than the limit you want. To keep the game instructions correct, you'll also want to change line 169 in the VIC version and line 170 in the 64 version to your new time limit.

If you'd rather not type in the program (VIC or 64 version), send a blank tape or formatted disk, a self-addressed, stamped return envelope, and $3 (U.S. funds) for each copy. Outside the U.S., don't send stamps but include the extra cost of postage. Please note the name of the program, which computer you own, and if you want the disk or tape loader included (VIC version only). Send it to:

Cal Overhulser
P.O. Box 494
Westford, MA 01886

See program listings on page 93.

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In Search Of The Computer Sandbox Part 1

Fred D'Ignazio
Associate Editor

Since I was a child I have been fascinated with learning. Learning, to me, has never meant the mindless accumulation of facts. Instead, it has meant the careful acquisition of thinking and communication skills—much in the way a backpacker shops for durable lightweight supplies that fit him just right, and that he can carry with him and use when he is on his own in the wilderness.

The microcomputer offers us a chance to become active learners. As Bill Higginson of MIT and Queens College has said, we can use microcomputers to build a curriculum around us. Instead of following a top-down curriculum of learning that has been mandated by society for all learners, we can start from the bottom and build our own curriculum, based on our own unique gifts, genius, needs, and desires. What do we have a special knack for? Whatever it is, it should be in our curriculum. What are our obsessions, our passions in life? These too should be in our curriculum.

Playing Dress-Up With Powerful Ideas

Almost everything we encounter in life can be seen as a problem. But we don't have to see problems as pranksters and villains waiting to ambush us, trip us up, and spoil our fun. Instead we can adopt a playful approach to solving problems, and microcomputers can help us develop this approach.

There is no single failsafe problem-solving style. Instead there are many styles, and it's helpful to experiment with as many as possible. I liken this experimentation to playing "dress up." Just as young children love to dress up in all sorts of colorful, oversized, and outlandish clothes, we should play dress-up with powerful ideas and problem-solving styles. We should put them on, try them out, and see how they "fit." This playful approach can turn problem-solving from a chore into a game. And it can give us the momentum and self-confidence we'll need when we come up against the many nasty, thorny problems that life throws our way.

The Computer Sandbox

The computer is like a sandbox, a playful environment where we can confront all sorts of problems and try on all sorts of problem-solving styles *and never get hurt.* It's all make-believe, so it's safe to go anywhere and say and do the most outrageous things. We can use the computer to learn cause-and-effect and responsibility for our decisions, but we can also experience the freedom to experiment and be creative.

There's lots of good "sandbox" software for the Commodore 64. Some of the best comes from Sunburst Communications. Sunburst's rich assortment of over three dozen Commodore 64 programs (including *Memory Castle, The Incredible Laboratory, The Pond, The Factory, The King's Rule,* and *Teddy's Playground)* create environments in which children of all ages can learn powerful problem-solving styles by making important decisions in make-believe worlds.

Lou Roberts, of EPIE (the Educational Products Information Exchange) has said that the computer's power comes from letting you learn powerful ideas, not through abstract theory, formulas, or descriptions, but through *experiencing* the ideas in a make-believe setting. For example, a child can learn advanced strategies of pattern recognition while she navigates a frog through an array of lilypads (in *The Pond*). She can master techniques to strengthen her sequential memory while she tries to find her way through a mazelike castle (in *Memory Castle*). She can practice methods of hypothesis generation and testing while she plays mad scientist and builds monsters (in *The Incredible Laboratory*).

Building monsters in The Incredible Laboratory.

In my May column, I wrote that one of real-life software's necessary ingredients is a hefty manual. The manual doesn't describe how to use the software, since real-life software should be easy to use and self-explanatory. Rather it should be an introduction to the skills and knowledge that the software is teaching and a resource book full of activities. All of the Sunburst programs come with this kind of manual.

Next month we'll look at a checklist to help evaluate computer programs and activities and see if they're up to sandbox standards. We'll also see how to turn your computer into a computer sandbox using software you already own.

(For more information on Sunburst software, write: Sunburst Communications, 39 Washington Avenue, Pleasantville, NY 10570. Or call 800-431-1934 or 914-769-5030 for a free catalog. You might also ask about their free videotape (either Beta or VHS format) on problem solving: "Bears, Monsters, and Frogs." It's a good introduction to teaching problem solving and to the educational philosophy of Sunburst.)

Weather Prophet

George W. Miller, Assistant Technical Editor

We all look at the forecast to see whether we should go on a picnic or stay home to read a book, or carry an umbrella or put on a short-sleeved shirt. This program for the 64 and Plus/4 can give you a pretty reliable idea of what weather to expect in the next day or two. It could also make a good school project. A disk drive is required.

Everyone talks about the weather; it's one of the safest topics to discuss. You can't argue with somebody who says "Beautiful day we're having." With "Weather Prophet," when you make a new acquaintance at a social gathering and the weather comes up, you can say "My computer is predicting rain," or "I think the forecast is wrong, my computer says it will be sunny."

You'll have to keep some records, of course. Ideally, you should load and run the program every day and spend a few minutes to update the weather files. The payoff is that as your weather database grows, your forecast becomes more accurate.

After entering the necessary information (temperature, humidity, wind speed and direction, and so on), you're given a short forecast. In addition, Weather Prophet looks back into the database for similar weather. It reminds you of what happened for several days after the last occurrence of any similar conditions, allowing you to better evaluate the short-range forecast generated by the program.

Weather Prophet tells you what the normal high and low temperature and rainfall or snowfall amounts for your area should be, and keeps track of the cumulative amounts of rain and snow, for you to compare against the average. Weather Prophet will also calculate the "heating and cooling degree days," so you'll know what to expect on your utility bills. It can even generate a monthly summary report. You choose whether all of this information is printed on the screen or a printer.

Professional weather forecasting services such as Accuweather and the National Weather Service have access to millions of dollars worth of state-of-the-art equipment, and they still have problems giving a reliable forecast. How can a BASIC program hope to emulate the mainframe computers used by these services?

During our testing period, Weather Prophet maintained an accuracy rating of over 98 percent. That's surprising, considering that the information needed to generate the forecast is very easy for anyone to obtain.

Predicting, Not Guessing

It's been said that to predict the weather, all you have to say is that tomorrow will be pretty much like today, and you'll be right more often than not. But 50 percent accuracy isn't a very good average. Or you could memorize weather folklore, such as *red sky at morning, sailors take warning; red sky at night, sailor's delight*. Some of these sayings are remarkably accurate, although they may be true only in certain areas.

Meteorologists have determined that three factors greatly influence local climatic conditions: barometric pressure, the rate of change of the barometer, and the wind direction.

In the northern hemisphere, the winds of a low pressure cell (also known as a *cyclone*) rotate in a counter-clockwise direction. A high pressure system (or *anti-cyclone*) has winds rotating in a clockwise direction. If you were to face into the wind, a low pressure cell would generally be located to your right, and an area of high pressure would exist somewhere to your left. Weather Prophet uses this knowledge to decide which type of weather system is influencing your local climatic pattern.

The rate of change of the barometric pressure helps determine how quickly a weather system is approaching and what type of system it is. A low pressure system usually brings in clouds and bad weather, while high pressure is usually accompanied by clear skies and fair weather. The barometric pressure reading determines how strong the approaching system is.

You can gather this information yourself very easily. Barometers can be purchased at most hardware stores. You can use a weather vane to judge the direction

of the wind or just observe the smoke from a chimney. Go outside and face north. East will be on your right hand, south is behind you, and west is to your left. You can easily decide which direction the wind is coming from.

As you gather data to develop your own historical file of local climatological data, you'll need information about the wind speed, too. This can be estimated quite accurately, using this table:

ESTIMATED WIND SPEED

Wind Speed (mph)	Observed Effect
0–1	calm, smoke rises vertically
1–3	direction seen in smoke, but not in a weather vane
4–7	leaves rustle
8–2	leaves and small twigs move
13–18	small branches move
19–24	small trees sway
25–31	large branches move
32–38	trees sway, walking into the wind is difficult
39–46	twigs break off trees, cars veer on road
47–54	roof slates may blow away
55–63	trees are uprooted
64–72	widespread damage apparent
73 and up	hurricane winds

You'll need the daily high and low temperatures, relative humidity, and the amount of precipitation as well. This can be obtained from newspapers, the news on television, or from NOAA (National Oceanic and Atmospheric Administration) Radio broadcasts. In most areas this public service band radio station broadcasts a continuous weather forecast from the National Weather Service, and, usually between 7:00 and 9:00 a.m. and again between 6:00 and 9:00 p.m., broadcasts a weather summary for the preceding day which includes all the information you'll need.

Of course, it would be more fun to collect the information yourself and make your data truly unique to your specific location. Rain gauges may be purchased at many stores, or you can make your own with a coffee can and a ruler. Your barometer may have a gauge for relative humidity built into it, although this can be influenced by its location and may not give a true indication of the actual relative humidity. To measure the high and low temperatures yourself, you'll need a Mini-Max Thermometer, which indicates temperature extremes.

Typing In Weather Prophet

Enter the program carefully using "The Automatic Proofreader," (published frequently in the GAZETTE). Lines 10–40 allow you to set the screen and border colors for your computer. If you're using a 64, delete the REM in line 20 when you're ready to save Weather Prophet. For the Plus/4, delete the REM in line 40. All other program lines are the same for both computers.

You'll have to customize Weather Prophet to display the local normal high and low temperatures, and rainfall and snowfall amounts for your area. Weather Prophet currently holds the normal conditions for Greensboro, North Carolina.

This weather information is available from several sources. Many almanacs list highs, lows, and precipitation. You could also check with your local newspaper or television station. The best source for climatological data is the National Oceanic and Atmospheric Administration:

NOAA
National Environmental Satellite, Data, and Information Service
National Climatic Data Center
Federal Building
Asheville, NC 28801

Request a copy of "Local Climatological Data, Annual Summary with Comparative Data" for your area.

When you have the information, change the DATA statements in lines 3400 and 3410 to the values for the monthly high temperatures in your area. Lines 3430 and 3440 should be changed to the average monthly low temperatures. Finally, lines 3460 and 3470 will contain average monthly precipitation, and line 3490 will be average monthly snowfall.

The values for each category begin with January for the first value and are entered in order through December.

If you're not using a Commodore printer, it may be necessary to change the commands to send information to your printer. All that's necessary is to enter the proper commands in lines 140 and 150. Be sure to include a RETURN command at the end of each line because these are subroutines.

Carefully enter the program exactly as listed with the exceptions of your customized DATA statements and printer commands. Weather Prophet uses relative files, and the syntax must be exact.

Putting Weather Prophet To Work

Load and run Weather Prophet. Be sure to leave the disk which contains Weather Prophet and your data files in the disk drive at all times. The program checks the disk for information frequently as it runs.

You first see the main menu. If you have a printer connected and would like a printout of any information from Weather Prophet, enter 0 to enable output to the printer. The screen will clear for a second, then return, but will now indicate that the printer is on. Be sure your printer is turned on before you use this option. You can turn off the printer by entering 0 again. The display will indicate the printer is off.

The more you use the program and accumulate information, the more intelligent Weather Prophet becomes. Try to collect and enter data at the same time each day. This will help the program maintain some degree of consistency as it evaluates the data.

First, tell the program about the day's weather. Press 1 to begin entering the data. You'll be prompted for the date, in month, day, and year format. Separate each entry with a comma. (For example, July 4, 1985 would be 7,4,85.)

Have the information you gathered on hand. Answer the prompts as they appear. If you mistype an entry, press RETURN until you reach the end of the data entry routine. The information you typed is displayed on the screen or printer, and you'll be asked if it's correct. Answer *no* if you've made a

mistake and you'll return to the beginning of the routine, with no harm done. Data must then be retyped.

Describe the cloud cover as a number between 0 and 100 percent, which represents the amount of the sky obscured by clouds. On a totally overcast day, for example, the cloud cover would be 100 percent.

The comment line is for your notes about the weather (fair, partly cloudy, rain, and so on). Any comments are OK, but be sure not to use commas.

When you've finished, the information you typed is displayed on the screen, along with the normal high and low temperatures for the month, rainfall and snowfall amounts, and heating or cooling degree days. A cumulative total is also displayed.

Next, the data is stored on the disk and Weather Prophet searches for similar conditions in the file and generates a short term forecast. It only attempts to forecast for the period during which it has a reasonably reliable forecast. This may cover between 12 and 72 hours.

Press any key to continue beyond the forecast. If any data similar to previous weather data is found, it is displayed, and the forecast conditions from that situation are shown. Use this historical record to evaluate the current forecast.

At times you may want a new forecast but don't want to store the information in the file, especially when weather conditions are changing rapidly. To generate a forecast, enter 2 from the main menu, and follow the prompts to enter barometric pressure, rate of change of the barometer, and wind direction. A forecast will be displayed, and the disk will be read in a search for similar conditions, as in data entry mode. No information will be stored on your disk.

Option 3, Search Data, allows you to review and analyze the information already stored. The program asks if you want to search by fields or for a specific record number. If you wish to look at a specific day and happen to know the record number, this is the quickest search. Press R and answer the next prompt with the number of the record. This is handy when you're updating a file with several days' data after being away for a long weekend and can't remember whether you entered data on Friday evening. Just search for the last record number, and see what that entry holds.

Enter F to search by field, and you can choose to search for a specific date, generate a monthly report, or return to the main menu. To search for a specific date, enter the date (in month, day, year format), and the program will search for the record for that date.

Generating a monthly report is where Weather Prophet can really show off. It takes several minutes to sort through the data, primarily because of the slow speed of the 1541 disk drive. The program lists the extreme conditions for the month you selected: highest temperature, lowest temperature, days with rain, and so on.

If you'd like to check how many degree days have accumulated since you've been running the program, enter 4 from the main menu for the Degree Day Register. The value of heating and cooling degree days will be displayed, along with options to clear each register separately, or to return to the main menu.

The Degree Day Register needs to be reset once each year. Generally, the Heating Degree Day Register should be set to 0 in July, and the Cooling Degree Day Register to 0 in January. Enter the appropriate response and continue with the program.

Option 5 allows a smooth exit from the program, without pressing the RUN/STOP key. It's a good idea to always use this option to end the program, because pressing RUN/STOP while the program is running could cause the files being written to your disk to be damaged.

Try to take a few minutes every day to update the data file. The more you use Weather Prophet, the more reliable it becomes. Daily updates are also necessary to keep the degree day registers accurate, and to develop accurate information for a monthly report. You'll find the information useful on a day-to-day basis.

See program listing on page 97.

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Daan Deenik

If your eyes get tired while checking long listings on your screen, this program will be a real aid. It highlights the current screen line, making it easier to keep your place while scanning the program. Originally written for the 64, we've added a version for the VIC.

Everyone who's written a program or typed one in from a magazine knows the sinking feeling you get when you realize you've made a mistake and you'll have to go back and check your work. Programs which contain long lists of DATA statements are especially annoying; it's easy to accidentally check a line twice or miss a line here or there.

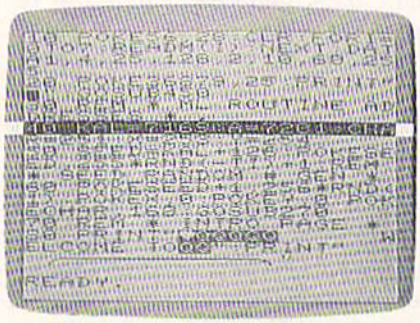
Have you ever wanted a ruler that would automatically move up and down the screen? "QuickScan" is just that, a bar that highlights screen lines. Just use the cursor keys to control the location of the highlighter.

How To Use The Highlighter

The instructions aren't complicated. Type in QuickScan and save it to tape or disk. When you run it, a short machine language program is POKEd into memory and a message (describing how to start it) is printed on the screen. To enable the 64 version, type SYS49152. The VIC version runs with or without memory expansion, and is enabled by SYS679. The ML program is loaded into RAM by a BASIC loader. Although there is a built-in checksum to help in entering the program, accurate typing is still required as any mistake could crash the computer.

Modifying QuickScan

QuickScan for the 64 uses seven multicolor sprites to create the highlighting bar. Here are a few ideas for modifications.



"QuickScan" is like a highlighted ruler that moves up and down the screen (VIC display).

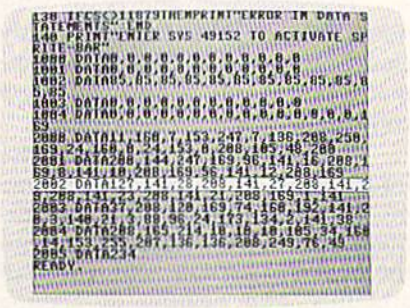
If you change the zeros in lines 1001 and 1003 to 255s and run the program again, you'll see a bar three lines high. The upper and lower parts of the bar are the same color as the characters on the screen, so you won't be able to see them. But the middle part is visible.

You can change the color of the middle part by POKEing 53285 with a number from 0 to 15. You can split the bar by giving the first four sprites low and the other three high priority (POKE 53275,15). This might come in handy with question and answer programs.

The VIC Version

Since the VIC doesn't have sprites or raster interrupts, a different technique was used to create the bar in the background. The computer checks for the position of the cursor and calculates how long it will take until that line will be printed. It then quickly changes the color of the screen and border to the second color and back again to the first. Since the program has to wait until the time is right, everything runs a little slower, especially when the cursor is near the bottom of the screen.

You can change the color of the border and background (even change the line to reverse characters) by POKEing a number from 0–255 into location 719 (POKE 719,x where x is a number from 0 to 255). The user's manual contains a complete list of screen/border color combinations.



It's especially helpful for debugging DATA statements (64 screen).

See program listings on page 101.

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machine language for beginners

From Machine Language To BASIC

Richard Mansfield
Senior Editor

This month we're going to create a kind of bridge between machine language (ML) and BASIC and, along the way, learn some new techniques which help manipulate data in ML.

Frequently, you'll see program listings like "Datastuffer" (Program 2). Sometimes that's all there is; at other times this mass of DATA statements is part of a larger BASIC program. However, in both cases, the data mass is actually a machine language program waiting to be brought to life. The user doesn't need to know anything about ML to type RUN and let Program 2 POKE all those numbers into RAM. When the numbers are in RAM, they comprise an ML program and the user can type SYS 49152 to activate it.

BASIC Builder

But how, if you've written an ML program, do you transform it into DATA statements? You could PEEK every location in your ML program and write down each number and then type them all into DATA statements. There are easier ways, however. Both COMPUTE! and the GAZETTE have published BASIC utilities, called DATAmakers, which do this job for you. This month, however, let's make an ML utility which asks for the start and end address of an ML program, and then rapidly builds a BASIC program like Program 2, complete with line numbers, DATA commands, commas, and, of course, all the numbers.

Program 1 does just that. It's a program which creates another program, a BASIC program. This is the 64 version, but the only adjustments you need to make for the VIC (with at least 16K expansion) are indicated in lines 100–220. The complete version of Program 1 will work as is on the LADS Assembler from my *Second Book of Machine Language*. Other assemblers will require some minor modifications. Program 1 will be presented next month also; this month, however, we'll discuss only through line 225.

Line 100 tells LADS that the program is to start at address $C000 (49152 in decimal). Line 110 tells it to actually store the program in memory. That's one option. You could also store it to disk and leave memory untouched.

Next there is a series of *label assignments.* All this means is that we're going to give names to some important locations in memory that we'll be using in the program. Then, when we want to access them, we don't need to remember any numbers—we can just use the names.

Two Fingers

Nevertheless, by understanding what these labels do, we'll pretty much understand the way the entire program works. So this month let's discuss each label; next month we'll look at the program proper.

First: what is the main goal of this program; what's it basically trying to accomplish? Essentially, we'll be moving a series of numbers (our ML program) from one place in RAM to another, from the location of the ML program down to the lower RAM where BASIC programs go. As with any large-scale moving job, we've got to keep track of where we are, within both the source and the target of the move. The computer does things one at a time. So, to move a chunk of memory, we'll pick up the first byte from the source zone, put it down in the target zone, pick up the second byte from the source zone, etc., until all the bytes are copied.

To do this, we've got to know, while the program executes, where we are *in two places at once* (the source zone and the target zone). We'll have to create two "fingers" which will always point to our current positions in memory. One finger will point at our location within the ML program being moved; the other finger will point at our location within the BASIC program being built. (In ML parlance these fingers are, perhaps with greater dignity, called *pointers.*)

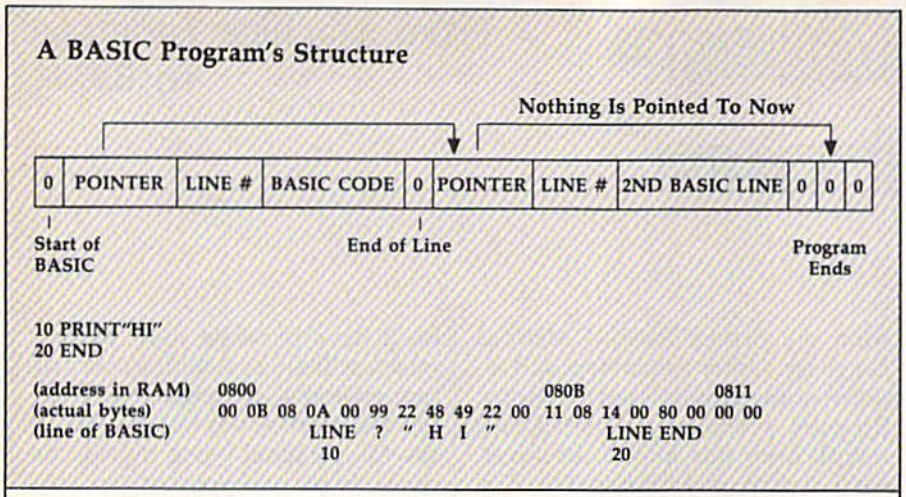
A pointer is a two-byte area in RAM somewhere and it's up to us to decide where. It should be located somewhere within the first 256 bytes because that lets us use the Indirect Y addressing mode, which is an easy way to access whole chunks of memory at once. The computer likes to use the first 256 bytes too (and for the same reason), but there are some safe places between $A3 (163 decimal) and $B1 (177), so we'll put our pointers in that area of memory.

In line 150, we assign the label PF to address $A3. You could give it any label you prefer, as long as that's the way you refer to it throughout the rest of the program. PF will be the finger pointing at the current (while the program is executing) location within the BASIC program we're creating.

What BASIC Looks Like

Line 170 defines, with the label PC, the other finger, the one pointing to within the ML program. Line 160 takes care of a housekeeping function for the BASIC program we'll be building. The figure illustrates what a BASIC program looks like in RAM.

A BASIC program always starts with a 0, each line ends with a 0, and the end of the whole program is signified by 0 0 0. The first byte (at address $0800 in the example line above) is a 0. Then the next two bytes form a pointer to the *start of the second line in the BASIC program* which is located at address $080B. As you can see, the computer expects pointers to be in re-



versed order so that the pointer 0B 08 is, really, referring to address $080B. In any case, we'll need to keep track of the proper location for each of these pointers as we build our BASIC program. They've got to be there or BASIC won't be able to LIST or RUN the program. So we'll keep them in the location defined in line 160, LINELINK.

The variable defined in line 180 will hold the address where the ML program ends, so we'll know when we've finished our job. The user provides this address along with the starting address (which will be stored in PC) before the program is activated.

Line 200 names a routine we're calling INTAFP which is located in BASIC ROM and which we'll want to use. It translates an integer number (like 3) into a floating point number (3.0000, the same thing, but with a decimal point). Normally this routine is used by BASIC, but we can use it too.

Numbers As Characters

Line 210 defines INTASCII as another built-in ROM routine which takes a floating point number and turns it into the ASCII code. The number 25 can take the form of a single-byte true number (when you POKE 500,25 you're storing the *real* number 25 in location 500). However, when you type a BASIC program in, you are using the ASCII code of numbers. ASCII numbers are *characters*, not real numbers; it's as if the characters "2 5" were in quotes. In an ML program in memory, each byte holds a true number, but in a BASIC DATA statement, the string of numbers are in the ASCII code. So, we've got to borrow these routines from ROM which transform the real numbers which comprise the ML program into the "character code" numbers which make up a BASIC program.

Line 215 defines the place we can jump to within ROM which will gracefully end our ML program, landing us back in BASIC mode without damaging anything. Line 220 shows where BASIC programs start in RAM and, thus, where we will start building our DATA mass. Finally, VARS in line 225 is defined as the pointer BASIC uses to tell where a BASIC program ends in memory and where variables begin. We'll need to adjust this pointer when we're all finished so the computer doesn't think our newly created program is larger or smaller than it actually is.

Now that we've defined all of our special routines and pointers, we are ready to go ahead and put them together to create the ML program, "Datastuffer." Next month we'll explore the internal structure of the program itself, but you can still play around with the utility. Type in Program 2 (Program 3 for the VIC) and just run it. You'll end up with a runnable ML program which will create a BASIC DATA mass. Even a mass of itself.

Program 4 is necessary. It's a little BASIC program which asks for the start and end addresses of your ML program and POKEs them into the pointers. You could do these things in ML, but the resulting program would be a bit too large to use as an example in this column.

Here's how to use Datastuffer:

Load and run Program 2 (for the 64), or Program 3 (for the VIC). Load the ML program you want to transform into BASIC DATA statements (make sure it doesn't load into the area 49152–49361 in the 64, or 20480–20689 in the VIC). Type NEW. Load and run STUFFERBAS (Program 4). That's it. STUFFERBAS will be overwritten by your new BASIC program.

When Datastuffer has finished, you can LIST the new program it has created. You'll have to add the FOR-NEXT loop that POKEs the ML program into memory. Finally, save the program to tape or disk.

See program listings on page 93.

Program 1: Datastuffer—Source Code

```
100 *= $C000;    ($5000 VIC)
110 .O
120 ; 64 VERSION  DATASTUFFER
130 ;----LABEL DEFINITIONS----------
140 ;
150 PF = $A3; CURRENT POSITION WITHIN BAS
    IC PROGRAM BEING CREATED
160 LINELINK = $A5;   HOLDER FOR POINTER
    {SPACE}IN BASIC ADDRESS
170 PC = $A7;   CURRENT POSITION WITHIN T
    HE ML TO BE FIXED
180 EADDR = $A9; HOLDER FOR TOP OF ML PRO
    GRAM BEING CONVERTED
200 INTAFP = $B391; TRANSLATES INTEGER TO
     FP FORMAT  ($D391 VIC)
210 INTASCII = $BDDD;TRANSLATES FP TO ASC
    II FORMAT   ($DDDD VIC)
215 WARM = $E37B;      ($E467 VIC)
220 BASIC = $0800;   WHERE BASIC STARTS I
    N RAM    ($1200 EXPANDED VIC)
225 VARS = 45; WHERE BASIC TEXT ENDS.
230 ;
240 ;----PRELIMINARIES--------------
250 ;
270 LDA #<BASIC:STA PF:LDA #>BASIC:STA PF
    +1; SET UP START OF BASIC
280 LDA #$50:STA LINENUM:LDA #$C3:STA LIN
    ENUM+1; START AT LINE 50000
290 LDA #0:STA COUNTER
300 TAY:STA (PF),Y; PUT ZERO BYTE (AT STA
    RT OF BASIC)
310 INC PF; ADJUST POINTER TO JUST PAST 0
     BYTE
```

```
320 ;
330 ;*  STORE LINE NUMBER AND DATA TOKEN
340 ;
350 NEXTLINE INY:INY; RAISE PF BY 2 TO GO
     PAST LINK
360 LDA LINENUM:STA (PF),Y; STORE LINE NU
    MBER LOW BYTE
370 INY:LDA LINENUM+1:STA (PF),Y; STORE L
    INE NUMBER HIGH BYTE
380 CLC:LDA LINENUM:ADC #10:STA LINENUM;
    {SPACE}RAISE LINE NUMBER BY 10
390 LDA LINENUM+1:ADC #0:STA LINENUM+1
400 INY:LDA #$83:STA (PF),Y:INY; STORE DA
    TA TOKEN
410 ;
420 ;*  TRANSLATE ML PROG. BYTE INTO ASCI
    I CHARS.
430 ;
440 DOMORE STY Y;SAVE Y
450 LDY #0:LDA (PC),Y:TAY;  GET BYTE OF M
    L
460 LDA #0; SET UP FOR ROM ROUTINES
470 JSR INTAFP:JSR INTASCII; TURN ML # IN
    TO ASCII
480 LDX #1:LDY Y:LOOP LDA $100,X:BEQ MORE
    :STA (PF),Y:INY:INX:JMP LOOP
490 ;
500 ;*  STORE COMMA, RAISE ML PROG. POINT
    ER
510 ;
520 MORE INC COUNTER
530 LDA #$2C:STA (PF),Y:INY; STORE A COMM
    A
540 INC PC:BNE GOON:INC PC+1; RAISE ML PO
    INTER
550 GOON LDA COUNTER:CMP #10:BEQ NEWLINE:
    JMP DOMORE; ONLY ALLOW 10 DATA ITEMS
560 ;
570 ;*  PREPARE FOR A NEW LINE OF DATA
580 ;
590 NEWLINE DEY:LDA #0:STA (PF),Y:STA COU
    NTER; STORE END OF LINE 0/FIX COUNTER
600 LDA PF:STA LINELINK:LDA PF+1:STA LINE
    LINK+1; SAVE LINK ADDR
610 INY:STY Y:CLC:LDA PF:ADC Y:STA PF
620 LDA #0:ADC PF+1;       ADD Y OFFSET TO
     CURRENT BASIC PROG POINTER
630 STA PF+1
640 ;  *PF NOW POINTS TO THE LINE LINK OF
     FOLLOWING LINE
650 ;  *SO PUNCH LINELINK POINTER INTO BA
    SIC
660 LDY #1:STA (LINELINK),Y:DEY:LDA PF:ST
    A (LINELINK),Y
670 ;
680 ;*  SEE IF WE'RE AT THE TOP OF THE ML
690 ;
700 SEC:LDA EADDR:SBC PC:STA 2:LDA EADDR+
    1:SBC PC+1:ORA 2
710 BCS BACK:LDA #0:DEY:STA (PF),Y
720 INY:STA (PF),Y:INY:STA (PF),Y
725 SEC:TYA:ADC PF:STA VARS:LDA #0:ADC PF
    +1:STA VARS+1:JMP WARM; END PROG.
730 BACK JMP NEXTLINE;   CONTINUE WITH NE
    XT LINE OF BASIC
740 ;
750 ;----STORAGE & DATA TABLES----------
760 ;
770 LINENUM .BYTE 0 0; HOLDS CURRENT LINE
     NUMBER
780 Y .BYTE 0;  TEMPORARY HOLDING PLACE F
    OR Y
790 COUNTER .BYTE 0;   KEEPS COUNT OF DAT
    A STATEMENTS PER BASIC LINE
```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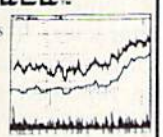

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Printer Wedge

James Chandler, Jr.

If you have a 64 and a Commodore 1525, MPS-801, or MPS-803 printer, here's an easy way to create, save, and print out your own custom characters. With "Printer Wedge," you can have true descenders, foreign language character sets, and customized graphics.

The Commodore 1525, MPS-801, and MPS-803 printers are inexpensive and generally reliable printers. But the printed characters leave much to be desired—no descenders. If you own one of these printers, you know how difficult it is to discern the difference between a lowercase and capital "P" or a lowercase "g" and the number "9." This program, "Printer Wedge," lets you define a new character set—including true descenders or foreign language characters.

The program is written in BASIC, but it POKEs a machine language "wedge" into memory. You don't have to know machine language to make it work, however. The wedge prints the user-defined characters in conjunction with many programs, including *SpeedScript*.

Printer Wedge characters can be any width from one to ten pixels, and any number of characters can be created, from one replacement character to an entire upper/lowercase font. Also, foreign language character sets can easily be defined (within the limits of printer resolution).

The program also has another mode which allows substitute character strings of up to 40 characters. For example, one could specify text replacements for LISTed graphics symbols (cursor controls, colors, etc.), allowing the printing of more readable program listings.

Creating Custom Characters

When you load and run Printer Wedge, you get a character creation screen. Characters are created on a grid seven high by ten wide. Move around the grid using the cursor keys, and plot dots with f7. Delete dots with f8. When the character is complete, assign the character with f1. The computer then prompts you for the key of the character. Press the key representing the character and the program appends a DATA statement to itself describing that character. That character will no longer be available to you—it will be replaced by the new character you've designed. It then loops back to the character creation screen.

When you're through creating the characters you wish to use, press f2. The program asks for a starting address, then POKEs the wedge to the specified location. You are then given the option of sending sample lines to the printer so you can inspect the new characters.

If you wish to alter any of the characters you've created, run the program again and press f2 when you finish. Since the character set is stored as part of Printer Wedge, you can create many character sets and save each by its own name, such as PWEDGE/ELITE or PWEDGE/SPANISH.

Create characters starting from the left column of the character creation grid. When printing, the wedge inserts one blank column at the right of a user-defined character. This allows proportional spacing of characters. For replacement characters to be in the same seven by five format of the 1525, 801, 803 character set, do not allow two adjacent blank columns in the first five columns of the character creation grid. In addition, do not leave column five blank.

To specify characters that cannot meet the above requirements, calculate the column values as in the 1525, 801, or 803 users' manual. Append a DATA statement to Printer Wedge using the following format:

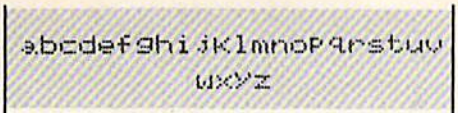
*[line number 3000 + 10 * ASCII]* **DATA** *[ASCII value of character],[number of character columns],[column 1],[column 2],,,,[last column]*

You can find the ASCII value of a character by typing (in immediate mode):

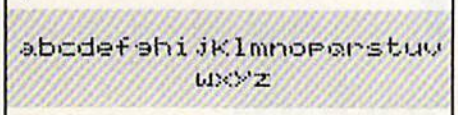
PRINT ASC("*[character]***")**

The line 10000 DATA 0 tells Printer Wedge it has read and POKEd all characters into memory. A replacement character for the double quote (SHIFT-2) should normally be specified (line 3340). Otherwise, printing a double quote character causes a graphic nightmare.

I've included three character sets as options for you to try. Any of these can be appended to Program 1. Character Set 1 (Program 2) replaces the lowercase g, p, and q with less ambiguous characters. Character Set 2 (Program 3) proportionally spaces without descenders. Character Set 3 (Program 4) squeezes characters into the top six rows, allowing one row for descenders. Program 5 allows for converting graphics symbols to text.



The standard lowercase character set of the 1525, MPS-801, and MPS-803 printers.



The letters with descenders—g, p, and q—are made more readable with character set 1.

Character set 2 offers more proportional spacing between letters.

Character Strings

Press f3 to assign a string of characters to a key. This can be useful in a couple of ways. You can make program listings more readable by replacing the reverse-heart that means "clear the screen" with the easier to read string [CLR]. To do this, type in the string [CLR] and assign it to the SHIFT–CLR/HOME key (by pressing f3). After entering all replacement strings in this manner, save PWEDGE/LIST. Programs can then be listed to disk or tape, then read back and printed with a short BASIC routine. To do this, first open a file to tape or disk, then enter **CMD** *(file number)*:**LIST**. After the file is created, type **PRINT#** *(file number)*:**CLOSE** *(file number)*. To read the file (and list it to the printer), open the file for input, open a line to the printer, use GET# to get characters, and PRINT# to send it to the printer.

SpeedScript allows the use of the Commodore key subset of the keyboard (left graphics symbols on the keys). [Commodore-D] could represent "Dear Friends," [Commodore-Y] could represent "Yours Truly," and so on. This would allow automation of the repetitive parts of letters or of any document form you use frequently.

If you'd rather not type in the program, send $3, a self-addressed stamped mailer, and a formatted disk or tape to:

James Chandler, Jr.
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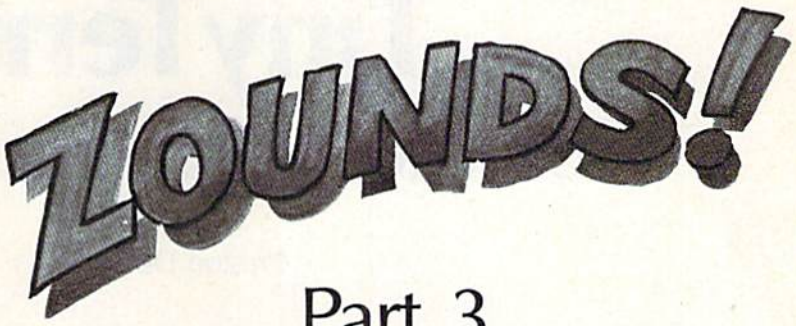
Chattanooga, TN 37415

See program listings on page 104.



Part 3

Lawrence Cotton

In this final installment, the author presents six more impressive 64 sound demos.

Before looking at the last six sound programs in this series, it would be helpful to review the introductory discussion in Part 1, found in the July issue. If you missed the first two installments, you can still benefit from the demos here. They're short and can be added to your own programs simply by renumbering the lines appropriately. You can also omit the REMarks in each of the demos. Even if you don't wish to use these in your own programs, I think you'll be surprised at some of the "zounds" your 64 is capable of producing.

In The Ear Of The Beholder

The first program, "Waveform 23," is only four lines. This waveform, largely undocumented, uses sync and ring modulation together with the triangle waveform. Several of the demos in this series use this waveform, but this program best illustrates its enormous potential. It plays only once, so you might add a loop to go back to line 10 if you wish to study the quality of the sound. Try changing the waveform (line 20) to a 17 (triangle) or 33 (sawtooth) or 21 (triangle plus ring mod). How blah. But with a 23? Listen!

Program 2, "Hear See Chord," is the longest program in the series. It shows how to gradually combine three notes produced by independent voices into a chord. The conventional square waveform (64) is used here.

For a little variety, try Program 3, "Rubber Band In A Drum." This program is unique in two respects. First, random frequencies (F2) are interspersed with a fixed frequency. Second, waveform 23 is POKEd to turn the sound *on* (rubber band), but the noise waveform 128 is POKEd to turn it *off* (drum).

Probably the most unpredictable sound is "Harmonix." Voices 2 and 3 are POKEd with waveforms 21 and 23, respectively. The step sizes of −10 and −50 determine the harmonics being generated. This sound seems to be long enough without repetition.

"Falling Sitar," Program 5, sounds just like its name. It too uses a random frequency (F1) superimposed on a gradually decreasing frequency (F2) at a gradually increasing rate (controlled by Q).

Last, but certainly not least, is "Glissando." How can such a sound be produced? Only on the Commodore 64.

See program listings on page 92.

TinyTerm

For The 1650 Automodem

Preston Douglas

This short telecommunications program automatically dials the phone numbers of your favorite bulletin boards. If the number is busy, it redials until it makes a connection. For the 64 or unexpanded VIC.

If you belong to a local bulletin board system (BBS), you probably know the frustration of reaching a busy signal again and again. The most popular, most active boards can be nearly impossible to reach.

One night while my 64 and I were working hard trying to get through to a busy bulletin board, it occurred to me that my VIC-20 was just sitting there doing nothing. If I could program the VIC to do the boring job of redialing, I could do something more interesting with the 64.

I found "MiniTerm-20," a terminal program for the VIC, in the September 1983 issue of COMPUTE!'s GAZETTE. It was written for another type of modem, so I set about converting and modifying it to work with the 1650.

Several things had to be added. First, the program had to be able to redial repeatedly until it detected a carrier tone (the signal that the call has been completed). Second, it had to reject the occasional false carrier hits that can happen with some busy signals. Third, it should sound an alarm to indicate to the user that the connection has succeeded. Finally, there should be a screen display to show that the program is getting busy signals and is still working.

"TinyTerm" does all four things. Plus, it fits into an unexpanded VIC. It's very short, so it doesn't have extras like upload/download, or file access.

Setting Up The Program

First, type in the program and save it to tape or disk. If you own a 64, make the following changes:

```
20 Z1=56577:Z2=56579:POKE53281
   ,1:Z3=10:FORA=54272TO54295:
   POKEA,0:NEXT          :rem 71

610 POKE54273,50:POKE54296,15:
    POKE54277,25:POKE54276,32:
    POKE54276,33:GOTO80:rem 70
```

In addition, you can customize TinyTerm in two ways. First, change the phone numbers in line 310 to three bulletin boards you belong to. Don't use any dashes or extra characters like spaces, and remember to put the number "1" in front of any long distance numbers. Line 60 can be changed to include your name, ID, and password for one of the bulletin boards. If you do this, you might not want to save a copy of the program with your real password, in case someone else might try to use it.

Before you start, check the switches on the 1650 Automodem. They should be set to originate (the O/A switch), data (D/T), and full duplex (F/H).

When you run TinyTerm, it will list the three telephone numbers from line 310 and wait for you to press a key. If you want to dial one of the three built-in numbers, press a number 1–3. To input a brand new number, press 4.

TinyTerm In Action

The program dials the number you've chosen until it makes contact with the BBS. If the line is busy, a message prints that the program is still trying. If the line is free and a carrier tone is detected, your VIC or 64 will make a sound (to get your attention). You can then log on.

If you have previously defined your name, ID, and password in line 60, press f2, f4, and f6 in that order. (Be sure to hold down SHIFT while you're pressing these keys.)

The program is written in BASIC, which has one advantage and one disadvantage. The good news is that programmers who are curious about how terminal programs work can trace through the listing and make modifications if they wish (see below for details on the program flow). The bad news is that once in a while, TinyTerm drops a character. This usually happens when a long message or menu is received from the BBS. It doesn't happen very often, though. BASIC can keep up with 300 baud pretty well.

How It Works

The VIC version barely fits into an unexpanded VIC. You may think you have a lot of memory after loading the program, but the variables and the buffer will quickly use most of it. Be careful if you start making modifications.

Line 10 opens the channel to

the modem and sets the baud rate. Next, the opening screen is printed.

Line 50 goes to the subroutine at 230–290, which creates an array for translating Commodore ASCII to true ASCII. Note line 270, where the function keys are defined:

f1 ASCII 3 (CTRL-C)
f3 ASCII 19 (CTRL-S)
f5 ASCII 17 (CTRL-Q)
f7 ASCII 16 (CTRL-P)

These control characters are used by some bulletin boards for special functions. Line 60 sets the values for the shifted function keys. In 70, the program jumps to 300, the dialing routine.

Lines 300–400 print the three numbers and prompt you for input. If option 4 (manual dial) is chosen, lines 410–420 ask you for a number. Line 430 is the beginning of the dialing routine. The numbers are extracted one by one, and the subroutine at 540–560 does the actual pulse dialing, with pauses between the clicks. TinyTerm then checks for a connection in lines 480–510. Change the 300 in line 480 if your phone circuits take an unusually long time to ring through.

Lines 570–590 check three times to make sure we've really gotten through. If the phone has been answered, we branch to 610, where the alarm is sounded. The program jumps back to line 80, the beginning of the main terminal program. A busy signal sends us back to the dialing routine.

Line 90 GETs a character from the modem. If the BBS is not sending, we jump to 130, to GET a character from the keyboard. If you have not pressed a key, it jumps back to 90, alternately checking the modem and the keyboard for a character. Because of the differences between Commodore ASCII and standard ASCII, the characters have to be translated, using the arrays I% and O%.

If you're tired of hearing busy signals from your favorite busy bulletin board, give TinyTerm a try. Your computer will take care of the dialing, giving you a chance to do other things while you wait to get through.

See program listing on page 100.

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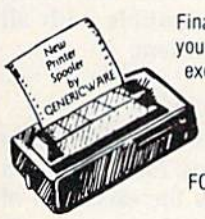

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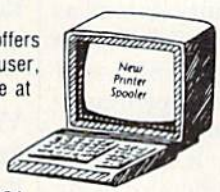

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VIC Emulator

Fausto Ibarra

If you've upgraded from a VIC to a 64, here's a way to keep your VIC BASIC programs from becoming obsolete.

Those who have upgraded from a VIC-20 to a Commodore 64 know that both machines have the same BASIC language, but won't run the same programs. Memory locations and screen, graphics, and sound differences make a translation necessary if you want VIC programs to run on the 64.

"VIC Emulator" makes your 64 behave just like a VIC. You can run most of your VIC programs written in BASIC without translating them, including games using custom characters and sound effects, utilities, and so on, and you can emulate programs written for the unexpanded, 3K, 8K, or 16K VIC.

The program is written entirely in machine language, so you need MLX, which appears frequently in the GAZETTE, to aid in your typing. After loading MLX, answer the prompts for the starting and ending address with 49152 and 51124, respectively. Next, type in the program and save it to disk or tape. Load it at any time with the command LOAD "*filename*",1,1 for tape, or LOAD"*filename*",8,1 for disk. After it's loaded, type NEW.

To run the program, enter SYS 49152. You are first asked to select the memory configuration of the VIC program. After this, you'll see the number of free bytes. At this point, load any VIC BASIC program and it will run normally. It's a good idea to use the emulator before loading *any* program because some programs change memory pointers when using custom characters. You can return to the normal 64 configuration at any time by entering SYS 64738.

If you press RUN/STOP-RESTORE, the computer will forget where the screen is and you won't see what you're typing. You can recover your program by blindly entering SYS 49152. After selecting the appropriate memory configuration, enter SYS 51055. You can use this command at any time if you accidentally type NEW and wish to recover your program.

What Does It Emulate?

The 64 screen is changed to the VIC's 22 characters. The program emulates all POKEs and PEEKs to screen and color memory, as well as alternate screens controlled with POKEs to locations 36866 and 36869. If you clear the screen, color memory is filled automatically with color code 1 (white). It also emulates the VIC's tone generator using the SID chip (it's good enough for most sound effects, but will not work correctly with programs using music.)

POKEs to change the screen and border color also work without modification. (Screen colors 8–15 are different on the 64, so you may get other color combinations when using them.) Custom characters will work perfectly without any modification, as will multicolor characters. High-resolution graphics will work if they don't use double height characters.

POKEs and PEEKs to locations 0, 1, and 2 are changed to reflect the 64 USR vector. POKEs to start and stop the cassette motor are also emulated.

For games and other programs requiring input, joystick and paddle, reading can be made as in the VIC (they must be connected in control port 1), and PEEKs to location 197 will return the key values of the VIC.

A Word Of Caution

VIC Emulator works with any program written entirely in BASIC. Joystick and paddle reading routines written in machine language will work if they don't use locations 0 and 1, which are used by the 6510 chip. Machine language routines which use the Kernal jump table will still work since they are compatible with all Commodore computers.

Wedge Works

The program works by wedging into the BASIC routines for PEEK and POKE. It intercepts the execution of these commands to change them to work properly on the 64. This is possible by copying BASIC memory from 40960 to 49151 ($A000–$BFFF) into the RAM beneath it, changing the routines to suit our needs, and telling the 6510 microprocessor to use the RAM memory by clearing bit 0 of location 1.

It also wedges into the PRINT routine to make the necessary changes to reflect the VIC's 22-character screen. Also, an interrupt routine is added to the normal IRQ service routine to permit joystick and paddle reading from machine language.

See program listing on page 103.

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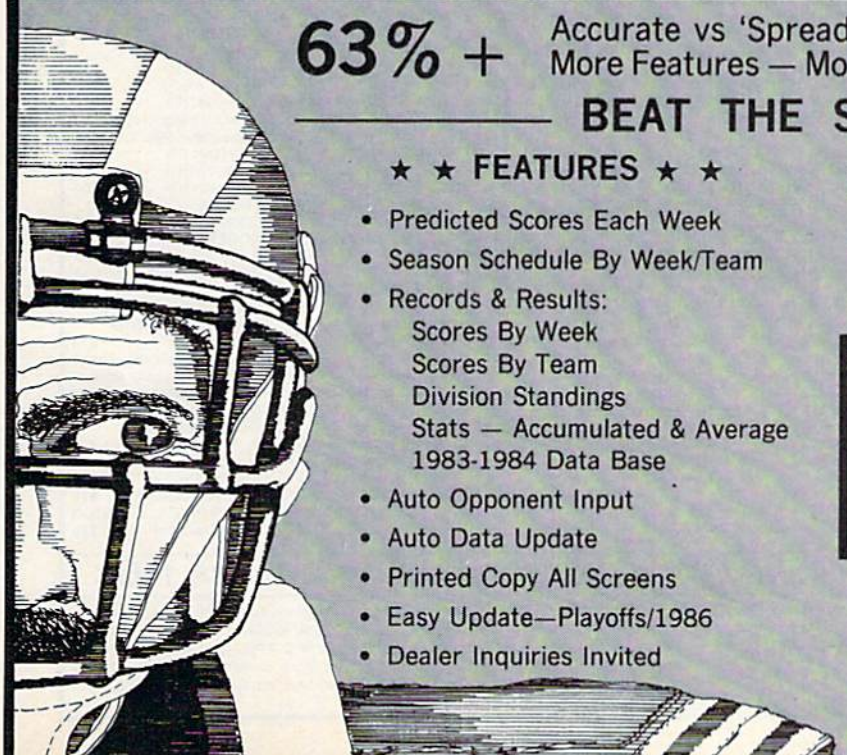

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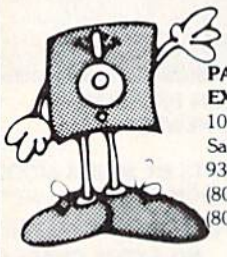

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simple answers to common questions

Tom R. Halfhill, Staff Editor

Each month, COMPUTE!'s GAZETTE tackles some questions commonly asked by Commodore users and by people shopping for their first home computer. If you have a question you'd like to see answered here, send it to this column, c/o COMPUTE!'s GAZETTE, P.O. Box 5406, Greensboro, NC 27403.

Q. BASIC is too slow for some programs I want to write, but I don't think I want to tackle machine language yet. What other languages are faster than BASIC but easier to learn than machine language?

A. Perhaps the easiest solution is not to learn another language at all—instead, try a BASIC *compiler.*

A compiler is a sophisticated program which takes another program written in a high-level language such as BASIC and translates (or *compiles*) it into machine language. Although a compiled program won't run as fast or be as compact as a program written directly in machine language, it still runs much faster than an ordinary BASIC program. The speed gain can range from 10 to 1,000 times faster, depending on what the program is doing.

Most compilers require you to observe a few extra programming rules, but it's still much easier than learning a whole new language. Several BASIC compilers are available for Commodore computers and have been advertised and reviewed in COMPUTE!'s GAZETTE.

If you're dissatisfied with BASIC for reasons other than execution speed, the other alternative is to explore different languages. Versions of Logo, Pascal, Forth, PILOT, COMAL, PROMAL, and others are available for Commodore computers. Some of these are compiled languages as well. Logo is known for its turtle graphics and recursive (self-repeating) structures; it's often the first language taught to children. Pascal is a popular structured language in colleges and universities. Forth is *extensible,* which means you can create new keywords and build your own custom language. PILOT lends itself to instructional and educational programming. COMAL is a relatively fast, structured language that strongly resembles BASIC and is very popular in Europe. PROMAL is a new compiled language that has much in common with Pascal.

Q. I've noticed that a lot of BASIC programs use words like OR and AND. Can you explain what they are and how they work?

A. One reason these keywords are so confusing is that they're used in BASIC programs in two completely different ways. Like the English word "star"—which can denote either a point of light in the sky or a leading actress—the meaning depends on the context.

Usually, AND and OR are used in BASIC with IF-THEN statements as *logical operators.* A logical operator is a keyword which defines how an IF-THEN statement should be resolved under different conditions. Here are some examples in English:

IF the Cubs win the pennant OR the Indians win the pennant THEN I'll pay you $10.

IF the Cubs win the pennant AND the Indians win the pennant THEN I'll pay you $20.

According to the first IF-THEN statement, the $10 bet will be paid off if *either* baseball team—the Cubs *or* the Indians—wins the pennant. The OR operator specifies that only one of the two conditions must be met. But in the second IF-THEN statement, the AND operator requires that *both* teams must win a pennant in their respective leagues to pay off the bet. Logical operators work the same way in BASIC. Since computers must see everything in terms of numbers, −1 means *true* and 0 means *false*:

```
IF A=-1 OR B=-1 THEN C=10
IF A=-1 AND B=-1 THEN C=10
```

Again, the first IF-THEN statement specifies that if the variable A equals −1 or the variable B equals −1, then the variable C becomes 10. Only one of the two possible conditions must be met for this to happen. But in the second IF-THEN statement, both conditions must be met for C to equal 10.

Logical operators are often combined with IF-THEN statements to form decision points in computer programs. The program's flow and reaction to user input can vary according to how it evaluates different conditions. It's up to the programmer, of course, to make sure the program can respond to any possible condition. Otherwise, it may "crash."

In another context, AND and OR are used in BASIC to directly manipulate bits in computer memory. All digital computers store information in the form of binary numbers, and those numbers are composed of bits, which are like tiny switches that can be turned on or off. For instance, the number 97 is stored in memory as a pattern of eight bits (1=on, 0=off):

```
01100001
```

Keywords such as AND and OR allow programmers to change these bit patterns in certain ways. Bit manipulation is beyond the scope of this column because it really has more to do with machine language than with BASIC. In fact, the keywords AND and OR correspond directly to machine language commands. To learn more about this subject, follow the "Machine Language for Beginners" column, which appears regularly in the GAZETTE.

bug-swatter

• Two problems affect the RENUM command from "MetaBASIC" (April). The first is relatively minor: After renumbering, the definition given to the f8 function key is garbled. A memory conflict causes this quirk, which cannot easily be fixed.

A more serious bug is that RENUM can ruin the second index number in a two-dimensional array. When MetaBASIC renumbers a program, it looks for GOTOs, GOSUBs, THENs, and other references to line numbers. Within an ON-GOTO or ON-GOSUB, the line numbers are separated by commas. So, if a line containing ON-GOTO or ON-GOSUB is followed by a two-dimensional array—A$(20,10), for example—the second number in the array will be treated as part of the ON statement, because it is preceded by a comma. The array variable will, in effect, be renumbered. To fix this, load MetaBASIC, type NEW, and enter this line:

```
FOR A=39243 TO 39246:POKEA,2
34:NEXT
```

You can now use the BSAVE command to save the altered MetaBASIC to disk. Tape users will have to use MLX: Enter **POKE 644,144: SYS 58260** to protect memory, load MetaBASIC, type NEW, enter the line above, load and run MLX, enter the starting and ending addresses (36864 and 40805), and then use SHIFT-S to save the new copy to tape.

• There are no bugs in the 64 version of "TurboDisk" (July). Some GAZETTE DISK subscribers have had trouble making a backup copy of the program, however. The program works correctly when loaded from the GAZETTE DISK, but a slight modification is necessary to make a backup.

There are three TurboDisk programs on the GAZETTE DISK. "TURBODISK BOOT" is a short BASIC program which loads and enables the main machine language program, "TURBODISK," which is called "TURBODISK.OBJ" in the July issue of the GAZETTE. If you're using a copy program, these are the two programs you'll need to put on the backup disk. They'll work correctly if they're copied directly from the GAZETTE DISK.

You can also make a backup by running the third program, "TDISK GENERATOR." It will create a file called "TURBODISK.OBJ" on your backup disk. But TURBODISK BOOT tries to load TURBODISK (without the .OBJ). So, you'll need to change line 10 of TURBODISK BOOT so it loads TURBODISK.OBJ rather than TURBODISK. After making the correction, save TURBODISK BOOT to the backup disk.

• VIC owners have reported that although "Screen-40" (June) converts the VIC screen to 40 columns and works well when printing to the screen, it has problems sending anything to a printer. Reader D. J. Stauffer has found a solution:

1. Load Screen-40.
2. Type **POKE 8402,104: POKE 8403,76: POKE 8404,122: POKE 8405,242**
3. Enter the necessary POKEs from the article: **POKE 43,1: POKE 44,44: POKE 11264,0: NEW**.
4. Load and run MLX, enter the starting and ending addresses (8192 and 10240), and press SHIFT-S to save the new copy of Screen-40.

• Reader David Gunderson writes that the score in the 64 version of "Heat Seeker" (March) may be difficult to read if you own an older 64 or a black-and-white television. To change the background color and make the score more legible, load Heat Seeker, **POKE 2076,6**, and save it back to tape or disk.

• As reported in the June "Bug-Swatter," the number 100 in line 130 of "1526 Hi-Res Screen Dump" (April) should be changed to a 130. This does not affect the program if all DATA statements were correctly typed. The program works as listed, and several readers have sent in modifications.

1526 Hi-Res Screen Dump is written in machine language and Peter Heine Jorgenson has noted that it exits back to BASIC via a BRK, rather than an RTS. To make it a little easier to use from BASIC programs, **POKE 49488,96**. Also, if you prefer not to have the screen centered on the page, pick a left margin between 0 and 40 (variable L) and add these POKEs before starting the screen dump:

R=L+40: POKE 49153,L: POKE 49393,L: POKE 49389,R

By printing one screen at left margin zero, rewinding the paper, and printing another screen at margin 40, you can create a double width, two-screen picture.

Readers Eric Thosteson and Robert Lewis own MPS-802 printers, which are functionally identical to the 1526, except for the line spacing. The MPS-802 allows more vertical positions per inch. If the lines seem to overlap when using the 802, add a **POKE 49289,24** before the SYS49152. Or, change the second number in line 330 from 18 to 24, and change the last (checksum) number in 330 from 885 to 891. Numbers larger than 18 on a 1526, or 24 on the 802, will cause more spacing between the lines.

Finally, because the program starts at 49152, it will not work with some hi-res programs which use the same locations. Paul Kroculik suggests the following changes to allow screen dumps from *Simons' BASIC*, "Screen-80" (September 1984), or "Hi-Res Graphics Made Simple" (August 1983):

```
110 PRINT:PRINT"TYPE SYS 52736
    TO BEGIN HI-RES DUMP": EN
    D
140 DATA 52736
150 DATA 53121
160 DATA 169,18,133,10,32,33,2
    06,32,633
170 DATA 67,206,32,81,206,76,1
    00,207,975
180 DATA 32,177,206,162,8,230,
    3,208,1026
190 DATA 2,230,4,202,208,247,7
    6,81,1050
200 DATA 207,173,0,221,41,3,73
    ,3,721
505 DATA 162,53,120,134,1,177,
    3,162,812
510 DATA 55,134,1,88,234,234,2
    34,234,1214
515 DATA 234,234,37,16,240,16,
    169,128,1074
540 DATA 165,17,201,8,208,208,
    70,16,893
550 DATA 230,15,165,15,201,8,2
    08,194,1036
580 DATA 96,76,13,206,169,0,13
    3,17,710
610 DATA 206,76,19,206,32,250,
    206,76,1071
620 DATA 16,206,222
```

Since the starting address has been moved to 52736, readers are cautioned not to use the Commodore DOS Wedge, which loads into the same area of memory.

MLX Machine Language Entry Program For Commodore 64 and VIC-20

Charles Brannon, Program Editor

MLX is a labor-saving utility that allows almost fail-safe entry of machine language programs published in COMPUTE!'s GAZETTE. You need to know nothing about machine language to use MLX—it was designed for everyone. There are separate versions for the Commodore 64 and expanded VIC-20 (at least 8K).

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

```
LOAD "filename",1,1 (for tape)
LOAD "filename",8,1 (for disk)
```

To start the program, you enter a SYS command that transfers control from BASIC to machine language.The starting SYS number always appears in the appropriate article.

Using MLX

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

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

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

To simplify your typing, MLX redefines part of the keyboard as a numeric keypad:

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

MLX Commands

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

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

MLX recognizes these commands:

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

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

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

What if you forgot where you stopped typing? Use the Display command to scan memory from the beginning to the end of the program. When you reach the end of your typing, the lines will contain a random pattern of numbers. When you see the end of your typing, press any key to stop the listing. Use the New Address command to continue typing from the proper location.

See program listings on page 106.

How To Type In *COMPUTE!'s GAZETTE* Programs

Each month, COMPUTE!'s GAZETTE publishes programs for the VIC-20, Commodore 64, Plus 4, and 16. Each program is clearly marked by title and version. Be sure to type in the correct version for your machine. Also, carefully read the instructions in the corresponding article. This can save time and eliminate any questions which might arise after you begin typing.

We publish two programs, appearing in alternating months, designed to make your typing effort easier: The Automatic Proofreader, and MLX, designed for entering machine language programs.

When entering a BASIC program, be especially careful with DATA statements as they are extremely sensitive to errors. A mistyped number in a DATA statement can cause your machine to "lock up" (you'll have no control over the computer). If this happens, the only recourse is to turn your computer off then back on, erasing whatever was in memory. So be sure to *save a copy of your program before you run it.* If your computer crashes, you can always reload the program and look for the error.

Special Characters

Most of the programs listed in each issue contain special control characters. To facilitate typing in any programs from the GAZETTE, use the following listing conventions.

The most common type of control characters in our listings appear as words within braces: {DOWN} means to press the cursor down key; {5 SPACES} means to press the space bar five times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing another key), the character is underlined. For example, A means hold down the SHIFT key and press A. You may see strange characters on your screen, but that's to be expected. If you find a number followed by an underlined key enclosed in braces (for example, {8 A}), type the key as many times as indicated (in our example, enter eight SHIFTed A's).

If a key is enclosed in special brackets, [ ], hold down the Commodore key (at the lower left corner of the keyboard) and press the indicated character.

Rarely, you'll see a single letter of the alphabet enclosed in braces. This can be entered on the Commodore 64 by pressing the CTRL key while typing the letter in braces. For example, {A} means to press CTRL-A.

The Quote Mode

Although you can move the cursor around the screen with the CRSR keys, often a programmer will want to move the cursor under program control. This is seen in examples such as {LEFT} and {HOME} in the program listings. The only way the computer can tell the difference between direct and programmed cursor control is *the quote mode.*

Once you press the quote key, you're in quote mode. This mode can be confusing if you mistype a character and cursor left to change it. You'll see a reverse video character (a graphics symbol for cursor left). In this case, you can use the DELete key to back up and edit the line. Type another quote and you're out of quote mode. If things really get confusing, you can exit quote mode simply by pressing RETURN. Then just cursor up to the mistyped line and fix it.

When You Read:	Press:	See:
{CLR}	SHIFT + CLR/HOME	
{HOME}	CLR/HOME	
{UP}	SHIFT + ↑ CRSR ↓	
{DOWN}	↑ CRSR ↓	
{LEFT}	SHIFT + ←CRSR→	
{RIGHT}	←CRSR→	
{RVS}	CTRL + 9	
{OFF}	CTRL + 0	
{BLK}	CTRL + 1	
{WHT}	CTRL + 2	
{RED}	CTRL + 3	
{CYN}	CTRL + 4	

When You Read:	Press:	See:
{PUR}	CTRL + 5	
{GRN}	CTRL + 6	
{BLU}	CTRL + 7	
{YEL}	CTRL + 8	
{ F1 }	f1	
{ F2 }	SHIFT + f1	
{ F3 }	f3	
{ F4 }	SHIFT + f3	
{ F5 }	f5	
{ F6 }	SHIFT + f5	
{ F7 }	f7	
{ F8 }	SHIFT + f7	

When You Read:	Press:	See:
←	←	
↑	SHIFT + ↑	

For Commodore 64 Only

When You Read:	Press:	See:
[1]	COMMODORE + 1	
[2]	COMMODORE + 2	
[3]	COMMODORE + 3	
[4]	COMMODORE + 4	
[5]	COMMODORE + 5	
[6]	COMMODORE + 6	
[7]	COMMODORE + 7	
[8]	COMMODORE + 8	

Tracker

(Article on page 69.)

```
5 POKE52,48:POKE56,48:CLR
                        :rem 234
10 PRINT"{CLR}{2 DOWN}{RIGHT}P
   LEASE WAIT FOR SET UP..."
                        :rem 245
15 GOSUB9000            :rem 175
20 POKE53281,1:POKE53280,7:POK
   ET+24,15:TS=0:TL=3   :rem 55
25 PRINT"{CLR}{5 DOWN}{BLK}
   {5 RIGHT}GAME INSTRUCTIONS
   {SPACE}(Y/N)":POKE198,0
                        :rem 158
30 GETA$:IFA$="Y"THENGOSUB8000
   :GOTO35              :rem 2
32 IFA$="N"THENGOTO35   :rem 248
33 GOTO30               :rem 2
35 PRINT"{CLR}{5 DOWN}{BLK}":I
   NPUT"{5 RIGHT}SKILL LEVEL (
   1-5)";SK             :rem 4
40 IFSK<1ORSK>5THEN35   :rem 71
45 BV=10*SK:BS=24*BV:SK=INT(30
   /SK-1.5)             :rem 221
50 P=1065:S=91:A=1064:C=9:Y=30
   :C1=9:SC=0           :rem 252
55 PRINT"{CLR}{BLK} T{2}+{BLK}
   R{2}+{BLK}A{2}+{BLK}C{2}+
   {BLK}K{2}+{BLK}E{2}+{BLK}R"
   SPC(13)"SCORE:"      :rem 223
60 POKEA,FC:POKEA+T,4:POKE2023
   ,160:POKE56295,10:POKEP,Y:P
   OKEP+T,6             :rem 224
64 FORN=1TO5:MN=INT(RND(1)*(19
   80-1180))+1180:POKEMN,Q:POK
   EMN+T,5:NEXT         :rem 176
66 FORN=1TO10:MN=INT(RND(1)*(1
   980-1180))+1180:POKEMN,28:P
   OKEMN+T,14:NEXT      :rem 39
68 GOSUB700:TI$="000000"
                        :rem 33
70 PRINT"{HOME}{RED}"SPC(34)SC
                        :rem 155
80 IFTI$>"000159"THEN465
                        :rem 55
82 IF(INT(TI/60)/SK)-INT(INT(T
   I/60)/SK)=0THEN2000:rem 135
84 PRINT"{HOME}"SPC(15)"{4}"(1
   20-INT(TI/60))"{LEFT}
   {2 SPACES}SECS {LEFT} "
                        :rem 243
86 GOSUB1000:M=P:IFFB=0THENS=X
   :ONJVGOTO96,104,92,102,98,1
   00,94,106:GOTO90     :rem 96
88 ONJVGOTO96,86,92,86,98,86,9
   4,86                 :rem 138
90 S=Y:C1=6:GOTO150     :rem 124
92 P=P+1:GOTO120        :rem 170
94 P=P-1:GOTO120        :rem 174
96 P=P-40:GOTO120       :rem 227
98 P=P+40:GOTO120       :rem 227
100 P=P+39:GOTO120       :rem 11
102 P=P+41:GOTO120        :rem 6
104 P=P-39:GOTO120       :rem 17
106 P=P-41                :rem 6
120 IFP<1064THENP=P+40  :rem 20
130 IFP>2023THENP=P-40  :rem 21
135 IFP=ATHENP=M:POKEM,Y:POKEM
   +T,C:GOTO80          :rem 185
145 IFPEEK(P)=86THEN455
                        :rem 103
150 IFPEEK(P)=QTHENY=Q:C=5:GOT
   O160                 :rem 136
155 IFPEEK(P)=28THENY=28:C=14
                        :rem 229
160 IFPEEK(M)=QTHENS=Q:C1=5:GO
   TO170                :rem 178
165 IFPEEK(M)=28THENS=28:C1=14
                        :rem 14
170 POKEP,Y:POKEP+T,C:Y=30:POK
   EM,S:POKEM+T,C1:S=91:C=6:C
   1=9:IFJV<>0THENGOSUB550
                        :rem 36
175 IFP<2023THENPOKE2023,160:P
   OKE56295,10:GOTO80   :rem 67
210 IFA+40>2023THEN230:rem 187
220 IF(PEEK(A+40)=SORPEEK(A+40
   )=QORPEEK(A+40)=28)THENA=A
   +40:F=A-40:GOTO300   :rem 95
230 IF(PEEK(A+1)=SORPEEK(A+1)=
   QORPEEK(A+1)=28)THENA=A+1:
   F=A-1:GOTO300        :rem 97
240 IF(PEEK(A-1)=SORPEEK(A-1)=
   QORPEEK(A-1)=28)THENA=A-1:
   F=A+1:GOTO300        :rem 104
250 IF(PEEK(A-40)=SORPEEK(A-40
   )=QORPEEK(A-40)=28)THENA=A
   -40:F=A+40:GOTO300:rem 104
260 GOTO80              :rem 57
300 IF(A=1983ORA=2022)THENPOKE
   A,FC:POKEA+T,4:POKEF,X:GOT
   O440                 :rem 198
400 IFA=PTHENA=F:POKEA,FC:POKE
   A+T,4:GOTO80         :rem 167
410 IFPEEK(A)=QTHENSC=SC+(2*BV
   ):GOSUB600           :rem 193
420 IFPEEK(A)=28THENSC=SC+BV:G
   OSUB600              :rem 46
430 POKEA,FC:POKEA+T,4:POKEF,X
   :GOSUB525:IFF=1064THENPOKE
   F,86:POKEF+T,0       :rem 173
435 GOTO70              :rem 60
440 POKE2023,FC:POKE56295,4:PO
   KEA,X:SC=SC+(4*BV)   :rem 90
450 PRINT"{CLR}"SPC(6)"
   {11 DOWN}{BLU}HOORAY! HERB
   IE'S HOME SAFE!":GOSUB700:
   GOTO470              :rem 108
455 PRINT"{CLR}"SPC(6)"
   {11 DOWN}{BLU}OUCH! ZAPPED
    BY A DEADLY X!":GOSUB900:
   TL=TL-1              :rem 17
460 GOTO470             :rem 110
465 PRINT"{CLR}"SPC(6)"
   {11 DOWN}{BLU}OH, NO! HERB
   IE IS STRANDED!":GOSUB800:
   TL=TL-1              :rem 55
470 PRINTTAB(14)"{9 UP}{RED}LE
   VEL "BV/10:PRINTTAB(12)"
   {RVS} HIGH SCORE {OFF}:
   {BLK}"HS             :rem 9
475 IFBV>10ANDSC<(BS-(4*BV))/2
   THENSC=SC-(4*BV):IFSC<0THE
   NSC=0                :rem 207
480 TS=TS+SC:IFSC=BSTHENTS=TS+
   500                  :rem 147
482 PRINTTAB(2)"{DOWN}{2}THIS
   {SPACE}ROUND:{4}"SCSPC(2)"
   {2}GAME TOTAL:{BLK}"TS
                        :rem 231
484 IFSC=BSTHENPRINT"{HOME}
   {RVS}{4}{2 SPACES}SPECIAL
   {SPACE}PERFECT ROUND BONUS
   --500!!!!{2 SPACES}
   {5 DOWN}"            :rem 52
486 IFTS>HSTHENHS=TS:PRINTTAB(
   10)"{DOWN}{RED}A NEW HIGH
   {SPACE}SCORE!!!":PRINT"
   {HOME}{4 DOWN}{BLK}"SPC(25
   )HS                  :rem 117
488 IFTL=0THENPRINT"{9 DOWN}":
   GOTO500              :rem 225
490 PRINTTAB(10)"{9 DOWN}{BLK}
   TRACKERS LEFT="      :rem 231
492 TC=26:FORN=1TOTL:PRINTTAB(
   TC)"{UP}{BLU}↑":TC=TC+2:NE
   XT                   :rem 78
494 FORN=1TO8000:NEXT:IFTL>0TH
   EN50                 :rem 147
500 PRINTTAB(10)"{4}{RVS} SORR
   Y, GAME OVER. {OFF}":PRINT
   TAB(11)"{2 DOWN}{2}{RVS} P
   LAY AGAIN? {OFF} {BLK}Y/N"
                        :rem 164
510 GETA$:IFA$=""THEN510
                        :rem 79
515 IFA$="Y"THEN20      :rem 250
520 END                 :rem 110
525 POKET+5,0:POKET+6,240:POKE
   T,15:POKET+1,67      :rem 188
530 POKET+4,17:POKET+4,16:POKE
   T,0:POKET+1,0:RETURN
                        :rem 101
550 POKET+5,0:POKET+6,240:POKE
   T+1,12:POKET,143     :rem 226
555 POKET+4,129:POKET+4,128:PO
   KET,0:POKET+1,0:RETURN
                        :rem 212
600 POKET+5,96:POKET+6,0
                        :rem 142
605 POKET,75:POKET+1,34:rem 98
610 POKET+4,33:FORN=1TO40:NEXT
   N:POKET+4,32         :rem 99
615 POKET,52:POKET+1,43:POKET+
   4,33:FORN=1TO40:NEXTN:POKE
   T+4,32               :rem 100
620 POKET,97:POKET+1,51:POKET+
   4,33:FORN=1TO100:NEXTN:POK
   ET+4,32              :rem 149
625 POKET,0:POKET+1,0:RETURN
                        :rem 11
700 POKET+5,0:POKET+6,240:POKE
   T+12,0:POKET+13,240:POKET+
   19,0:POKET+20,240    :rem 37
702 FORI=1TO3           :rem 13
704 POKET,195:POKET+1,16:POKET
   +8,4:POKET+7,48:POKET+15,3
   3:POKET+14,135       :rem 190
706 GOSUB750:FORN=1TO200:NEXT:
   GOSUB760             :rem 155
708 POKET,31:POKET+1,21:POKET+
   8,5:POKET+7,71:POKET+15,42
   :POKET+14,62         :rem 79
710 GOSUB750:FORN=1TO300:NEXT:
   GOSUB760             :rem 151
712 POKET,96:POKET+1,22:POKET+
   8,5:POKET+7,152:POKET+15,4
   4:POKET+14,193       :rem 189
714 GOSUB750:FORN=1TO500:NEXT:
   GOSUB760:NS=150      :rem 75
716 FORJ=1TO2:POKET,135:POKET+
   1,33:POKET+8,8:POKET+7,97:
   POKET+15,67:POKET+14,15
                        :rem 68
718 GOSUB750:FORN=1TONS:NEXTN:
   NS=50:GOSUB760:NEXTJ:NEXTI
                        :rem 253
720 POKET,223:POKET+1,29:POKET
   +8,7:POKET+7,119:POKET+15,
   59:POKET+14,190      :rem 243
722 GOSUB750:FORN=1TO200:NEXT:
   GOSUB760             :rem 153
724 POKET,30:POKET+1,25:POKET+
   8,6:POKET+7,71:POKET+15,50
   :POKET+14,60         :rem 78
726 GOSUB750:FORN=1TO300:NEXT:
   GOSUB760             :rem 158
728 POKET,96:POKET+1,22:POKET+
   8,44:POKET+7,193:POKET+15,
   16:POKET+14,195      :rem 253
730 GOSUB750:FORN=1TO900:NEXT:
   GOSUB760             :rem 159
732 POKET,0:POKET+1,0:POKET+7,
   0:POKET+8,0:POKET+14,0:POK
   ET+15,0              :rem 58
740 RETURN              :rem 123
750 POKET+4,17:POKET+11,17:POK
   ET+18,17:RETURN      :rem 239
760 POKET+4,16:POKET+11,16:POK
   ET+18,16:RETURN      :rem 237
800 POKET+5,0:POKET+6,240:FORH
   N=255TO1STEP-2:POKET,50:PO
   KET+1,HN             :rem 254
810 POKET+4,17:POKET+4,16:NEXT
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    HN:POKET,0:POKET+1,0:RETUR
    N                          :rem 117
850 POKET+5,9:POKET+6,0:POKET,
    246:POKET+1,2:POKET+4,33
                               :rem 9
860 FORJ=1TO80:NEXT:POKET+4,32
    :POKET,0:POKET+1,0:RETURN
                               :rem 22
900 POKET+5,0:POKET+6,236:POKE
    T,5:POKET+1,1:POKET+4,129
                               :rem 53
910 FORN=1TO1500:NEXT:POKET+4,
    128:RETURN                 :rem 28
1000 SN=SNAND1:JS=PEEK(PA+SN):
    JV=JSANDJM                 :rem 73
1010 FORJI=1TO8:IFJV=JV(JI)THE
    N1030                      :rem 162
1020 NEXT:JI=0                 :rem 60
1030 JV=JI:FB=-((JSANDFM)=ZR):
    RETURN                     :rem 8
2000 MI=INT(RND(1)*(1933-1424)
    )+1424:FORN=1TO4:XX=X
                               :rem 163
2010 IF(PEEK(MI)=30ORPEEK(MI)=
    31)THENMI=MI+1:GOTO2010
                               :rem 199
2020 IF(PEEK(MI)=91ORPEEK(MI)=
    28ORPEEK(MI)=QORPEEK(MI)=
    86)THENXX=86               :rem 200
2030 POKEMI,27:FORG=11TO2STEP-
    1:POKEMI+T,G:NEXTG:GOSUB8
    50:POKEMI,XX:POKEMI+T,0
                               :rem 82
2040 MI=MI+1:NEXT:IF(PEEK(MI)<
    >30ANDPEEK(MI)<>31)THENPO
    KEMI,86:POKEMI+T,0:rem 44
2050 GOTO80                    :rem 104
8000 PRINT"{CLR}{DOWN}"TAB(8)"
    {PUR}◄[2]+++++ {BLK}TRACK
    ER [2]+++++{BLU}↑"
                               :rem 173
8010 PRINT"{2 DOWN}[4]{RIGHT}U
    SE PORT 2 JOYSTICK TO MOV
    E TRACKER."                :rem 88
8015 PRINT"{2 RIGHT}FIRE BUTTO
    N LAYS TRACK."             :rem 183
8020 PRINT"{DOWN}{RIGHT}WHEN T
    RACKER IS HOME, PURPLE HE
    RBIE"                      :rem 127
8025 PRINT"{2 RIGHT}CAN MOVE O
    N TRACK AND COLLECT PTS."
                               :rem 243
8030 PRINT"{DOWN}{RIGHT}THE ME
    ANIES LEAVE DEADLY X'S."
                               :rem 205
8035 PRINT"{2 RIGHT}DON'T LET
    {SPACE}TRACKER RUN INTO T
    HEM."                      :rem 179
8040 PRINT"{DOWN}{RIGHT}TRACKE
    R & PURPLE HERBIE ARE PAR
    ALYZED"SPC(4)"WHEN MEANIE
    S APPEAR."                 :rem 210
8045 PRINT"{DOWN}{RIGHT}USE TR
    ACKER TO BUILD A NEW PATH
     AFTER":PRINT"{2 RIGHT}ME
    ANIES ATTACK."             :rem 211
8050 PRINT"{DOWN}{RIGHT}DON'T
    {SPACE}BE TOO GREEDY--YOU
    'RE IN A RACE"             :rem 105
8055 PRINT"{2 RIGHT}AGAINST TH
    E CLOCK TO GET HERBIE HOM
    E!":GOSUB700               :rem 254
8060 PRINTTAB(7)"{2 DOWN}{BLK}
    HIT {RVS}RETURN{OFF} TO C
    ONTINUE"                   :rem 33
8065 GETA$:IFA$=""THEN8065
                               :rem 201
8070 IFA$<>CHR$(13)THEN8060
                               :rem 240
8100 PRINT"{CLR}"SPC(9)"{DOWN}
    {RVS}[4] CAST OF CHARACTE
    RS {OFF}{DOWN}"            :rem 222
8110 LN=72:FORV=1TO8           :rem 202
8115 PRINTTAB(12)"{DOWN}"CC$(V
    );CT$(V)" {BLK}-- ";CN$(V
    )                          :rem 239
8120 POKET+5,9:POKET+6,210:POK
    ET+1,LN:POKET,143:LN=LN-3
                               :rem 91
8125 POKET+12,9:POKET+13,210:P
    OKET+8,LN:POKET+7,210:LN=
    LN-3                       :rem 32
8130 POKET+19,9:POKET+20,210:P
    OKET+15,LN:POKET+14,209:L
    N=LN-3                     :rem 133
8135 POKET+4,17:POKET+11,17:PO
    KET+18,17                  :rem 10
8140 FORI=1TO500:NEXTI:rem 101
8145 POKET+4,16:POKET+11,16:PO
    KET+18,16                  :rem 8
8150 FORJ=1TO200:NEXTJ:NEXTV
                               :rem 52
8155 FORN=TTOT+23:POKET,0:NEXT
                               :rem 178
8160 PRINTTAB(8)"{2 DOWN}[4]HI
    T {RVS}RETURN{OFF} TO CON
    TINUE"                     :rem 42
8165 GETA$:IFA$=""THEN8165
                               :rem 203
8170 IFA$<>CHR$(13)THEN8160
                               :rem 242
8175 RETURN                    :rem 181
9000 PA=56320:JM=15:FM=16:ZR=0
    :T=54272:X=32              :rem 210
9010 FC=31:Q=164:FORN=TTOT+24:
    POKEN,0:NEXT               :rem 107
9020 FORJI=1TO8:READJV(JI):NEX
    T                          :rem 225
9030 POKE56334,PEEK(56334)AND2
    54:POKE1,PEEK(1)AND251
                               :rem 237
9040 FORI=0TO2047:POKE12288+I,
    PEEK(53248+I):NEXTI
                               :rem 154
9050 POKE1,PEEK(1)OR4:POKE5633
    4,PEEK(56334)OR1           :rem 189
9060 POKE53272,(PEEK(53272)AND
    240)+12                    :rem 238
9070 FORCH=0TO39:READNW:POKE12
    504+CH,NW:NEXTCH           :rem 169
9080 FORV=1TO8:READCC$(V),CT$(
    V),CN$(V):NEXTV:RETURN
                               :rem 253
10000 DATA14,6,7,5,13,9,11,10
                               :rem 166
10100 DATA255,195,255,219,219,
    219,219,219                :rem 35
10200 DATA60,60,195,219,219,19
    5,60,60                    :rem 79
10300 DATA219,219,219,126,126,
    219,219,219                :rem 28
10400 DATA60,36,255,255,255,21
    9,24,126                   :rem 129
10500 DATA255,219,219,255,255,
    195,231,255                :rem 33
10600 DATA "{BLU}","↑",TRACKER
                               :rem 122
10700 DATA "[2]","+",TRACK
                               :rem 215
10800 DATA "{PUR}","◄",PURPLE
    {SPACE}HERBIE              :rem 117
10900 DATA "{GRN}","{RVS}$
    {OFF}",20-100 PTS
                               :rem 241
11000 DATA "[7]","£", 10-50 P
    TS                         :rem 204
11100 DATA "[3]","{RVS} {OFF}"
    ,HOME 40-200 PTS:rem 106
11200 DATA "{RED}","[",MEANIE
                               :rem 20
11300 DATA "{BLK}","V",DEADLY
    {SPACE}X                   :rem 96
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Zounds!

(Article on page 81.)

Program 1: Waveform 23

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10 FORL=54272TO54295:POKEL,0:N
   EXT:POKE54296,15        :rem 16
20 POKE54277,8:POKE54278,255:P
   OKE54276,23:REM COMPARE WIT
   H 17, 21 OR 33          :rem 154
40 FORF2=15TO30STEP5:POKE54287
   ,F2                     :rem 244
50 FORF1=1TO255STEP4:POKE54273
   ,F1:NEXTF1:NEXTF2:POKE54278
   ,15                     :rem 215
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Program 2: Hear See Chord

```
10 FORL=54272TO54295:POKEL,0:N
   EXT:POKE54296,15        :rem 16
20 V1=54276:V2=54283:V3=54290:
   W=65:Q=100              :rem 201
30 POKE54275,8:POKE54282,8:POK
   E54289,8:REM SQUARE WAVE US
   ED WITH WAVEFORM 65     :rem 9
40 POKE54277,2:POKE54278,12:RE
   M ADSR V1               :rem 203
50 POKE54284,2:POKE54285,12:RE
   M ADSR V2               :rem 201
60 POKE54291,2:POKE54292,12:RE
   M ADSR V3               :rem 199
70 POKE54273,16:POKE54272,195:
   REM C                   :rem 199
80 POKE54280,21:POKE54279,31:R
   EM E                    :rem 144
90 POKE54287,25:POKE54286,30:R
   EM G                    :rem 155
100 FORZ=1TO30:POKEV1,W:REM TO
    TAL NO. OFNOTES TO BE PLAY
    ED                     :rem 45
110 FORT=1TOQ:NEXT:REM TIME DE
    LAY                    :rem 100
120 POKEV2,W:POKEV1,W-1:REM TU
    RNS ON{4 SPACES}VOICE 2, T
    URNS OFF VOICE 1       :rem 231
130 FORT=1TOQ:NEXT:POKEV2,W-1:
    REM AFTER DELAY TURNS OFF
    {SPACE}VOICE 2         :rem 154
140 POKEV3,W:POKEV2,W-1:REM TU
    RNS ON{4 SPACES}VOICE 3, T
    URNS OFF VOICE 2       :rem 237
150 FORT=1TOQ:NEXT:POKEV3,W-1:
    REM AFTER DELAY TURNS OFF
    {SPACE}VOICE 3         :rem 158
160 Q=Q-5:NEXT:REM TIME DELAY
    {SPACE}IS DECREASING, THUS
     NOTES PLAYED MORE RAPIDLY
                           :rem 126
170 FORT=1TO1200:NEXT:END
                           :rem 49
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Program 3: Rubber Band In A Drum

```
10 FORL=54272TO54295:POKEL,0:N
   EXT:POKE54296,15        :rem 16
20 POKE54277,6:REM ATTACK/DECA
   Y (SUSTAIN/RELEASE IS 0)
                           :rem 219
30 FORZ=1TO40:A=INT(60*RND(1))
   +1:Q=INT(100*RND(1))+1:REM
   {SPACE}Z = NO. OF SOUNDS
                           :rem 209
40 POKE54273,40:REM UNCHANGING
    FREQUENCY FOR VOICE ONE
                           :rem 25
50 F2=INT(55*RND(1))+1:REM VAR
   IABLE FREQUENCY FOR VOICE 2
    TO BE POKED NEXT LINE
                           :rem 85
60 POKE54287,F2            :rem 67
70 POKE54276,23:REM TURNS ON V
   OICE 1 WITH WAVEFORM 23
                           :rem 53
```

```
80 FORT=1TOQ:NEXT:REM VARIABLE
   TIME BETWEEN SOUNDS
                          :rem 247
90 POKE54276,128:NEXTZ:REM TUR
   N OFF VOICE 23 WITH A 128 Y
   IELDS UNIQUE SOUND :rem 153
```

Program 4: Harmonix

```
10 FORT=54272TO54295:POKET,0:N
   EXT:POKE54296,15     :rem 32
20 AD=15:SR=190:REM ENVELOPE V
   ALUES TO BE POKED INTO VOIC
   ES 2 AND 3 NEXT LINE
                          :rem 203
30 POKE54284,AD:POKE54291,AD:P
   OKE54285,SR:POKE54292,SR
                          :rem 235
40 POKE54283,21:POKE54290,23:R
   EM TURNS{2 SPACES}ON VOICES
    2 AND 3               :rem 126
50 FORF1=200TO1STEP-10:POKE542
   73,F1                  :rem 65
60 FORF2=200TO1STEP-50:FORF3=1
   TO4:POKE54280,F2:POKE54287,
   F3:NEXTF3              :rem 47
70 NEXTF2:NEXTF1:FORQ=15TO0STE
   P-.1:POKE54296,Q:NEXTQ:REM
   {SPACE}STOPS SOUND GRADUALL
   Y                      :rem 93
```

Program 5: Falling Sitar

```
10 FORL=54272TO54295:POKEL,0:N
   EXT:POKE54296,15     :rem 16
20 POKE54277,4:POKE54278,12:RE
   M ADSR                 :rem 68
30 F2=150:Q=50:REM Q IS STARTI
   NG SPEED,{2 SPACES}DECREASE
   D IN LINE 80 TO SPEED UP
                          :rem 79
40 FORZ=1TO50:REM NO. OF CYCLE
   S                      :rem 92
45 F1=INT(100*RND(1))+10:POKE5
   4276,23:REMEMBER THIS WAVEF
   ORM?                   :rem 111
50 FORT=1TOQ:NEXTT        :rem 207
60 POKE54273,F1:REM RANDOM FRE
   Q                      :rem 74
70 POKE54287,F2:REM DESCENDING
    FREQ                  :rem 100
80 POKE54276,20:Q=Q-1:F2=F2-3:
   NEXTZ:POKE54273,30:REM 30 G
   IVES LAST TONE ONLY:rem 230
```

Program 6: Glissando

```
10 FORT=54272TO54295:POKET,0:N
   EXT:POKE54296,15     :rem 32
20 A=15:D=107:REM ADSR VALUES
   {SPACE}TO BE POKED INTO ENV
   ELOPE REGISTERS NEXT LINE
                          :rem 5
30 POKE54277,A:POKE54284,A:POK
   E54291,A:POKE54278,D:POKE54
   285,D:POKE54292,D    :rem 99
40 POKE54286,50:POKE54287,40:R
   EM CAREFULLY CHOSEN FREQUEN
   CIES FOR VOICE 3     :rem 127
50 POKE54276,33:POKE54283,23:P
   OKE54290,23:REM TURNS ON AL
   L THREE VOICES       :rem 157
60 FORF1=10TO50STEP1:POKE54273
   ,F1:REM VOICE 1 FREQUENCIES
                          :rem 231
70 FORF2=30TO1STEP-5:POKE54280
   ,F2:REM VOICE 2 FREQUENCIES
                          :rem 232
75 NEXTF2:NEXTF1          :rem 19
80 POKE54276,32:POKE54283,32:P
   OKE54290,32:REM TURNS VOICE
   S OFF                  :rem 140
```

Machine Language For Beginners

(Article on page 77.)

Program 2: Datastuffer—64 Version

```
10 FORI=49152TO49361:READD:POK
   EI,D:CS=CS+D:NEXT    :rem 196
20 IFCS<>30003THEN PRINT"ERROR
   IN DATA STATEMENTS":rem 58
50000 DATA169,0,133,163,169,8,
      133,164,169,80    :rem 174
50010 DATA141,208,192,169,195,
      141,209,192,169,0:rem 68
50020 DATA141,211,192,168,145,
      163,230,163,200,200
                        :rem 137
50030 DATA173,208,192,145,163,
      200,173,209,192,145
                        :rem 161
50040 DATA163,24,173,208,192,1
      05,10,141,208,192:rem 51
50050 DATA173,209,192,105,0,14
      1,209,192,200,169:rem 55
50060 DATA131,145,163,200,140,
      210,192,160,0,177:rem 38
50070 DATA167,168,169,0,32,145
      ,179,32,221,189 :rem 235
50080 DATA162,1,172,210,192,18
      9,0,1,240,7         :rem 6
50090 DATA145,163,200,232,76,8
      5,192,238,211,192:rem 68
50100 DATA169,44,145,163,200,2
      30,167,208,2,230:rem 254
50110 DATA168,173,211,192,201,
      10,240,3,76,64    :rem 155
50120 DATA192,136,169,0,145,16
      3,141,211,192,165:rem 58
50130 DATA163,133,165,165,164,
      133,166,200,140,210
                        :rem 145
50140 DATA192,24,165,163,109,2
      10,192,133,163,169
                        :rem 114
50150 DATA0,101,164,133,164,16
      0,1,145,165,136   :rem 200
50160 DATA165,163,145,165,56,1
      65,169,229,167,133
                        :rem 135
50170 DATA2,165,170,229,168,5,
      2,176,26,169      :rem 82
50180 DATA0,136,145,163,200,14
      5,163,200,145,163:rem 46
50190 DATA56,152,101,163,133,4
      5,169,0,101,164   :rem 209
50200 DATA133,46,76,123,227,76
      ,28,192,0,0       :rem 15
```

Program 3: Datastuffer—VIC Version

```
10 FORI=20480TO20689:READD:POK
   EI,D:CS=CS+D:NEXT    :rem 191
20 IFCS<>27930THENPRINT"ERROR
   {SPACE}IN DATA STATEMENTS"
                        :rem 73
50000 DATA169,0,133,163,169,18
      ,133,164,169,80   :rem 223
50010 DATA141,208,80,169,195,1
      41,209,80,169,0   :rem 220
50020 DATA141,211,80,168,145,1
      63,230,163,200,200
                        :rem 85
50030 DATA173,208,80,145,163,2
      00,173,209,80,145:rem 57
50040 DATA163,24,173,208,80,10
      5,10,141,208,80   :rem 203
50050 DATA173,209,80,105,0,141
      ,209,80,200,169   :rem 207
50060 DATA131,145,163,200,140,
      210,80,160,0,177:rem 242
50070 DATA167,168,169,0,32,145
      ,211,32,221,221   :rem 209
50080 DATA162,1,172,210,80,189
      ,0,1,240,7        :rem 210
50090 DATA145,163,200,232,76,8
      5,80,238,211,80   :rem 220
50100 DATA169,44,145,163,200,2
      30,167,208,2,230:rem 254
50110 DATA168,173,211,80,201,1
      0,240,3,76,64     :rem 103
50120 DATA80,136,169,0,145,163
      ,141,211,80,165   :rem 210
50130 DATA163,133,165,165,164,
      133,166,200,140,210
                        :rem 145
50140 DATA80,24,165,163,109,21
      0,80,133,163,169  :rem 10
50150 DATA0,101,164,133,164,16
      0,1,145,165,136   :rem 200
50160 DATA165,163,145,165,56,1
      65,169,229,167,133
                        :rem 135
50170 DATA2,165,170,229,168,5,
      2,176,26,169      :rem 82
50180 DATA0,136,145,163,200,14
      5,163,200,145,163:rem 46
50190 DATA56,152,101,163,133,4
      5,169,0,101,164   :rem 209
50200 DATA133,46,76,103,228,76
      ,28,80,0,0        :rem 218
```

Program 4: Stufferbas

```
10 INPUT"START ADDRESS";SA
                        :rem 152
20 INPUT"END ADDRESS";EA
                        :rem 212
30 H%=SA/256:L%=SA-256*H%:POKE
   167,L%:POKE168,H%    :rem 143
40 H%=EA/256:L%=EA-256*H%:POKE
   169,L%:POKE170,H%    :rem 111
50 SYS49152:REM VIC USERS SYS
   {SPACE}20480         :rem 248
```

Friendly Alien

(Article on page 70.)

Program 1: Friendly Alien—64 Version

```
6 GOTO20                :rem 209
7 PRINT"{HOME}{BLU}TIME: ";MID
  $(TI$,3,2);":";RIGHT$(TI$,2)
                        :rem 177
8 IFTI$>TU$THENPRINT"{HOME}TIM
  E IS UP!!!{4 SPACES}":FORI=1
  TO1500:NEXT:GOTO1300:rem 106
10 RETURN               :rem 65
11 LO=LO-Q2:RETURN      :rem 159
12 LO=LO-Q1:RETURN      :rem 159
13 LO=LO+P:RETURN       :rem 108
14 LO=LO+Q3:RETURN      :rem 161
15 LO=LO+Q2:RETURN      :rem 161
16 LO=LO+Q1:RETURN      :rem 161
17 LO=LO-P:RETURN       :rem 114
18 LO=LO-Q3:RETURN      :rem 167
20 POKE56,48:POKE52,48:CLR
                        :rem 23
30 POKE53281,1:PRINT"{CLR}
   {6 DOWN}{8 SPACES}{RVS}
   {BLU}*****FRIENDLY ALIEN***
   **{OFF}              :rem 1
35 PRINT"{4 DOWN}{4 RIGHT}
   {10 SPACES}{BLK}SETTING UP.
   ...                  :rem 218
36 POKE56334,PEEK(56334)AND254
```

```
:POKE1,PEEK(1)AND251
                        :rem 138
40 NM=12288:FORI=NMTONM+511:PO
KEI,PEEK(I+40960):NEXT
                        :rem 199
42 FORI=0TO7:POKENM+8*59+I,PEE
K(53248+81*8+I):NEXT:POKENM
+8*59+3,255             :rem 0
44 FORI=0TO7:POKENM+8*61+I,PEE
K(53248+8*77+I):NEXT
                        :rem 219
48 POKE1,PEEK(1)OR4:POKE56334,
PEEK(56334)OR1:CK=0:rem 144
50 FORI=NM+272TONM+311:READA:C
K=CK+A:POKEI,A:NEXT :rem 95
58 FORI=NM+344TONM+383:READA:C
K=CK+A:POKEI,A:NEXT:rem 112
68 FORI=0TO31:READA:CK=CK+A:PO
KENM+I,A:NEXT           :rem 6
69 FORI=0TO7:READA:CK=CK+A:POK
ENM+8*60+I,A:NEXT   :rem 205
70 IFCK=15391THEN100    :rem 132
71 PRINT"**ERROR IN DATA STATE
MENTS**":PRINT"{DOWN}**CHEC
K LINES 8070-8093**":END
                        :rem 162
100 X=RND(-TI):POKE53280,0:POK
E53281,0                :rem 180
101 PRINT"{CLR}{DOWN}{GRN}
{RVS}GUIDE THE LITTLE ALIE
N WITH A JOYSTICK
{2 SPACES}IN PORT 2";
                        :rem 243
110 PRINT" AND PICK UP ALL THE
 CANDY.                 :rem 55
135 PRINT:PRINT"{RVS}{RED}THEN
 GUIDE HIM TO THE PHONE AN
D THEN TO THE SPACESHIP.
                        :rem 10
160 PRINT:PRINT"{RVS}{YEL}LOOK
 OUT FOR THE CANS OF COLA.
";                      :rem 22
161 PRINT" IF HE{4 SPACES}DRIN
KS COLA HE WILL HAVE AN AL
LERGIC";                :rem 101
165 PRINT"{4 SPACES}REACTION A
ND CAN'T BE GUIDED.:rem 39
168 PRINT:PRINT"{RVS}{CYN}IF H
E TOUCHES A FLU BUG, ";
                        :rem 140
169 PRINT"{RVS}OR IF YOU RUN
{2 SPACES}OUT OF TIME, HE
{SPACE}WILL GET THE FLU AN
D CANNOT GO HOME.   :rem 91
170 PRINT"{7 RIGHT}{RVS}{DOWN}
{8}***YOU HAVE 2 MINUTES**
*                       :rem 68
500 PRINT"{DOWN}{8 RIGHT}{RVS}
{GRN}ENTER SKILL LEVEL 1-5
{OFF}"                  :rem 41
502 GETA$:IFA$=""THEN502
                        :rem 81
503 A=VAL(A$):IFA<1ORA>5THEN50
0                       :rem 63
505 SC=1024             :rem 52
510 CM=54272:PRINT"{CLR}":POKE
53280,14:POKE53281,1:P5=15
                        :rem 44
511 O=0:H1=1:H2=32:H3=3:H4=34:
H5=35:H6=36:H7=42:H8=61:H9
=2:P6=45:P7=46:P8=47
                        :rem 31
512 VL=54296:SL=54272:SH=54273
:WF=54276:Q1=39:Q2=40:Q3=4
1:Q4=42::P1=56320:P=1
                        :rem 125
515 POKE53272,(PEEK(53272)AND2
40)+12:POKESL+5,17:POKESL+
6,241                   :rem 226
519 REM: ***BUILD BORDER
                        :rem 105
520 FORB=SC+Q2TOSC+80:POKEB,35
:POKECM+B,6:NEXT    :rem 141
525 FORB=SC+79TOSC+999STEPQ2:P
OKEB,35:POKECM+B,6:NEXT
                        :rem 129
530 FORB=SC+998TOSC+960STEP-1:
POKEB,35:POKECM+B,6:NEXT
                        :rem 134
535 FORB=SC+960TOSC+Q2STEP-Q2:
POKEB,35:POKECM+B,6:NEXT
                        :rem 182
600 REM: ***PLACE FLUBUGS
                        :rem 175
605 FORI=1TO9*A         :rem 128
610 GOSUB4000           :rem 219
612 IFPEEK(X)=35THEN610:rem 97
620 POKEX,42:POKECM+X,3:IFI<=A
THENF(I)=X:POKEX+CM,7
                        :rem 219
622 NEXT                :rem 217
700 REM: ***PLACE COLA:rem 183
705 FORI=1TO15*A        :rem 174
710 GOSUB4000           :rem 220
720 IFPEEK(X)=35ORPEEK(X)=42OR
PEEK(X-Q2)=36ORPEEK(X+Q2)=
36THEN710               :rem 252
725 POKEX,36:POKECM+X,2:NEXT
                        :rem 13
800 REM: ***PLACE CANDY :rem 8
803 C=2:FORI=1TO20:C=C+1:IFC>7
THENC=2                 :rem 229
810 GOSUB4000           :rem 221
820 IFPEEK(X)<>32ORPEEK(X+1)<>
32ORPEEK(X-1)<>32ORPEEK(X+
Q2)<>32THEN810      :rem 240
822 IFPEEK(X-Q2)<>32THEN810
                        :rem 80
825 POKEX,34:POKECM+X,C:NEXT
                        :rem 29
830 RP=20:LO=SC+918:TI$="00000
0":TU$="000159"     :rem 164
899 REM: ***MAIN LOOP :rem 165
900 IFRP=.THEN3000      :rem 39
920 POKELO,37:POKELO+Q2,38:POK
ELO+CM,4:POKELO+CM+Q2,4
                        :rem 48
922 GOSUB7              :rem 84
930 POKESH,50:POKEVL,10:POKEWF
,17:GOTO1500            :rem 98
935 POKEWF,16             :rem 0
1000 AA=P5-(PEEK(P1)ANDP5)
                        :rem 210
1050 LT=LO:ONAAGOSUB11,15,10,1
7,18,16,10,13,12,14
                        :rem 145
1080 POKELT,H2:POKELT+Q2,H2
                        :rem 155
1099 REM: ***COLLISION CHECKER
                        :rem 16
1100 TL=PEEK(LO):BL=PEEK(LO+Q2
)                       :rem 116
1102 IFTL=H1ORTL=H3ORTL=H5ORBL
=.ORBL=H9ORBL=H5THENLO=LT
:GOTO900            :rem 192
1103 IFTL=H2ANDBL=H2THEN900
                        :rem 139
1110 IFTL=H7ORBL=H7THEN1300
                        :rem 140
1115 IFTL=H8ORBL=H8THEN3500
                        :rem 151
1120 IFTL=H6ORBL=H6THEN1400
                        :rem 140
1130 IFTL=H4ORBL=H4THENRP=RP-1
:GOTO1200           :rem 217
1135 IFTL=P6ORTL=P7ORTL=P8ORBL
=P8THEN3100         :rem 174
1140 GOTO900            :rem 152
1199 REM: ***CANDY PICKUP
                        :rem 171
1200 POKELO,37:POKELO+Q2,38:PO
KELO+CM,4:POKELO+CM+Q2,4
                        :rem 88
1210 POKESH,150:POKEWF,33:FORL
=1TO25:NEXT         :rem 70
1220 POKESH,200:FORL=1TO25:NEX
T:POKEWF,32:GOTO900
                        :rem 78
1299 REM: ***FLUBUG COLLISION
                        :rem 226
1300 POKELO,37:POKELO+Q2,38:PO
KELO+CM,3:POKELO+CM+Q2,3
                        :rem 87
1310 POKESL,150:FORL=1TO5:POKE
WF,17:POKESH,25:FORX=1TO3
0:NEXT:POKEWF,16    :rem 56
1320 POKEWF,33:FORX=1TO50:NEXT
:POKESL,0:FORX=1TO200:NEX
T:NEXT:POKEWF,32    :rem 149
1325 GOTO2000           :rem 198
1399 REM: ***COLA COLLISION (G
LUG-GLUG)               :rem 25
1400 POKELO,37:POKELO+Q2,38:PO
KELO+CM,4:POKELO+CM+Q2,4
                        :rem 90
1410 POKESL,150:FORL=1TO4:POKE
WF,17:POKESH,25:FORX=1TO1
5:NEXT:POKEWF,16    :rem 59
1412 FORX=1TO25:NEXT:POKESL,0:
FORX=1TO200:NEXT:NEXT
                        :rem 106
1415 POKELO,32:POKELO+Q2,32:PO
KELO+CM,1:POKELO+CM+Q2,1
                        :rem 79
1416 AA=INT(RND(1)*8)+1:GOTO10
50                      :rem 36
1499 REM: ***SELECT & MOVE FLU
BUG                     :rem 85
1500 D=INT(RND(P)*A)+P:rem 238
1510 LT=LO:LO=F(D):X=INT(RND(P
)*8)+P:FT=F(D)      :rem 133
1515 ONXGOSUB11,12,13,14,15,16
,17,18                  :rem 161
1634 F(D)=LO            :rem 129
1635 LO=LT:IFPEEK(F(D))<>H2AND
PEEK(F(D))<>37ANDPEEK(F(D
))<>38THENF(D)=FT   :rem 71
1700 POKEFT,H2          :rem 55
1702 IFF(D)=LOORF(D)=LO+Q2THEN
POKELO+CM,H3:POKELO+CM+Q2
,H3:GOTO1310        :rem 181
1710 POKEF(D),H7:POKEF(D)+CM,7
:GOTO935            :rem 244
2000 POKEVL,.:POKESH,.  :rem 75
2001 PRINT"{CLR}{5 DOWN}{BLK}H
E CAUGHT THE FLU FROM THE
 FLU BUG AND{2 SPACES}CAN
NOT GO HOME."      :rem 122
2002 GOTO2040           :rem 195
2025 PRINT"{CLR}{RIGHT}
{3 DOWN}{BLK}{15 SPACES}
{RVS}YOU WON!!"     :rem 82
2030 PRINT"{DOWN}{11 SPACES}";
MID$(TT$,3,2);" MINUTE ";
RIGHT$(TT$,2)" SECONDS
                        :rem 148
2035 PRINT"{DOWN}{RIGHT}
{13 SPACES}SKILL LEVEL"A
                        :rem 1
2040 PRINT"{2 DOWN}{3 RIGHT}
{12 SPACES}{RVS}PLAY AGAI
N?"                     :rem 247
2045 POKE53272,21       :rem 140
2050 GETA$:IFA$=""THEN2050
                        :rem 177
2055 IFA$="Y"THENRUN100:rem 79
2060 PRINT"{CLR}":END   :rem 61
2999 REM: ***BUILD SPACEPHONE
                        :rem 207
3000 Q=SC+80:R=SC+160:GOSUB600
0:GOSUB7:POKELO,32:POKELO
+Q2,32:LO=SC+918    :rem 89
3002 PRINT"{HOME}{2 DOWN}
{RIGHT}{CYN}+,{2 SPACES}"
:PRINT"{RIGHT}-.{YEL}/ ":
RP=20:GOTO900       :rem 181
3099 REM: ***RING SPACEPHONE
                        :rem 135
3100 LO=SC+84:POKELO,37:POKELO
```

```
    +Q2,38:POKELO+CM,4:POKELO
    +CM+Q2,4          :rem 152
3110 POKEWF,17:FORL=1TO3:FORM=
    1TO50:POKESH,150:FORN=1TO
    13:NEXT           :rem 221
3120 POKESH,0:NEXT:GOSUB7:FORM
    =1TO1000:NEXT:GOSUB7:NEXT
    :POKEWF,16        :rem 18
3399 REM: ***BUILD SPACESHIP
                      :rem 132
3400 Q=SC+200:R=SC+440:GOSUB7:
    GOSUB6000:GOSUB7  :rem 44
3401 PRINT"{HOME}{2 DOWN}
    {RIGHT}{4 SPACES}":PRINT"
    {RIGHT}{4 SPACES}":rem 19
3402 LO=SC+918:POKELO,37:POKEL
    O+Q2,38:POKELO+CM,4:POKEL
    O+CM+Q2,4         :rem 211
3406 GOSUB7:GOSUB3600:GOSUB7
                      :rem 248
3408 PRINT"{7 DOWN}"SPC(20)"
    {CYN};            :rem 172
3410 GOSUB7:GOSUB3600:GOSUB7
                      :rem 243
3425 PRINT"{HOME}{6 DOWN}"SPC(
    19)"{CYN}@#B      :rem 31
3430 PRINTSPC(17)"<<###<<
                      :rem 113
3435 PRINTSPC(19)"A#C :rem 198
3440 GOSUB7:GOSUB3600:GOSUB7
                      :rem 246
3450 PRINT"{HOME}{5 DOWN}"SPC(
    18)"{CYN}@###B    :rem 81
3452 PRINTSPC(18)"{CYN}#####
                      :rem 107
3460 PRINTSPC(13)"{CYN}#######
    ########          :rem 195
3462 PRINTSPC(18)"{CYN}#####
                      :rem 108
3470 PRINTSPC(18)"{CYN}A###C
                      :rem 169
3480 GOSUB7:GOSUB3600:GOSUB7
                      :rem 250
3490 T=SC+343:FORB=1TO3:POKET,
    H8:POKECM+T,H3:T=T+Q3:NEX
    T:POKESC+387,H2   :rem 164
3492 POKESC+427,H2      :rem 5
3495 POKEVL,0:POKESH,0:RP=20:G
    OTO900            :rem 233
3499 REM: ***PUT ALIEN ON RAMP
                      :rem 164
3500 TT$=TI$:LO=SC+386:POKELO,
    37:POKELO+Q2,38:POKELO+CM
    ,4:POKELO+CM+Q2,4:rem 213
3505 FORL=1TO1500:NEXT :rem 80
3510 POKESC+386,32:POKESC+426,
    32:POKESC+384,32:POKESC+3
    43,32:POKESC+425,32
                      :rem 71
3520 FORL=1TO2000:NEXT:GOTO202
    5                 :rem 133
3599 REM: ***SPACESHIP SOUND
                      :rem 159
3600 POKEVL,15:POKEWF,33:FORL=
    1TO3:FORM=1TO255STEP2:POK
    ESH,M:NEXT:GOSUB7:NEXT
                      :rem 94
3640 POKEWF,32:RETURN   :rem 6E
4000 X=INT(RND(1)*740)+SC+3*Q2
    :RETURN           :rem 166
5999 REM: ***RELOCATE FLUBUGS
                      :rem 227
6000 FORI=PTOA:IFF(I)>QANDF(I)
    <RTHENPOKEF(I),H2:F(I)=F(
    I)+280            :rem 192
6022 NEXTI:GOSUB7:RETURN
                      :rem 93
8070 DATA,,,24,24,,,,255,255,2
    55,255,255,255,255,255,,,
    ,56,56,56,56,56   :rem 160
8075 DATA36,126,126,60,24,24,2
    4,60,126,189,189,189,189,
    36,66,66          :rem 125
8080 DATA,,31,127,127,255,255,
    255,,,248,240,224,192,128
    ,,254,253,248,240,224
                      :rem 202
8085 DATA192,128,,,,128,64,32,
    18,9,6,63,33,63,63,43,53,
    235,63            :rem 243
8090 DATA7,31,63,127,127,255,2
    55,255,255,255,255,127,12
    7,63,31,7         :rem 151
8092 DATA224,248,252,254,254,2
    55,255,255,255,255,255,25
    4,254,252,248,224 :rem 51
8093 DATA,,,255,255,255,,
                      :rem 246
```

Program 2: Friendly Alien—VIC Version

See instructions in article before typing.

```
6 GOTO20              :rem 209
7 PRINT"{HOME}{BLU}TIME: ";MID
  $(TI$,3,2);":";RIGHT$(TI$,2)
                      :rem 177
8 IFTI$>TU$THENPRINT"{HOME}TIM
  E IS UP!!!{4 SPACES}":FORI=1
  TO1500:NEXT:GOTO1300:rem 106
9 RETURN              :rem 25
11 LO=LO-Q2:RETURN    :rem 159
12 LO=LO-Q1:RETURN    :rem 159
13 LO=LO+P1:RETURN    :rem 157
14 LO=LO+Q3:RETURN    :rem 161
15 LO=LO+Q2:RETURN    :rem 161
16 LO=LO+Q1:RETURN    :rem 161
17 LO=LO-P1:RETURN    :rem 163
18 LO=LO-Q3:RETURN    :rem 167
20 IFPEEK(44)<32THENPOKE56,28:
  POKE52,28:CLR       :rem 80
30 PRINT"{CLR}{6 DOWN}{RVS}
  {BLK}****FRIENDLY ALIEN****
  {OFF}               :rem 85
35 PRINT"{4 DOWN}{4 RIGHT}SETT
  ING UP....          :rem 74
40 NM=7168:FORI=NMTONM+511:POK
  EI,PEEK(I+25600):NEXT
                      :rem 146
50 FORI=NM+272TONM+311:READA:P
  OKEI,A:NEXT         :rem 96
58 FORI=NM+344TONM+383:READA:P
  OKEI,A:NEXT         :rem 113
62 FORI=0TO7:POKENM+8*59+I,PEE
  K(32768+81*8+I):NEXT:POKENM
  +8*59+3,255         :rem 6
64 FORI=0TO7:POKENM+8*61+I,PEE
  K(32768+8*77+I):NEXT:CK=0
                      :rem 22
68 FORI=0TO31:READA:CK=CK+A:PO
  KENM+I,A:NEXT       :rem 6
69 FORI=0TO7:READA:CK=CK+A:POK
  ENM+8*60+I,A:NEXT   :rem 205
94 FORI=832TO936:READA:CK=CK+A
  :POKEI,A:NEXT       :rem 234
95 IFCK=16964THEN100  :rem 146
96 PRINT"{RVS}{BLK}{DOWN}*DATA
   STATEMENT ERROR*{DOWN}* SE
  E LINES 8070-9040*":END
                      :rem 55
100 X=RND(-TI)        :rem 37
110 PRINT"{CLR}{BLU}{RVS}GUIDE
   THE LITTLE ALIENWITH A JO
  YSTICK AND{3 SPACES}PICK U
  P ALL THE CANDY.    :rem 110
135 PRINT"{BLK}{RVS}THEN GUIDE
   HIM TO THE PHONE AND SPAC
  ESHIP.              :rem 4
160 PRINT"{DOWN}{BLU}{RVS}LOOK
   OUT FOR THE CANS OF COLA.
   IF HE DRINKS COLA,";
                      :rem 19
161 PRINT" HE WILL HAVE AN ALL
  ERGIC REACTION AND CAN'T B
  E GUIDED.           :rem 222
165 PRINT"{DOWN}{BLK}{RVS}IF H
  E TOUCHES A FLU{3 SPACES}B
  UG, OR IF YOU RUN OUTOF TI
  ME,";               :rem 206
167 PRINT" HE WILL GET
  {2 SPACES}THE FLU AND CAN'
  T GO{2 SPACES}HOME.
                      :rem 199
169 PRINT"{DOWN}{BLU}{RVS}YOU'
  VE 1 MIN. 30 SEC.   :rem 255
500 PRINT"{DOWN}{PUR}{RVS}ENTE
  R SKILL LEVEL 1-5{OFF}
                      :rem 157
502 GETA$:IFA$=""THEN502
                      :rem 81
503 A=VAL(A$):IFA<1ORA>5THEN50
  0                   :rem 63
505 SC=4*(PEEK(36866)AND128)+6
  4*(PEEK(36869)AND112)
                      :rem 10
510 CM=37888+4*(PEEK(36866)AND
  128)-SC:PRINT"{CLR}"
                      :rem 161
515 POKE36869,PEEK(36869)AND24
  0OR15               :rem 252
517 VL=36878:SL=36874:SH=36876
  :Q1=21:Q2=22:Q3=23:P1=1
                      :rem 17
519 REM**BUILD BORDER   :rem 5
520 FORB=SC+Q2TOSC+44:POKEB,35
  :POKECM+B,6:NEXT    :rem 141
525 FORB=SC+43TOSC+505STEPQ2:P
  OKEB,35:POKECM+B,6:NEXT
                      :rem 103
530 FORB=SC+504TOSC+484STEP-1:
  POKEB,35:POKECM+B,6:NEXT
                      :rem 118
535 FORB=SC+484TOSC+Q2STEP-Q2:
  POKEB,35:POKECM+B,6:NEXT
                      :rem 183
600 REM**PLACE FLUBUGS :rem 75
605 FORI=1TO9*A       :rem 128
610 GOSUB4000         :rem 219
612 IFPEEK(X)=35THEN610:rem 97
620 POKEX,42:POKECM+X,3:IFI<=A
  THENF(I)=X:POKEX+CM,7
                      :rem 219
622 NEXT              :rem 217
700 REM**PLACE COLA     :rem 83
705 FORI=1TO12*A      :rem 171
710 GOSUB4000         :rem 220
720 IFPEEK(X)=35ORPEEK(X)=42OR
  PEEK(X-Q2)=36ORPEEK(X+Q2)=
  36THEN710           :rem 252
725 POKEX,36:POKECM+X,2:NEXT
                      :rem 13
800 REM**PLACE CANDY  :rem 164
803 C=2:FORI=1TO20:C=C+1:IFC>7
  THENC=2             :rem 229
810 GOSUB4000         :rem 221
820 IFPEEK(X)<>32ORPEEK(X+1)<>
  32ORPEEK(X-1)<>32ORPEEK(X+
  Q2)<>32ORPEEK(X-Q2)<>32THE
  N810                :rem 238
825 POKEX,34:POKECM+X,C:NEXT
                      :rem 29
830 RP=20:LO=SC+460:TI$="00000
  0":TU$="000129"     :rem 153
899 REM**MAIN LOOP      :rem 65
900 IFRP=0THEN3000      :rem 41
920 POKELO,37:POKELO+Q2,38:POK
  ELO+CM,4:POKELO+CM+Q2,4
                      :rem 48
922 GOSUB7            :rem 84
930 POKEVL,10:POKESH,220:GOTO1
  500                 :rem 247
935 POKEVL,0:POKESH,0   :rem 46
1000 SYS832:AA=PEEK(830)
                      :rem 103
1050 LT=LO:ONAAGOSUB11,12,13,1
  4,15,16,17,18       :rem 119
```

```
1080 POKELT,32:POKELT+Q2,32
                        :rem 113
1099 REM**COLLISION CK :rem 69
1100 TL=PEEK(LO):BL=PEEK(LO+Q2
     )                  :rem 116
1102 IFTL=1ORTL=3ORTL=35ORBL=0
     ORBL=2ORBL=35THENLO=LT:GO
     TO900              :rem 185
1110 IFTL=42ORBL=42THEN1300
                        :rem 90
1115 IFTL=61ORBL=61THEN3500
                        :rem 101
1120 IFTL=36ORBL=36THEN1400
                        :rem 98
1130 IFTL=34ORBL=34THENRP=RP-1
     :GOTO1200          :rem 175
1135 IFTL=45ORTL=46ORTL=47ORBL
     =47THEN3100        :rem 58
1140 GOTO900            :rem 152
1199 REM**CANDY PICKUP :rem 71
1200 POKELO,37:POKELO+Q2,38:PO
     KELO+CM,4:POKELO+CM+Q2,4
                        :rem 88
1210 POKESH,150:POKEVL,15:FORL
     =1TO10:NEXT        :rem 69
1220 POKESH,200:FORL=1TO10:NEX
     T:POKESH,0:POKEVL,0:GOTO9
     00                 :rem 120
1299 REM**FLUBUG COLLISION
                        :rem 126
1300 POKELO,37:POKELO+Q2,38:PO
     KELO+CM,3:POKELO+CM+Q2,3
                        :rem 87
1305 FORZ=1TO10         :rem 124
1310 POKESH,150:POKEVL,15:FORL
     =1TO50:NEXT        :rem 74
1320 POKESL,150:FORL=1TO50:NEX
     T                  :rem 178
1325 POKESH,0:FORL=1TO50:NEXT:
     NEXT:POKEVL,0:POKESL,0:GO
     TO2000             :rem 198
1399 REM**COLA COLLISION (GLUG
     -GLUG)             :rem 181
1400 POKELO,37:POKELO+Q2,38:PO
     KELO+CM,4:POKELO+CM+Q2,4
                        :rem 90
1410 POKESH,0:POKEVL,10:FORX=1
     TO3:POKESL,210:FORL=1TO10
     :NEXT:POKESL,250:FORL=1TO
     25:NEXT            :rem 137
1412 POKESL,0:FORL=1TO200:NEXT
     :NEXT              :rem 244
1415 POKELO,32:POKELO+Q2,32:PO
     KELO+CM,1:POKELO+CM+Q2,1
                        :rem 79
1416 AA=INT(RND(1)*8)+1:GOTO10
     50                 :rem 36
1499 REM**SELECT & MOVE FLUBUG
                        :rem 241
1500 D=INT(RND(1)*A)+1:rem 176
1510 LT=LO:LO=F(D):X=INT(RND(1
     )*8)+1:FT=F(D)     :rem 71
1515 ONXGOSUB11,12,13,14,15,16
     ,17,18             :rem 161
1635 F(D)=LO:LO=LT:IFPEEK(F(D)
     )<>32ANDPEEK(F(D))<>37AND
     PEEK(F(D))<>38THENF(D)=FT
                        :rem 31
1700 POKEFT,32          :rem 34
1702 IFF(D)=LOORF(D)=LO+Q2THEN
     POKELO+CM,3:POKELO+CM+Q2,
     3:GOTO1305         :rem 41
1710 POKEF(D),42:POKEF(D)+CM,7
     :GOTO935           :rem 219
2000 POKEVL,0:POKESH,0 :rem 79
2001 PRINT"{CLR}{5 DOWN}{BLK}H
     E CAUGHT THE FLU FROMTHE
     {SPACE}FLU BUG AND CAN
     {3 SPACES}NOT GO HOME."
                        :rem 122
2002 GOTO2040           :rem 195
2025 PRINT"{CLR}{RIGHT}
     {3 DOWN}{BLK}{5 SPACES}
     {RVS}YOU WON!!"    :rem 82
2030 PRINT"{DOWN} ";MID$(TT$,3
     ,2);" MINUTE ";RIGHT$(TT$
     ,2)" SECONDS       :rem 148
2035 PRINT"{DOWN}{RIGHT}
     {3 SPACES}SKILL LEVEL"A
                        :rem 1
2040 PRINT"{2 DOWN}{3 RIGHT}
     {2 SPACES}PLAY AGAIN?"
                        :rem 229
2045 POKE36869,PEEK(36869)AND2
     40OR0              :rem 246
2050 GETA$:IFA$=""THEN2050
                        :rem 177
2055 IFA$="Y"THENRUN100:rem 79
2060 PRINT"{CLR}":END   :rem 61
2999 REM**BUILD SPACEPHONE
                        :rem 107
3000 Q=SC+44:R=SC+88:GOSUB6000
     :GOSUB7:POKELO,32:POKELO+
     Q2,32:LO=SC+460    :rem 42
3002 PRINT"{HOME}{2 DOWN}
     {RIGHT}{CYN}+,{2 SPACES}"
     :PRINT"{RIGHT}-.{YEL}/ ":
     RP=20:GOTO900      :rem 181
3099 REM**RING SPACEPHONE
                        :rem 35
3100 LO=SC+48:POKELO,37:POKELO
     +Q2,38:POKELO+CM,4:POKELO
     +CM+Q2,4           :rem 152
3110 POKEVL,15:FORL=1TO3:FORM=
     1TO50:POKESH,230:FORN=1TO
     5:NEXT             :rem 176
3120 POKESH,0:NEXT:GOSUB7:FORM
     =1TO1000:NEXT:GOSUB7:NEXT
     :POKEVL,0          :rem 224
3399 REM**BUILD SPACESHIP
                        :rem 32
3400 Q=SC+110:R=SC+242:GOSUB60
     00:GOSUB7          :rem 59
3401 PRINT"{HOME}{2 DOWN}
     {RIGHT}{4 SPACES}":PRINT"
     {RIGHT}{4 SPACES}":rem 19
3402 LO=SC+460:POKELO,37:POKEL
     O+Q2,38:POKELO+CM,4:POKEL
     O+CM+Q2,4          :rem 203
3406 GOSUB7:GOSUB3600:GOSUB7
                        :rem 248
3408 PRINT"{7 DOWN}"SPC(10)"
     {CYN};             :rem 171
3410 GOSUB3600:GOSUB7   :rem 2
3425 PRINT"{HOME}{6 DOWN}"SPC(
     9)"{CYN}@#B        :rem 238
3430 PRINTSPC(7)"<<###<<
                        :rem 64
3435 PRINTSPC(9)"A#C    :rem 149
3440 GOSUB7:GOSUB3600:GOSUB7
                        :rem 246
3450 PRINT"{HOME}{5 DOWN}"SPC(
     8)"{CYN}@###B      :rem 32
3452 PRINTSPC(8)"{CYN}#####
                        :rem 58
3460 PRINTSPC(5)"{CYN}########
     ###                :rem 8
3462 PRINTSPC(8)"{CYN}#####
                        :rem 59
3470 PRINTSPC(8)"{CYN}A###C
                        :rem 120
3480 GOSUB7:GOSUB3600:GOSUB7
                        :rem 250
3490 T=SC+189:FORB=1TO3:POKET,
     61:POKECM+T,3:T=T+Q3:NEXT
     :POKESC+215,32:POKESC+237
     ,32                :rem 131
3495 POKEVL,0:POKESH,0:RP=20:G
     OTO900             :rem 233
3499 REM**PUT ALIEN ON RAMP
                        :rem 64
3500 TT$=TI$:LO=SC+214:POKELO,
     37:POKELO+Q2,38:POKELO+CM
     ,4:POKELO+CM+Q2,4:rem 203
3505 FORL=1TO1500:NEXT :rem 80
3510 POKESC+214,32:POKESC+236,
     32:POKESC+212,32:POKESC+1
     89,32:POKESC+235,32
                        :rem 57
3520 FORL=1TO2000:NEXT:GOTO202
     5                  :rem 133
3599 REM**SPACESHIP SOUND
                        :rem 59
3600 POKEVL,15:FORL=1TO5:FORM=
     220-LTO160-LSTEP-4:POKESH
     ,M:NEXT            :rem 221
3640 FORM=160-LTO220-LSTEP4:PO
     KESH,M:NEXT:GOSUB7:NEXT:R
     ETURN              :rem 232
4000 X=INT(RND(1)*372)+SC+3*Q2
     :RETURN            :rem 167
5999 REM**RELOCATE FLUBUGS
                        :rem 127
6000 FORI=1TOA:IFF(I)>QANDF(I)
     <RTHENPOKEF(I),32:F(I)=F(
     I)+154             :rem 140
6022 NEXTI:RETURN       :rem 108
8000 REM**CUSTOM CHARACTER DAT
     A                  :rem 130
8070 DATA,,,24,24,,,,255,255,2
     55,255,255,255,255,255,,,
     56,56,56,56,56,56 :rem 11
8075 DATA36,126,126,60,24,24,2
     4,60,126,189,189,189,189,
     36,66,66           :rem 125
8080 DATA,,31,127,127,255,255,
     255,,,248,240,224,192,128
     ,,254,253,248,240,224,192
     ,128               :rem 89
8085 DATA,,,128,64,32,18,9,6,6
     3,33,63,63,43,53,235,63
                        :rem 100
8090 DATA7,31,63,127,127,255,2
     55,255,255,255,255,127,12
     7,63,31,7          :rem 151
8092 DATA224,248,252,254,254,2
     55,255,255,255,255,255,25
     4,254,252,248,224 :rem 51
8093 DATA,,,255,255,255,,
                        :rem 246
8999 REM**ML JOYSTICK ROUTINE
                        :rem 74
9000 DATA120,8,72,152,72,138,7
     2,173,19,145,72,173,34,14
     5,72,169,0,141,62,3,141,6
     3,3,169            :rem 241
9010 DATA127,141,34,145,173,32
     ,145,73,255,41,128,42,8,1
     69,195,141,19,145,173,17,
     145,73             :rem 207
9020 DATA255,41,60,74,74,40,42
     ,168,41,16,201,16,208,3,1
     41,63,3,152,41,15,162,0,2
     32,224             :rem 159
9030 DATA9,240,8,221,160,3,208
     ,246,142,62,3,104,141,34,
     145,104,141,19,145,104,17
     0,104              :rem 109
9040 DATA168,104,40,88,96,2,3,
     1,5,4,12,8,10      :rem 105
```

Program 3: Friendly Alien—VIC Disk Loader

See instructions in article before typing.

```
60000 PRINT"{CLR}{4 DOWN}LOADI
      NG MAIN PROGRAM.."
                        :rem 53
60001 PRINT"{4 DOWN}"   :rem 12
60002 IFFRE(8)<4000THENPRINT"N
      OT ENOUGH MEMORY!!
      {3 SPACES}YOU NEED AN EX
      PANDER!!":END     :rem 17
60003 IFFRE(8)<7000THEN60008
                        :rem 30
60007 POKE8192,0:POKE44,32:POK
      E642,32           :rem 84
60008 POKE631,13:POKE632,82:PO
```

```
      KE633,85:POKE634,78:POKE
      635,13:POKE198,5 :rem 51
60009 PRINT"LOAD"+CHR$(34)+"VI
      CFRIENDLY*"+CHR$(34)+",8
      {3 UP}":END       :rem 39
```

Program 4: Friendly Alien—VIC Tape Loader

See instructions in article before typing.

```
60000 PRINT"{CLR}{4 DOWN}LOADI
      NG MAIN PROGRAM.."
                        :rem 53
60001 IF FRE(8)<4000THENPRINT"
      NOT ENOUGH MEMORY!!
      {3 SPACES}YOU NEED AN EX
      PANDER!!":END     :rem 16
60002 IF FRE(8)<7000THEN60004
                        :rem 25
60003 POKE8192,0:POKE642,32:PO
      KE44,32           :rem 80
60004 POKE631,131:POKE198,1:EN
      D                 :rem 253
```

Weather Prophet

(Article on page 73.)

```
10 REM IF COMPUTER IS 64, DELE
   TE "REM" IN LINE 20:rem 113
20 REM POKE53280,1:POKE53281,1
                        :rem 157
30 REM IF COMPUTER IS +4, DELE
   TE "REM" IN LINE 40:rem 106
40 REM COLOR 0,2:POKE65305,249
                        :rem 140
50 DIMIN$(720),HO%(720),MH(12)
   ,ML(12),AR(12),AS(12),NO%(7
   20),D%(50)           :rem 174
60 BL$="{40 SPACES}"    :rem 153
70 FORT=1TO12:READMH(T):NEXT:F
   ORT=1TO12:READML(T):NEXT
                        :rem 21
80 FORT=1TO12:READAR(T):NEXT:F
   ORT=1TO12:READAS(T):NEXT
                        :rem 15
90 FORT=1TO8:READDI$(T):NEXT
                        :rem 18
100 OPEN15,8,15:OPEN1,8,2,"RC.
    INDEX,S,R"          :rem 38
110 INPUT#15,A:IFA=62THENGOSUB
    240:GOTO1110        :rem 66
120 INPUT#1,RC%,TR%,HD$,CD$,MP
    $,AP$,MS$,AS$:GOSUB240:IFR
    C%=720THENRC%=0     :rem 168
130 GOTO1110            :rem 144
140 OPEN4,4,7:CMD4:RETURN
                        :rem 26
150 PRINT#4:CLOSE4:RETURN
                        :rem 120
160 PRINT#15,"P"+CHR$(2)+CHR$(
    LB)+CHR$(HB)+CHR$(1):RETUR
    N                   :rem 246
170 HB=INT(X1/256):LB=X1-HB*25
    6:RETURN            :rem 22
180 RC$="":FORA=1TO100:GET#1,A
    $:RC$=RC$+A$:NEXT:RETURN
                        :rem 226
190 PRINT#15,"I0":RETURN
                        :rem 179
200 CLOSE1:OPEN1,8,2,"WX.DATA,
    L,"+CHR$(100):RETURN
                        :rem 203
210 OPEN15,8,15:GOSUB190:RETUR
    N                   :rem 143
220 GETG$:IFG$=""THEN220
                        :rem 87
230 RETURN              :rem 117
240 CLOSE1:CLOSE15:RETURN
                        :rem 109
250 MO=0:PRINT"{CLR}{DOWN}ENTE
    R NUMBER OF MONTH FOR REPO
    RT:";:INPUTMO       :rem 207
260 YR=0:PRINT"{CLR}{DOWN}ENTE
    R YEAR FOR REPORT";:INPUTY
    R                   :rem 1
270 IFMO<1ORMO>12THEN250
                        :rem 213
280 PRINT"{CLR}{8 DOWN}
    {18 SPACES}WAIT!!":rem 125
290 HI=0:LO=200:BA=0:RA=0:SN=0
    :WS=0:DE=0:ED=0:RH=0:BL=33
    :PC=0               :rem 128
300 PRINT"{DOWN}{13 SPACES}PRE
    PARING REPORT":GOSUB210:GO
    SUB200              :rem 146
310 FORX1=1TOTR%:GOSUB170:G$="
    ":GOSUB160          :rem 169
320 FORA=1TO6:GET#1,A$:G$=G$+A
    $:NEXT              :rem 89
330 IFYR<>VAL(MID$(G$,5,2))THE
    N360                :rem 191
340 IFMO=VAL(MID$(G$,3,2))THEN
    GOSUB630            :rem 242
350 IFMO<VAL(MID$(G$,3,2))THEN
    X1=TR%              :rem 106
360 NEXT:CLOSE1:GOSUB190:CLOSE
    15                  :rem 35
370 IFLO=200THENPRINT"{CLR}
    {5 DOWN}NO DATA FOR THIS M
    ONTH EXISTS.":GOTO620
                        :rem 112
380 IFPR=1THENGOSUB140:rem 126
390 PRINT"{CLR}{RVS}{2 SPACES}
    MONTHLY REPORT FOR :{OFF}"
    ;MO;"/"YR           :rem 252
400 PRINT"NORMAL HIGH:";MH(MO)
    ;:PRINT"{3 SPACES}NORMAL L
    OW:"ML(MO)          :rem 6
410 PRINT"NORMAL RAIN: "AR(MO)
    ;:PRINT"{2 SPACES}NORMAL S
    NOW: "AS(MO)        :rem 36
420 PRINT"{DOWN}HIGHEST BAROME
    TER READING..."BA::rem 102
430 PRINT"ON "MID$(DA$(1),3,2)
    "/"MID$(DA$(1),1,2)"/"MID$
    (DA$(1),5,2)        :rem 144
440 PRINT"LOWEST BAROMETER REA
    DING...."BL         :rem 40
450 PRINT"ON "MID$(DA$(2),3,2)
    "/"MID$(DA$(2),1,2)"/"MID$
    (DA$(2),5,2)        :rem 149
460 PRINT"HIGHEST TEMPERATURE.
    ........"HI         :rem 244
470 PRINT"ON "MID$(DA$(3),3,2)
    "/"MID$(DA$(3),1,2)"/"MID$
    (DA$(3),5,2)        :rem 154
480 PRINT"LOWEST TEMPERATURE..
    ........"LO         :rem 0
490 PRINT"ON "MID$(DA$(4),3,2)
    "/"MID$(DA$(4),1,2)"/"MID$
    (DA$(4),5,2)        :rem 159
500 PRINT"HIGHEST WIND "WS" FR
    OM ";DI$(WD)        :rem 158
510 PRINT"ON "MID$(DA$(5),3,2)
    "/"MID$(DA$(5),1,2)"/"MID$
    (DA$(5),5,2)        :rem 155
520 PRINTPC;"DAYS WITH PRECIPI
    TATION."            :rem 44
530 PRINT"MOST RAINFALL.......
    ........"RA         :rem 186
540 PRINT"ON "MID$(DA$(6),3,2)
    "/"MID$(DA$(6),1,2)"/"MID$
    (DA$(6),5,2)        :rem 161
550 PRINT"HEAVIEST SNOWFALL...
    ........"SN         :rem 197
560 PRINT"ON "MID$(DA$(7),3,2)
    "/"MID$(DA$(7),1,2)"/"MID$
    (DA$(7),5,2)        :rem 166
570 PRINT"HIGHEST HUMIDITY....
    ........"RH         :rem 168
580 PRINT"ON "MID$(DA$(9),3,2)
    "/"MID$(DA$(9),1,2)"/"MID$
    (DA$(9),5,2)        :rem 174
590 PRINT"TOTAL HEATING DEGREE
     DAYS..."DE         :rem 227
600 PRINT"TOTAL COOLING DEGREE
     DAYS..."ED         :rem 230
610 IFPR=1THENGOSUB150:rem 123
620 GOSUB2350:RETURN    :rem 252
630 GOSUB160:GOSUB180   :rem 3
640 IFBA<VAL(MID$(RC$,7,5))THE
    NBA=VAL(MID$(RC$,7,5)):DA$
    (1)=MID$(RC$,1,6)   :rem 64
650 IFBL>VAL(MID$(RC$,7,5))THE
    NBL=VAL(MID$(RC$,7,5)):DA$
    (2)=MID$(RC$,1,6)   :rem 90
660 IFHI<VAL(MID$(RC$,13,3))TH
    ENHI=VAL(MID$(RC$,13,3)):D
    A$(3)=MID$(RC$,1,6)
                        :rem 182
670 IFLO>VAL(MID$(RC$,16,3))TH
    ENLO=VAL(MID$(RC$,16,3)):D
    A$(4)=MID$(RC$,1,6)
                        :rem 212
680 IFWS<VAL(MID$(RC$,20,3))TH
    ENWS=VAL(MID$(RC$,20,3)):W
    D=VAL(MID$(RC$,19,1))
                        :rem 188
690 IFWS=VAL(MID$(RC$,20,3))TH
    ENDA$(5)=MID$(RC$,1,6)
                        :rem 160
700 IFRA<VAL(MID$(RC$,23,5))TH
    ENRA=VAL(MID$(RC$,23,5)):D
    A$(6)=MID$(RC$,1,6)
                        :rem 190
710 IFVAL(MID$(RC$,23,5))<>0TH
    ENPC=PC+1           :rem 237
720 IFSN<VAL(MID$(RC$,28,4))TH
    ENSN=VAL(MID$(RC$,28,4)):D
    A$(7)=MID$(RC$,1,6)
                        :rem 229
730 IFRH<VAL(MID$(RC$,32,3))TH
    ENRH=VAL(MID$(RC$,32,3)):D
    A$(9)=MID$(RC$,1,6)
                        :rem 206
740 H=VAL(MID$(RC$,13,3)):L=VA
    L(MID$(RC$,16,3))   :rem 60
750 TP=65-INT((H+L)/2):IFSGN(T
    P)=-1THENTP=INT((H+L)/2)-6
    5:GOTO770           :rem 105
760 DE=DE+TP:GOTO780    :rem 205
770 ED=ED+TP            :rem 188
780 RETURN              :rem 127
790 PRINT"{CLR}{DOWN}
    {6 SPACES}SEARCHING FOR "M
    O$"/"DA$"/"YR$      :rem 46
800 GOSUB210:GOSUB200:R=0:FORP
    T=1TOTR%:X1=PT:GOSUB170:RC
    $=""                :rem 251
810 GOSUB160:RC$="":FORA=1TO6:
    GET#1,A$:RC$=RC$+A$:NEXT
                        :rem 190
820 IFSE$=RC$THENR=PT:PT=TR%:R
    C$=""               :rem 151
830 NEXT                :rem 218
840 IFR=0THEN870        :rem 184
850 A$="":GOSUB160:GOSUB180
                        :rem 39
860 GOSUB240:RETURN     :rem 206
870 GOSUB240:PRINT"{10 SPACES}
    RECORD NOT FOUND.":RETURN
                        :rem 180
880 F=1:PRINT"{CLR}SEARCH BY
    {RVS}F{OFF}IELD OR {RVS}R
    {OFF}ECORD NUMBER?"
                        :rem 215
890 GOSUB220:IFG$="R"THEN1060
                        :rem 178
900 IFG$<>"F"THEN890    :rem 103
910 PRINT"{CLR}{5 DOWN}ENTER N
    UMBER OF FIELD FOR SEARCH:
    "                   :rem 234
920 PRINTTAB(7)"{DOWN}{RVS} 1.
     {OFF}{2 SPACES}SPECIFIC D
    ATE                 :rem 33
930 PRINTTAB(7)"{DOWN}{RVS} 2.
     {OFF}{2 SPACES}GENERATE M
    ONTHLY REPORT       :rem 145
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940 PRINTTAB(7)"{DOWN}{RVS} 3.
    {OFF}{2 SPACES}RETURN TO
    {SPACE}MAIN MENU"      :rem 30
950 GOSUB2220:G=ASC(G$)-48:ONGG
    OTO980,250,970         :rem 35
960 GOTO950                :rem 118
970 RETURN                 :rem 128
980 PRINT"{CLR}{14 SPACES}
    {RVS} SEARCH FOR DATE
                           :rem 176
990 PRINT"ENTER DATE (MONTH, D
    AY, YEAR)"             :rem 205
1000 PRINT"SEPARATE EACH ENTRY
     WITH A COMMA.":INPUTMO$,
    DA$,YR$                :rem 124
1010 IFVAL(DA$)<=9THENDA$="0"+
    DA$                    :rem 61
1020 IFVAL(MO$)<=9THENMO$="0"+
    MO$                    :rem 131
1030 IFVAL(YR$)<=9THENYR$="0"+
    YR$                    :rem 177
1040 SE$=DA$+MO$+YR$:GOSUB790:
    IFR=0THENGOSUB2350:RETURN
                           :rem 193
1050 GOSUB2640:GOSUB2350:RETUR
    N                      :rem 176
1060 PRINT"{CLR}":GOSUB210:GOS
    UB200:RC$=""           :rem 56
1070 PRINT"RECORD NUMBER FOR S
    EARCH?":INPUTR:IFR>TR%THE
    N720                   :rem 5
1080 X1=R:GOSUB170:GOSUB160:GO
    SUB180:GOSUB190:GOSUB240:
    GOSUB2640:GOSUB2350
                           :rem 133
1090 RETURN                :rem 170
1100 GOSUB240:PRINT"{CLR}INVAL
    ID RECORD NUMBER":GOSUB23
    50:RETURN              :rem 35
1110 PRINT"{GRN}":PRINTCHR$(14
    ):FL=0:F=0:Q=FRE(0)
                           :rem 155
1120 PRINT"{CLR}{3 DOWN}
    {11 SPACES}WEATHER PROPHE
    T                      :rem 107
1130 PRINT"{2 DOWN}{4 SPACES}
    {RVS} 1 {OFF}{5 SPACES}EN
    TER NEW DATA           :rem 109
1140 PRINT"{DOWN}{4 SPACES}
    {RVS} 2 {OFF}{5 SPACES}FO
    RECAST                 :rem 51
1150 PRINT"{DOWN}{4 SPACES}
    {RVS} 3 {OFF}{5 SPACES}SE
    ARCH DATA              :rem 46
1160 PRINT"{DOWN}{4 SPACES}
    {RVS} 4 {OFF}{5 SPACES}DE
    GREE DAY REGISTER:rem 207
1170 PRINT"{DOWN}{4 SPACES}
    {RVS} 5 {OFF}{5 SPACES}EX
    IT PROGRAM             :rem 180
1180 PRINT"{DOWN}{4 SPACES}
    {RVS} 0 {OFF}{5 SPACES}TO
    GGLE PRINTER OPTION
                           :rem 157
1190 PRINT"{RED}":PRINT"{DOWN}
    {5 SPACES}";TR%;" RECORDS
     IN DATA BASE.":PRINT"
    {GRN}"                 :rem 14
1200 IFPR=1THENPRINT"
    {12 SPACES}{RVS} PRINTER
    {SPACE}ON "            :rem 181
1210 IFPR=0THENPRINT"{RED}
    {12 SPACES}{RVS} PRINTER
    {SPACE}OFF {GRN}":rem 173
1220 GOSUB2220:G=VAL(G$):ONGOS
    UB1270,3000,880,3150,3280
                           :rem 71
1230 IFG$="0"THENGOSUB1250
                           :rem 232
1240 GOTO1110              :rem 195
1250 IFPR=0THENPR=1:RETURN
                           :rem 191
1260 IFPR=1THENPR=0:RETURN
                           :rem 192
1270 PRINT"{CLR}{DOWN}ENTER DA
    TE: MONTH, DAY, YEAR AS 1
    2,31,84"               :rem 161
1280 PRINT"SEPARATE EACH ENTRY
     WITH A COMMA.":INPUTMO$,
    DA$,YR$                :rem 134
1290 IFVAL(DA$)<=9THENDA$="0"+
    DA$                    :rem 71
1300 IFVAL(MO$)<=9THENMO$="0"+
    MO$                    :rem 132
1310 IFVAL(YR$)<=9THENYR$="0"+
    YR$                    :rem 178
1320 IFRC%=0THEN1370       :rem 118
1330 GOSUB210:GOSUB200:X1=RC%:
    GOSUB170:GOSUB160:rem 131
1340 G$="":FORA=1TO6:GET#1,A$:
    G$=G$+A$:NEXT:GOSUB240
                           :rem 2
1350 IFMID$(G$,3,2)<MO$THENMP$
    ="00":MS$="00"         :rem 123
1360 IFMID$(G$,5,2)<YR$THENAP$
    ="00":MP$="00":MS$="00":A
    S$="00"                :rem 48
1370 BA$="":GOSUB3020:GOSUB303
    0                      :rem 242
1380 HI$="":PRINT"{CLR}{DOWN}E
    NTER HIGH TEMPERATURE:";:
    INPUTHI$               :rem 17
1390 LO$="":PRINT"{CLR}{DOWN}E
    NTER LOW TEMPERATURE:";:I
    NPUTLO$                :rem 248
1400 GOSUB3090:WS$="":PRINT"
    {CLR}{DOWN}ENTER AVERAGE
    {SPACE}WIND SPEED":INPUTW
    S$:WS=VAL(WS$)         :rem 32
1410 RA$="":PRINT"{CLR}{DOWN}E
    NTER PRECIPITATION [0.00]
     INCHES.":INPUTRA$
                           :rem 229
1420 MP$=STR$(VAL(MP$)+VAL(RA$
    )):AP$=STR$(VAL(AP$)+VAL(
    RA$))                  :rem 215
1430 SN$="":PRINT"{CLR}{DOWN}E
    NTER SNOWFALL TO NEAREST
    {SPACE}TENTH INCH.":INPUT
    SN$                    :rem 184
1440 MS$=STR$(VAL(MS$)+VAL(SN$
    )):AS$=STR$(VAL(AS$)+VAL(
    SN$))                  :rem 1
1450 RH$="":PRINT"{CLR}{DOWN}E
    NTER RELATIVE HUMIDITY";:
    INPUTRH$               :rem 66
1460 CC$="":PRINT"{CLR}{DOWN}E
    NTER CLOUD COVER PERCENTA
    GE";:INPUTCC$          :rem 166
1470 WC$="":PRINT"{CLR}{DOWN}E
    NTER COMMENT ON CURRENT W
    X CONDITIONS:"         :rem 110
1480 PRINT"{DOWN}LIMIT COMMENT
    S TO 40 CHARACTERS.
    {2 SPACES}(ONE{2 SPACES}F
    ULL SCREEN LINE.):rem 131
1490 PRINT"{RVS}{DOWN}
    {6 SPACES}DO NOT USE A CO
    MMA OR COLON.{6 SPACES}":
    PRINT:INPUTWC$:PRINT"
    {CLR}"                 :rem 152
1500 RC$=DA$+MO$+YR$+BA$
                           :rem 28
1510 RC$=RC$+CR$+LEFT$(BL$,1-L
    EN(CR$))               :rem 74
1520 RC$=RC$+LEFT$(BL$,3-LEN(H
    I$))+HI$               :rem 69
1530 RC$=RC$+LEFT$(BL$,3-LEN(L
    O$))+LO$               :rem 90
1540 RC$=RC$+DI$+LEFT$(BL$,1-L
    EN(DI$))               :rem 61
1550 RC$=RC$+LEFT$(BL$,3-LEN(W
    S$))+WS$               :rem 122
1560 RC$=RC$+LEFT$(BL$,5-LEN(R
    A$))+RA$               :rem 79
1570 RC$=RC$+LEFT$(BL$,4-LEN(S
    N$))+SN$               :rem 107
1580 RC$=RC$+LEFT$(BL$,3-LEN(R
    H$))+RH$               :rem 93
1590 RC$=RC$+LEFT$(BL$,3-LEN(C
    C$))+CC$               :rem 54
1600 RC$=RC$+WC$+LEFT$(BL$,40-
    LEN(WC$))              :rem 135
1610 RC$=RC$+LEFT$(BL$,5-LEN(M
    P$))+MP$               :rem 95
1620 RC$=RC$+LEFT$(BL$,6-LEN(A
    P$))+AP$               :rem 73
1630 RC$=RC$+LEFT$(BL$,5-LEN(A
    S$))+AS$               :rem 79
1640 RC$=RC$+LEFT$(BL$,5-LEN(M
    S$))+MS$               :rem 104
1650 RC%=RC%+1:TR%=TR%+1:R=RC%
    :IFTR%=721THENTR%=720
                           :rem 0
1660 GOSUB2640:PRINT"{RVS}
    {5 SPACES}IS DATA CORRECT
    ? (YES OR NO){7 SPACES}"
                           :rem 61
1670 GOSUB220:IFG$="N"THENRC%=
    RC%-1:TR%=TR%-1        :rem 142
1680 IFG$="N"THENPRINT"RE-ENTE
    R FROM START":FORT=1TO500
    0:NEXT:GOTO1270        :rem 29
1690 IFG$<>"Y"THEN1670:rem 222
1700 GOSUB210:X1=RC%:GOSUB170:
    GOSUB190:GOSUB200:GOSUB16
    0                      :rem 216
1710 PRINT#1,RC$:CLOSE1:GOSUB1
    90:PRINT#15,"S0:RC.INDEX"
    :CLOSE15               :rem 146
1720 OPEN1,8,2,"RC.INDEX,S,W"
                           :rem 156
1730 PRINT#1,RC%,"TR%","HD$",
    "CD$","MP$","AP$","MS$","
    AS$:CLOSE1             :rem 155
1740 IFRC%=1ANDTR%=1THEN1770
                           :rem 141
1750 NO%(RC%)=RC%:IN$(RC%)=MID
    $(RC$,7,5):IFRC%=1ANDTR%=
    1THEN1770              :rem 149
1760 GOSUB2520             :rem 23
1770 BA=VAL(MID$(RC$,7,5)):CR%
    =VAL(MID$(RC$,12,1)):DI=V
    AL(MID$(RC$,19,1)):rem 27
1780 IFPR=1THENGOSUB140
                           :rem 179
1790 PRINT"{CLR}":PRINT"{RVS}
    {7 SPACES}GENERAL SHORT T
    ERM FORECAST{6 SPACES}"
                           :rem 111
1800 IFBA>=30.2ANDCR%=1ANDDI>=
    6ANDDI<=8THEN2040 :rem 43
1810 IFBA>=30.2ANDCR%=2ANDDI>=
    6ANDDI<=8THEN2050 :rem 46
1820 IFBA>=30.1ANDBA<=30.2ANDC
    R%=1ANDDI>=6ANDDI<=8THEN1
    990                    :rem 203
1830 IFBA>=30.1ANDBA<=30.2ANDC
    R%=5ANDDI>=6ANDDI<=8THEN2
    000                    :rem 191
1840 IFBA>=30.1ANDBA<=30.2ANDC
    R%=2ANDDI>=6ANDDI<=8THEN2
    020                    :rem 191
1850 IFBA>=30.1ANDBA<=30.2ANDC
    R%=3ANDDI>=6ANDDI<=8THEN2
    030                    :rem 194
1860 IFBA>=30.1ANDBA<=30.2ANDC
    R%=2ANDDI<=5ANDDI>=4THEN2
    060                    :rem 192
1870 IFBA>=30.1ANDBA<=30.2ANDC
    R%=3ANDDI=5ORDI=4THEN2070
                           :rem 23
1880 IFBA>=30.1ANDBA<=30.2ANDC
    R%=2ANDDI<=4ANDDI>=2THEN2
    090                    :rem 194
1890 IFBA>=30.1ANDBA<=30.2ANDC
    R%=3ANDDI<=4ANDDI>=2THEN2
    100                    :rem 188
1900 IFBA<=29.8ANDCR%=2ANDDI>=
    2ANDDI<=3THEN2140 :rem 49
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1910 IFBA<=29.8ANDCR%=3ANDDI<=
     5ANDDI>=3THEN2230 :rem 54
1920 IFBA<=29.8ANDCR%=3ANDDI<=
     3ANDDI>=1THEN2260 :rem 54
1930 IFBA<=29.8ANDCR%=5THEN229
     0                 :rem 36
1940 IFBA<=30.1ANDCR%=3ANDDI>=
     4ANDDI<=8THEN2180 :rem 50
1950 IFBA<=30.1ANDCR%=4ANDDI<=
     6ANDDI>=5THEN2200 :rem 44
1960 IFBA<=30.1ANDCR%=2ANDDI>=
     2ANDDI<=3THEN2110 :rem 37
1970 IFBA<=30.1ANDCR%=2ANDDI=4
     THEN2170          :rem 228
1980 PRINT"LITTLE CHANGE DURIN
     G NEXT 24 HOURS.":GOTO230
     0                 :rem 252
1990 PRINT"FAIR, WITH LITTLE T
     EMPERATURE CHANGE FORNEXT
      DAY OR TWO.":GOTO2300
                       :rem 117
2000 PRINT"FAIR TODAY, WARMER
     {SPACE}WITH A CHANCE OF S
     OME";             :rem 211
2010 PRINT"RAIN WITHIN 2 DAYS.
     ":GOTO2300        :rem 90
2020 PRINT"TURNING WARMER, WIT
     H RAIN LIKELY IN 24
     {2 SPACES}TO 36 HOURS.":G
     OTO2300           :rem 102
2030 PRINT"WARMER, WITH RAIN I
     N 18-36 HOURS.":GOTO2300
                       :rem 3
2040 PRINT"CONTINUED FAIR WITH
      LITTLE CHANGE IN
     {4 SPACES}TEMPERATURE.":G
     OTO2300           :rem 221
2050 PRINT"FAIR, WITH SLOWLY R
     ISING TEMPERATURES
     {3 SPACES}FOR NEXT 2 DAYS
     .":GOTO2300       :rem 232
2060 PRINT"PRECIPITATION LIKEL
     Y WITHIN 24 HOURS.":GOTO2
     300               :rem 110
2070 PRINT"INCREASING WINDS, P
     RECIPITATION LIKELY
                       :rem 177
2080 PRINT"WITHIN 12-24 HOURS.
     ":GOTO2300        :rem 91
2090 PRINT"RAIN WITHIN 12-18 H
     OURS.":GOTO2300   :rem 9
2100 PRINT"BECOMING WINDY WITH
      RAIN LIKELY WITHIN
     {2 SPACES}12-24 HOURS.":G
     OTO2300           :rem 211
2110 PRINT"IN WINTER,
     {2 SPACES}PRECIPITATION L
     IKELY WITHIN 24 HOURS.
                       :rem 44
2120 PRINT"IN SUMMER, CLOUDY W
     ITH LIGHT BREEZES.
     {3 SPACES}RAIN LIKELY IN
     {SPACE}A DAY OR TWO.
                       :rem 69
2130 GOTO2300          :rem 196
2140 PRINT"IN SUMMER, RAIN LIK
     ELY WITHIN 24 HOURS.
                       :rem 126
2150 PRINT"IN WINTER, RAIN OR
     {SPACE}SNOW LIKELY, WINDS
     {3 SPACES}INCREASING.
                       :rem 177
2160 GOTO2300          :rem 199
2170 PRINT"MORE RAIN FOR NEXT
     {SPACE}DAY OR TWO.":GOTO2
     300               :rem 253
2180 PRINT"HIGH WINDS AND POSS
     IBLE HEAVY RAIN TODAY";
                       :rem 88
2190 PRINT"CLEARING AND COOLER
      TOMORROW.":GOTO2300
                       :rem 232
2200 PRINT"CLEARING WITHIN A F
     EW HOURS.{2 SPACES}FAIR
                       :rem 143
2210 PRINT"WEATHER FOR NEXT SE
     VERAL DAYS.       :rem 27
2220 GOTO2300          :rem 196
2230 PRINT"{RED}{RVS} SEVERE S
     TORM WARNING!     :rem 186
2240 PRINT"WINDY WITH HEAVY PR
     ECIPITATION TODAY.
                       :rem 197
2250 PRINT"CLEARING AND TURNIN
     G COOLER TOMORROW.":PRINT
     "{GRN}":GOTO2300  :rem 53
2260 PRINT"SEVERE NORTHEAST GA
     LES, WITH HEAVY RAIN OR S
     NOW.              :rem 12
2270 PRINT"TURNING COOLER IN W
     INTER.            :rem 3
2280 GOTO2300          :rem 202
2290 PRINT"CLEARING AND COOLER
                       :rem 6
2300 IFPR=1THENGOSUB150
                       :rem 169
2310 GOSUB2350:IFTR%=1THENCL=0
     :GOSUB2580:GOTO2330:rem 1
2320 GOSUB2380         :rem 20
2330 IFCL=0THENPRINT"
     {5 SPACES}NO ADDITIONAL D
     ATA AVAILABLE":GOTO2350
                       :rem 161
2340 PRINT"{3 SPACES}SIMILIAR
     {SPACE}DATA FOUND IN FILE
     ":GOSUB2350:GOSUB3290:PRI
     NT"{2 UP}"        :rem 250
2350 CLOSE15:GOSUB210:CLOSE15
                       :rem 9
2360 PRINT"{RVS}{7 SPACES}PRES
     S ANY KEY TO CONTINUE
     {8 SPACES}";      :rem 207
2370 GOSUB220:PRINT"{CLR}":RET
     URN               :rem 152
2380 CL=0:A=0:U=1:IFRC%=1ANDTR
     %=1THEN2520       :rem 163
2390 U=0:FORT=1TOTR%:IFT=RC%TH
     EN2410            :rem 235
2400 IFBA$=IN$(T)ANDNO%(T)<>RC
     %THENU=U+1:HO%(U)=NO%(T)
                       :rem 185
2410 NEXT:IFU=0THEN2510
                       :rem 136
2420 T=0:C=0:GOSUB210:GOSUB200
                       :rem 12
2430 T=T+1:RC$="":IFT>UTHEN251
     0                 :rem 37
2440 X1=HO%(T):GOSUB170:rem 67
2450 GOSUB160:FORA=1TO19:GET#1
     ,A$               :rem 190
2460 RC$=RC$+A$:NEXT   :rem 132
2470 IFCR$<>MID$(RC$,12,1)THEN
     2430              :rem 123
2480 IFDI$<>MID$(RC$,19,1)THEN
     2430              :rem 123
2490 C=C+1:D%(C)=HO%(C)
                       :rem 178
2500 CL=1:GOSUB240:RETURN
                       :rem 46
2510 CL=0:GOSUB240:RETURN
                       :rem 46
2520 GOSUB210:OPEN1,8,2,"BA.IN
     DEX,S,R"          :rem 209
2530 FORP=1TOTR%:INPUT#1,NO%(P
     ),IN$(P):NEXT:GOSUB240
                       :rem 219
2540 FORI=1TOTR%:IFI=RC%THENI=
     I+1               :rem 58
2550 FORJ=ITOTR%:IFIN$(I)<IN$(
     J)THEN2570        :rem 158
2560 HI$=IN$(I):IN$(I)=IN$(J):
     IN$(J)=HI$:NI=NO%(I):NO%(
     I)=NO%(J):NO%(J)=NI
                       :rem 189
2570 NEXT:NEXT         :rem 134
2580 GOSUB210:PRINT#15,"S0:BA.
     INDEX"            :rem 136
2590 IFTR%=1THENNO%(1)=RC%:IN$
     (1)=STR$(BA)      :rem 167
2600 OPEN1,8,2,"BA.INDEX,S,W":
     I=0               :rem 120
2610 I=I+1:IFI>TR%THEN2630
                       :rem 9
2620 PRINT#1,NO%(I):PRINT#1,IN
     $(I):GOTO2610     :rem 11
2630 GOSUB240:PRINT"{CLR}":RET
     URN               :rem 153
2640 IFPR=1THENGOSUB140
                       :rem 175
2650 PRINT"{CLR}{RVS}RECORD#
     {OFF}"R;"{RVS}DATA ENTRY
     {SPACE}FOR:{OFF}";
                       :rem 180
2660 PRINTMID$(RC$,3,2);"/";MI
     D$(RC$,1,2);"/";MID$(RC$,
     5,2)              :rem 124
2670 PRINT"BAROMETRIC PRESSURE
     ..... ";MID$(RC$,7,5)"
     INCHES"           :rem 118
2680 PRINT"HIGH TEMPERATURE...
     .....";:HI$=MID$(RC$,1
     3,3)              :rem 103
2690 PRINTVAL(HI$)"DEG. F"
                       :rem 207
2700 PRINT"{6 SPACES}NORMAL HI
     GH.....";MH(VAL(MID$
     (RC$,3,2)))"DEG. F"
                       :rem 241
2710 PRINT"LOW TEMPERATURE....
     .....";:LO$=MID$(RC$,1
     6,3)              :rem 110
2720 PRINTVAL(LO$)"DEG. F"
                       :rem 211
2730 PRINT"{6 SPACES}NORMAL LO
     W.....";ML(VAL(MID$
     (RC$,3,2)))"DEG. F"
                       :rem 248
2740 PRINT"WIND DIRECTION.....
     ..... ";          :rem 2
2750 WD=VAL(MID$(RC$,19,1)):PR
     INTDI$(WD)        :rem 57
2760 PRINT"WIND SPEED.........
     .....";VAL(MID$(RC$,20
     ,3));"MPH"        :rem 153
2770 PRINT"RAINFALL (PAST 24 H
     RS).....";VAL(MID$(RC$,23
     ,5))"INCHES"      :rem 19
2780 PRINT"{6 SPACES}NORMAL MO
     NTHLY RAIN..";AR(VAL(MID$
     (RC$,3,2)));"INCHES"
                       :rem 237
2790 PRINT"{6 SPACES}MONTHLY R
     AIN TO DATE.";VAL(MID$(RC
     $,79,5))"INCHES"  :rem 89
2800 PRINT"{6 SPACES}YEARLY RA
     IN TO DATE..";VAL(MID$(RC
     $,83,6))"INCHES"  :rem 38
2810 PRINT"SNOWFALL (PAST 24 H
     RS).....";VAL(MID$(RC$,28
     ,4))"INCHES"      :rem 47
2820 PRINT"{6 SPACES}NORMAL MO
     NTHLY SNOW..";AS(VAL(MID$
     (RC$,3,2)))"INCHES"
                       :rem 203
2830 PRINT"{6 SPACES}MONTHLY S
     NOW TO DATE.";VAL(MID$(RC
     $,89,5))"INCHES" :rem 114
2840 PRINT"{6 SPACES}YEARLY SN
     OW TO DATE..";VAL(MID$(RC
     $,94,6))"INCHES"  :rem 73
2850 PRINT"RELATIVE HUMIDITY..
     .....";VAL(MID$(RC$,32
     ,3));"%"          :rem 64
2860 PRINT"PERCENT CLOUD COVER
     .....";VAL(MID$(RC$,35
     ,3));"%"          :rem 166
2870 HI=VAL(HI$):LO=VAL(LO$):H
     D=65-INT((HI+LO)/2)
                       :rem 109
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2880 TD=(HI+LO)/2:RH=VAL(MID$(
     RC$,32,3)):RH=RH/100
                          :rem 88
2890 IFSGN(HD)=-1THEN2930
                          :rem 191
2900 Z=VAL(HD$)+HD:HD$=STR$(Z)
     :PRINT"HEATING DEGREE DAY
     S.......";HD     :rem 139
2910 IFF=1THEN2970       :rem 16
2920 PRINT"{6 SPACES}TOTAL FOR
      SEASON.....";HD$:GOTO297
     0                   :rem 232
2930 CD=(INT(HI+LO)/2)-65:IFSG
     N(CD)=-1THEN2970 :rem 148
2940 Z=VAL(CD$)+CD:CD$=STR$(Z)
     :PRINT"COOLING DEGREE DAY
     S.......";CD     :rem 134
2950 IFF=1THEN2970       :rem 20
2960 PRINT"{6 SPACES}TOTAL FOR
      SEASON.....";CD$:rem 162
2970 PRINTMID$(RC$,38,40);
                          :rem 201
2980 IFPR=1THENGOSUB150
                          :rem 183
2990 RETURN              :rem 180
3000 PRINT"{CLR}{10 SPACES}FOR
     ECAST WEATHER       :rem 108
3010 GOSUB3020:GOSUB3030:GOSUB
     3090:PRINT"{CLR}":GOSUB17
     80:RETURN           :rem 81
3020 PRINT"{CLR}{DOWN}ENTER:":
     PRINT"BAROMETRIC PRESSURE
     ":INPUTBA$:BA=VAL(BA$):RE
     TURN                :rem 62
3030 PRINT"{CLR}{DOWN}RATE OF
     {SPACE}CHANGE: " :rem 220
3040 PRINT"RAPID CHANGE IS ANY
      CHANGE GREATER THAN 0.06
      INCHES PER HOUR.:rem 188
3050 PRINT"{DOWN}ENTER:":PRINT
     "{DOWN}{RVS} 1.{OFF}
     {2 SPACES}STEADY"TAB(20)"
     {RVS} 4.{OFF}{2 SPACES}SL
     OWLY RISING"        :rem 213
3060 PRINT"{DOWN}{RVS} 2.{OFF}
     {2 SPACES}FALLING SLOWLY"
     TAB(20)"{RVS} 5.{OFF}
     {2 SPACES}RISING RAPIDLY"
                          :rem 76
3070 PRINT"{DOWN}{RVS} 3.{OFF}
     {2 SPACES}FALLING RAPIDLY
     ":PRINT             :rem 138
3080 CR$="":INPUTCR$:CR%=VAL(C
     R$):RETURN          :rem 192
3090 PRINT"{CLR}{DOWN}ENTER NU
     MBER FOR WIND DIRECTION:
                          :rem 90
3100 PRINT"{DOWN}{RVS} 1.{OFF}
      NORTH"TAB(20)"{RVS} 5.
     {OFF} SOUTH         :rem 122
3110 PRINT"{DOWN}{RVS} 2.{OFF}
      NORTHEAST"TAB(20)"{RVS}
     {SPACE}6.{OFF} SOUTHWEST
                          :rem 237
3120 PRINT"{DOWN}{RVS} 3.{OFF}
      EAST"TAB(20)"{RVS} 7.
     {OFF} WEST          :rem 210
3130 PRINT"{DOWN}{RVS} 4.{OFF}
      SOUTHEAST"TAB(20)"{RVS}
     {SPACE}8.{OFF} NORTHWEST
                          :rem 243
3140 DI$="":PRINT:INPUTDI$:DI=
     VAL(DI$):RETURN     :rem 63
3150 PRINT"{CLR}{DOWN}
     {8 SPACES}{RVS} DEGREE DA
     Y REGISTERS         :rem 240
3160 PRINT"{DOWN}HEATING DEGRE
     E DAYS: ";HD$       :rem 46
3170 PRINT"{DOWN}COOLING DEGRE
     E DAYS: ";CD$       :rem 53
3180 PRINTTAB(5)"{DOWN}TOTALS
     {SPACE}AS OF LAST ENTRY.
                          :rem 93
3190 PRINT"{6 DOWN}{6 SPACES}
     {RVS} 1.{OFF}{2 SPACES}CL
     EAR HEATING DEGREE DAYS
                          :rem 41
3200 PRINT"{DOWN}{6 SPACES}
     {RVS} 2.{OFF}{2 SPACES}CL
     EAR COOLING DEGREE DAYS
                          :rem 216
3210 PRINT"{DOWN}{6 SPACES}
     {RVS} 3.{OFF}{2 SPACES}RE
     TURN TO MAIN MENU:rem 232
3220 GOSUB220:IFG$="3"THENRETU
     RN                   :rem 210
3230 IFG$="1"THENHD$="00":GOTO
     3260                 :rem 114
3240 IFG$="2"THENCD$="00":GOTO
     3260                 :rem 111
3250 GOTO3220             :rem 202
3260 GOSUB210:PRINT#15,"S0:RC*
     ":CLOSE15:OPEN1,8,2,"RC.I
     NDEX,S,W"            :rem 60
3270 PRINT#1,RC%","TR%","HD$",
     "CD$","MP$","AP$","MS$","
     AS$:CLOSE1:RETURN:rem 182
3280 END                  :rem 164
3290 F=1:FORX=1TOC        :rem 79
3300 IFD%(X)=TR%+1ANDTR%<720TH
     ENRETURN             :rem 77
3310 X1=D%(X):GOSUB170:GOSUB21
     0:GOSUB200           :rem 138
3320 GOSUB160:GOSUB180    :rem 50
3330 R=D%(X):IFR=RC%THEN3370
                          :rem 120
3340 IFR=0THEN3370        :rem 20
3350 GOSUB2640:GOSUB2350:GOSUB
     240:Y=Y+1:IFY<4THEND%(X)=
     D%(X)+1:GOTO3300     :rem 39
3360 IFD%(X)+3<D%(X+3)THENX=X+
     4                    :rem 242
3370 NEXT                 :rem 12
3380 PRINT"{16 SPACES}END OF F
     ILE":GOSUB240:F=0:RETURN
                          :rem 130
3390 REM HIGH TEMPERATURE DATA
                          :rem 59
3400 DATA47.6,50.8,59.3,70.7,7
     7.9,84.2             :rem 147
3410 DATA87.4,86.2,80.4,70.1,5
     9.9,50.4             :rem 137
3420 REM LOW TEMPERATURE DATA
                          :rem 7
3430 DATA27.3,29.0,36.5,45.9,5
     5.0,62.6             :rem 131
3440 DATA66.9,66.3,59.3,46.7,3
     7.1,29.9             :rem 154
3450 REM MONTHLY PRECIPITATION
      DATA                :rem 208
3460 DATA3.32,3.30,3.77,3.17,3
     .61,3.81             :rem 119
3470 DATA4.57,4.21,3.65,3.00,2
     .74,3.31             :rem 116
3480 REM MONTHLY SNOWFALL DATA
                          :rem 94
3490 DATA3.2,2.4,1.9,.1,0,0,0,
     0,0,0,.2,1.4         :rem 255
3500 DATA"NORTH","NORTHEAST","
     EAST","SOUTHEAST","SOUTH"
     ,"SOUTHWEST"         :rem 239
3510 DATA"WEST","NORTHWEST"
                          :rem 168
```

TinyTerm

(Article on page 82.)

(Note: This is a VIC version. Commodore 64 owners should see article for modifications.)

```
10 OPEN2,2,3,CHR$(38)+CHR$(224
   )                      :rem 128
20 Z1=37136:Z2=37138:POKE36879
   ,137:Z3=0              :rem 172
30 POKEZ1,98:PRINT"{CLR}"
                          :rem 88
40 PRINT"{HOME}{3 DOWN}"SPC(Z3
   )"DDDDDDDDDDDDDDDDDDDDD":P
   RINTSPC(Z3) "{BLK}
   {7 SPACES}TINYTERM" :rem 54
50 PRINTSPC(Z3)"{DOWN}DDDDDDDD
   DDDDDDDDDDDDDD":GOSUB230
                          :rem 50
60 ID$(1)="NAME":ID$(2)="ID":I
   D$(3)="PASS WORD"      :rem 26
70 GOTO300                :rem 51
80 PRINTCHR$(147)+CHR$(14)+"ON
    LINE":PRINTCHR$(187);
                          :rem 237
90 GET#2,A$:IFA$=""THEN130
                          :rem 161
100 IFI%(ASC(A$))=13THENPRINT"
    {LEFT} "              :rem 170
110 PRINTCHR$(157);CHR$(I%(ASC
    (A$)));CHR$(187);:IFI%(ASC
    (A$))=34THENPOKE212,0
                          :rem 87
120 GOTO90                :rem 53
130 GETA$:IFA$=""THEN90:rem 32
140 IFA$=CHR$(137)THENS=1:GOTO
    180                   :rem 175
150 IFA$=CHR$(138)THENS=2:GOTO
    180                   :rem 178
160 IFA$=CHR$(139)THENS=3:GOTO
    180                   :rem 181
170 PRINT#2,CHR$(O%(ASC(A$)));
    :GOTO90               :rem 97
180 FORX=1TOLEN(ID$(S))
                          :rem 110
190 T$=MID$(ID$(S),X,1)
                          :rem 212
200 PRINT#2,CHR$(O%(ASC(T$)));
                          :rem 146
210 NEXT:PRINTCHR$(13):PRINT#2
    ,CHR$(13)             :rem 77
220 GOTO90                :rem 54
230 DIMI%(255),O%(255) :rem 87
240 FORZ=32TO64:O%(Z)=Z:NEXT:O
    %(13)=13:O%(20)=8:O%(160)=
    32                    :rem 1
250 FORZ=65TO90:Y=Z+32:O%(Z)=Y
    :NEXT:FORZ=91TO95:O%(Z)=Z:
    NEXT                  :rem 74
260 FORZ=193TO218:Y=Z-128:O%(Z
    )=Y:NEXT              :rem 75
270 O%(133)=3:O%(134)=19:O%(13
    5)=17:O%(136)=16      :rem 29
280 FORZ=0TO255:Y=O%(Z):IFY<>0
    THENI%(Y)=Z           :rem 32
290 NEXT:RETURN           :rem 244
300 PRINTCHR$(147)+CHR$(14)
                          :rem 240
310 P$(1)="1235559876":P$(2)="
    1235556789":P$(3)="1235554
    433"                  :rem 153
320 FORX=1TO3:PRINTX;+"-"+P$(X
    ):NEXT                :rem 207
330 PRINT" 4 -MANUAL ENTRY"
                          :rem 24
340 PRINT:PRINT" SELECTION ?"
                          :rem 148
350 GETB$:IFB$=""THEN350
                          :rem 85
360 IFB$="1"THEN PH$=P$(1)
                          :rem 94
370 IFB$="2"THENPH$=P$(2)
                          :rem 97
380 IFB$="3"THENPH$=P$(3)
                          :rem 100
390 IFB$="4"THEN410       :rem 10
400 GOTO430               :rem 100
410 PRINT:PRINT"ENTER PHONE NU
    MBER":INPUTPH$        :rem 244
420 IFLEN(PH$)<7THEN410:rem 72
430 POKEZ2,100            :rem 15
440 PRINT:PRINT"DIALING...":PO
    KEZ1,32:FORX=1TO1000:NEXTX
                          :rem 211
```

```
450 FORPN=1TOLEN(PH$)  :rem 27
460 NN=VAL(MID$(PH$,PN,1))
                       :rem 217
470 GOSUB540:NEXTPN    :rem 203
480 FORDL=1TO300:POKEZ1,6:POKE
    Z1,100:IFPEEK(Z1)=45THEN57
    0                  :rem 250
490 IFPEEK(Z1)<>125THENPRINT"
    {SPACE}{+}":GOTO510
                       :rem 238
500 PRINT"{RVS}{2 SPACES}{OFF}
    "                  :rem 10
510 NEXTDL             :rem 101
520 POKEZ1,0           :rem 173
530 PRINT:PRINT"NO CONNECTION
    {SPACE}FOR NR. ":PRINT"
    {DOWN}"PH$:GOTO600 :rem 83
540 PRINTNN;:IFNN=0THENNN=10
                       :rem 56
550 FORX=1TONN:POKEZ1,0:FORXX=
    1TO45:NEXTXX:POKEZ1,32:FOR
    XX=1TO24:NEXTXX:NEXTX
                       :rem 17
560 FORDL=1TO200:NEXTDL:RETURN
                       :rem 216
570 FORX=1TO3:FORRR=1TO20:C(X)
    =PEEK(Z1):NEXT:NEXT
                       :rem 173
580 IFC(1)+C(2)+C(3)=135THEN61
    0                  :rem 112
590 PRINT"NR. ";PH$" BUSY-"
                       :rem 232
600 FORX=1TO300:POKEZ2,32:POKE
    Z1,0{2 SPACES}:NEXT:GOTO43
    0                  :rem 210
610 FORX=1TO100:POKE36878,15:P
    OKE36875,245:NEXT:POKE3687
    8,0:GOTO80         :rem 233
```

Power BASIC: QuickScan

(Article on page 76.)

Program 1: QuickScan—64 Version

```
100 PRINTCHR$(147);CHR$(144)
                       :rem 50
110 FORAD=704TO766:READDA:POKE
    AD,DA:NEXT: REM SPRITE
                       :rem 4
120 FORAD=49152TO49251:READDA:
    POKEAD,DA:{4 SPACES}CS=CS+
    DA:NEXT:REM M-L PROGRAM
                       :rem 43
130 IFCS<>11879THENPRINT"ERROR
     IN DATA STATEMENTS":END
                       :rem 145
140 PRINT"ENTER SYS 49152 TO A
    CTIVATE SPRITE-BAR"
                       :rem 181
1000 DATA0,0,0,0,0,0,0,0,0,0,0,0
     ,0,0,0,0,0,0,0,0  :rem 131
1001 DATA0,0,0,0,0,85,85,85,85
     ,85,85,85,85,85   :rem 221
1002 DATA85,85,85,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0,0:rem 224
1003 DATA0,0,0,0,0,0,0,0,0,0,0,0
     ,0,169            :rem 206
2000 DATA11,160,7,153,247,7,13
     6,208,250,169,24,160,0,24
     ,153,0,208,105,48:rem 244
2001 DATA200,200,144,247,169,9
     6,141,16,208,169,8,141,10
     ,208,169,56,141,12:rem 54
2002 DATA208,169,127,141,28,20
     8,141,27,208,141,29,208,1
     41,23,208,141,21 :rem 206
2003 DATA208,169,1,141,37,208,
     120,169,74,160,192,141,20
     ,3,140,21,3,88,96  :rem 2
2004 DATA24,173,134,2,141,38,2
     08,165,214,10,10,10,105,3
     4,160,14,153,255 :rem 182
2005 DATA207,136,136,208,249,7
     6,49,234           :rem 142
```

Program 2: QuickScan—VIC Version

```
10 FORA=679TO735:READB:CK=CK+B
   :POKEA,B:NEXT:IFCK<>6811THE
   NPRINT"DATA ERROR":END
                       :rem 45
15 PRINT"{CLR}{DOWN}SYS 679 TO
    ACTIVATE"          :rem 116
20 DATA 120,169,185,141,20,3,1
   69,2,141,21,3,169   :rem 250
30 DATA 25,141,37,145,88,96,17
   3,15,144,72,165     :rem 180
40 DATA 214,10,10,24,105,24,20
   5,4,144,208,251     :rem 135
50 DATA 162,19,202,208,253,169
   ,11,141,15,144      :rem 109
60 DATA 162,81,234,202,208,252
   ,104,141,15,144     :rem 152
70 DATA 76,191,234     :rem 122
```

Maze-Mania

(Article on page 68.)

```
10 W=54272:FORT=WTOW+24:POKET,
   0:NEXT              :rem 31
20 POKE657,128:POKE53280,0:POK
   E53281,0:PRINT"{CLR}
   {8 DOWN}{GRN}"TAB(14)"{RVS}
   MAZE-MANIA          :rem 78
30 PRINT"{6 DOWN}"TAB(4)"{4}PL
   EASE WAIT WHILE DATA IS LOA
   DED":DIMU(255),H(255)
                       :rem 79
40 CZ=0:FORIG=49152TO49619:REA
   DYA:POKEIG,YA:CZ=CZ+YA:NEXT
                       :rem 175
50 FORBI=50176TO50442:READKA:P
   OKEBI,KA:CZ=CZ+KA:NEXT
                       :rem 40
60 IFCZ<>91037THENPRINT"{DOWN}
   {8 SPACES}{RVS}{WHT}ERROR I
   N DATA STATEMENTS{4}":STOP
                       :rem 146
70 FORF=1TO23:READU(F),H(F):NE
   XT                  :rem 208
80 LV=1:VL=LV+1:PL=1:MN(1)=3:M
   N(2)=3:PP=65:J=5:K=15:G$="
   {WHT}Q":POKE198,0   :rem 101
90 FORI=1TO2:SC(I)=0:NEXT
                       :rem 44
100 PRINT"{CLR}{3 DOWN}{GRN}"T
    AB(12)"{RVS}MAZE-MANIA":PR
    INT"{4 DOWN}"TAB(11)"{RVS}
    1{OFF} NORMAL GAME"
                       :rem 188
110 PRINT"{2 DOWN}"TAB(11)"
    {RVS}2{OFF} FADE GAME":PRI
    NT"{2 DOWN}"TAB(11)"{RVS}3
    {OFF} NERVOUS GAME"
                       :rem 113
120 PRINT"{3 DOWN}"TAB(10)"INP
    UT YOUR CHOICE {WHT}{B}
    {GRN}{LEFT}";:POKE204,0
                       :rem 3
130 GETMT$:IFMT$=""ORMT$<"1"OR
    MT$>"3"THEN130     :rem 61
140 PRINTMT$:PRINT"{2 DOWN}"TA
    B(7)"HOW MANY PLAYERS (1 O
    R 2) {WHT}{B}{LEFT}{GRN}";
    :POKE204,0         :rem 100
150 GETA$:IFA$=""ORA$<"1"ORA$>
    "2"THEN150         :rem 192
160 NP=VAL(A$):MT=VAL(MT$):PRI
    NTA$:POKE204,1:POKE207,0:P
    OKE646,VL          :rem 217
170 MT$=" {RVS} {OFF} {RVS}
    {OFF} {RVS} {OFF} {RVS}
    {OFF} {RVS} {OFF} {RVS}B
    {OFF}":M$="{RVS}
    {12 SPACES}":MM$="{RIGHT}
    {RVS}B{OFF}"+MT$+"{2 LEFT}
    "                  :rem 75
180 A=1226:B=55498:POKE56322,P
    EEK(56322)AND127   :rem 38
190 C=A:D=B:PRINT"{CLR}{DOWN}
    {2 SPACES}LEVEL"LVTAB(15)"
    TIME 000"TAB(28)"SCORE"SC(
    PL)                :rem 135
200 PRINT"{DOWN} {RVS}{A}CCCCC
    CCCCCCCCCMAZE-MANIACCCCCCCC
    CCCCC{S}"          :rem 114
210 FORI=1TO17:PRINT" {RVS}B
    {OFF}"MT$TAB(25)MM$" {RVS}
    B{OFF}":NEXT:PRINT"{HOME}
    {5 DOWN}";:FORI=1TO8
                       :rem 67
220 PRINTTAB(14)M$"{DOWN}":NEX
    T:PRINT"{HOME}{4 DOWN}"TAB
    (13)" "            :rem 31
230 PRINT"{HOME}{12 DOWN}"TAB(
    38)" ":PRINT"{7 DOWN}"TAB(
    26)" "             :rem 114
240 PRINT" {RVS}{Z}CCCCCCCCCCC
    CCCCCCCCCCCCCCCCCCCCCCCCCC
    {X}":PRINT"{DOWN}"TAB(12)"
    PLAYER"PL;         :rem 222
250 PRINTTAB(22)"MEN ";:FORI=1
    TOMN(PL):PRINTG$;:NEXT
                       :rem 248
260 T=INT(15*RND(1)):A=A+T*40:
    B=B+T*40:POKEA+1,32:POKEA+
    34,32              :rem 205
270 FORP=5TO11STEP2:Q=INT(11*R
    ND(1))+6:Z=INT(11*RND(1))+
    6:PRINT"{HOME}";:FORI=0TOQ
                       :rem 144
280 PRINT"{DOWN}";:NEXTI:PRINT
    TAB(P)" ":PRINT"{HOME}";:F
    ORI=0TOZ:PRINT"{DOWN}";:NE
    XTI                :rem 66
290 PRINTTAB(P+23)" ";:NEXTP:F
    ORQ=4TO19STEP2:P=INT(10*RN
    D(1))+15:PRINT"{HOME}";
                       :rem 180
300 FORI=0TOQ:PRINT"{DOWN}";:N
    EXTI:PRINTTAB(P);:PRINT" "
    :NEXTQ             :rem 140
310 POKE1542,102:POKE55814,0:P
    OKE1543,160:POKE55815,0
                       :rem 224
320 AA=INT(A/256):BB=AA*256:CC
    =A-BB:POKE167,CC:POKE169,C
    C:POKE168,AA:POKE170,AA
                       :rem 169
330 POKE911,K:POKE910,200:POKE
    912,K              :rem 20
340 POKE900,0:POKE904,J:POKE90
    5,0:POKE902,0:POKE903,0:PO
    KE901,8:POKE56325,PP
                       :rem 252
350 IFMT=2THENPOKE902,1:GOTO37
    0                  :rem 154
360 IFMT=3THENPOKE903,1
                       :rem 144
370 SYS49152           :rem 158
380 IFPEEK(900)=1THENSYS65418:
    GOTO410            :rem 229
390 IFPEEK(910)<=0THENSYS65418
    :GOTO700           :rem 36
400 GOTO380            :rem 104
410 IFPEEK(167)+256*PEEK(168)=
    1541THENT=PEEK(910):SC(PL)
    =SC(PL)+(T*LV):GOTO430
                       :rem 58
420 N1=1:N2=9:GOSUB730:MN(PL)=
    MN(PL)-1:GOTO520   :rem 246
430 POKE1541,32:POKE1542,81:PO
    KE55814,1:N1=10:N2=23:GOSU
```

```
    B730                    :rem 192
440 IFA$="1"THENMN(PL)=MN(PL)+
    1:GOTO490               :rem 38
450 POKE646,VL              :rem 54
460 IFPL=1THENGOSUB680:PL=2:CK
    =1:GOTO510              :rem 4
470 S2=S2+SC(PL):GOSUB680:PL=1
    :GOTO490                :rem 60
480 IFA$="1"THENPL=2        :rem 124
490 PP=PP-5:CK=0:J=J+1:K=K+4:L
    V=LV+1:IFLV=11THEN660
                            :rem 112
500 VL=VL+1                 :rem 114
510 GOSUB710:POKE900,0:POKE646
    ,VL:GOTO170             :rem 238
520 IFMN(PL)>0THEN510       :rem 225
530 IFA$="1"THEN570         :rem 9
540 PRINT"{HOME}{12 DOWN}"TAB(
    11)"{WHT}GAME OVER PLAYER"
    PL:LV(PL)=LV:GOSUB690
                            :rem 220
550 IFPL=2THENA$="1":PL=1:GOTO
    640                     :rem 203
560 A$="1":PL=2:GOTO510     :rem 0
570 LV(PL)=LV:PRINT"{CLR}
    {11 DOWN}"TAB(14)"{GRN}GAM
    E OVER":GOSUB690        :rem 1
580 PRINT"{CLR}{2 DOWN}"TAB(15
    )"SCOREBOARD":PRINTTAB(15)
    "{10 T}{3 DOWN}"        :rem 3
590 POKE56322,PEEK(56322)OR128
    :FORI=1TONP             :rem 200
600 PRINT"{DOWN}"TAB(8)"PLAYER
    "ISPC(5-LEN(STR$(SC(I))))S
    C(I)TAB(27)"LEVEL"LV(I)-1
                            :rem 176
610 NEXT:PRINT"{5 DOWN}"TAB(12
    )"PRESS {RVS}FIREBUTTON
    {OFF}{DOWN}":PRINTTAB(13)"
    TO PLAY AGAIN"          :rem 25
620 WAIT56321,16,16:WAIT56321,
    16                      :rem 247
630 PRINT"{CLR}":POKE53265,27:
    POKE53270,200:GOTO80:rem 3
640 IFCK=1THEN490           :rem 241
650 GOTO510                 :rem 106
660 PRINT"{CLR}{7 DOWN}"TAB(14
    )"{GRN}WELL DONE!!" :rem 2
670 PRINT"{DOWN}{3 SPACES}YOU
    {SPACE}HAVE COMPLETED ALL
    {SPACE}TEN LEVELS":GOSUB69
    0:GOTO580               :rem 49
680 PRINT"{HOME}{DOWN}"TAB(28)
    "SCORE"SC(PL):MN(PL)=MN(PL
    )+1:FORI=1TO1000:NEXT:RETU
    RN                      :rem 26
690 FORI=1TO2800:NEXT:RETURN
                            :rem 61
700 PRINT"{HOME}{12 DOWN}"TAB(
    14)"{WHT}OUT OF TIME":FORI
    =1TO500:NEXT:GOTO420
                            :rem 107
710 IFMN(PL)>3THENMN(PL)=3
                            :rem 71
720 RETURN                  :rem 121
730 POKEW+24,15:POKEW+5,17:POK
    EW+6,241                :rem 219
740 FORI=N1TON2:POKEW,U(I):POK
    EW+1,H(I):POKEW+4,17:FORT=
    1TO50:NEXT:POKEW+4,16
                            :rem 120
750 POKEW+1,U(I)-20:POKEW,H:PO
    KEW+4,17:FORT=1TO50:NEXT:P
    OKEW+4,16:NEXT:RETURN
                            :rem 184
760 DATA 120,169,255,141,15,21
    2,169,129,141,18,212,162,1
    7,173,27                :rem 84
770 DATA 212,74,74,74,74,205,1
    33,3,144,244,157,48,194,15
    7,0                     :rem 105
780 DATA 194,202,16,235,162,35
    ,189,150,193,157,96,194,15
    7,144,194               :rem 168
790 DATA 138,157,192,194,138,7
    4,168,189,186,193,157,240,
    194,202,16              :rem 229
800 DATA 231,169,73,141,20,3,1
    69,192,141,21,3,88,96,173,
    132                     :rem 93
810 DATA 3,240,3,76,49,234,173
    ,135,3,240,21,173,27,212,2
    01                      :rem 22
820 DATA 50,176,14,230,2,165,2
    ,41,7,9,24,141,17,208,141
                            :rem 130
830 DATA 22,208,162,17,222,0,1
    94,240,3,76,80,193,189,48,
    194                     :rem 103
840 DATA 157,0,194,138,10,168,
    189,240,194,16,27,73,255,2
    4,105                   :rem 205
850 DATA 1,133,251,185,96,194,
    56,229,251,153,96,194,185,
    97,194                  :rem 28
860 DATA 233,0,153,97,194,76,1
    76,192,185,96,194,24,125,2
    40,194                  :rem 19
870 DATA 153,96,194,185,97,194
    ,105,0,153,97,194,138,10,1
    68,185                  :rem 26
880 DATA 96,194,133,251,185,97
    ,194,133,252,140,61,3,160,
    0,177                   :rem 207
890 DATA 251,201,160,144,44,18
    9,240,194,73,255,24,105,1,
    157,240                 :rem 34
900 DATA 194,173,27,212,74,74,
    74,74,205,133,3,144,3,157,
    48                      :rem 52
910 DATA 194,172,61,3,185,144,
    194,153,96,194,185,145,194
    ,153,97                 :rem 72
920 DATA 194,76,80,193,201,81,
    208,8,169,1,141,132,3,76,8
    0                       :rem 0
930 DATA 193,172,61,3,185,144,
    194,133,253,185,145,194,13
    3,254,160               :rem 148
940 DATA 0,169,32,145,253,169,
    102,145,251,172,61,3,165,2
    51,153                  :rem 238
950 DATA 144,194,24,105,0,133,
    253,165,252,153,145,194,10
    5,212,133               :rem 124
960 DATA 254,152,41,7,208,2,16
    9,13,172,134,3,240,19,254,
    192                     :rem 92
970 DATA 194,189,192,194,201,8
    ,144,5,169,0,157,192,194,1
    70,189                  :rem 22
980 DATA 204,193,160,0,145,253
    ,202,48,3,76,109,192,206,1
    44,3                    :rem 139
990 DATA 208,20,173,143,3,141,
    144,3,173,142,3,208,6,238,
    132                     :rem 80
1000 DATA 3,76,147,193,206,142
    ,3,162,47,173,142,3,232,5
    6,233                   :rem 129
1010 DATA 100,16,250,142,60,4,
    24,105,100,162,47,232,56,
    233,10                  :rem 144
1020 DATA 16,250,142,61,4,24,1
    05,10,9,48,141,62,4,76,0
                            :rem 70
1030 DATA 196,36,7,38,7,40,7,4
    2,7,44,7,254,4,78,5
                            :rem 114
1040 DATA 158,5,238,5,62,6,142
    ,6,222,6,187,4,189,4,191
                            :rem 104
1050 DATA 4,193,4,195,4,197,4,
    216,216,216,216,216,1,1,1
    ,1,1,1,1                :rem 249
1060 DATA 40,40,40,40,40,40,12
    ,11,0,0,0,11,12,0,173,137
    ,3,205,136,3,176        :rem 94
1070 DATA 6,238,137,3,76,49,23
    4,160,0,234,234,234,140,1
    37,3,169,32,145         :rem 118
1080 DATA 167,165,169,133,167,
    165,170,133,168,162,0,134
    ,4,134,5,173,1          :rem 74
1090 DATA 220,74,176,1,136,74,
    176,1,200,74,176,1,202,74
    ,176,1,232,134          :rem 59
1100 DATA 4,132,5,74,42,41,1,1
    41,188,2,165,4,201,1,240,
    18,201,255              :rem 89
1110 DATA 240,3,76,145,196,165
    ,169,208,2,198,170,198,16
    9,76,100,196,230,169
                            :rem 144
1120 DATA 208,2,230,170,160,0,
    177,169,201,32,208,3,76,1
    26,196,201,102,240
                            :rem 240
1130 DATA 3,76,137,196,169,1,1
    41,132,3,76,229,196,165,1
    69,133,167,165,170:rem 37
1140 DATA 133,168,76,229,196,1
    65,167,133,169,165,168,13
    3,170,165,5,201,1,240
                            :rem 178
1150 DATA 23,201,255,240,3,76,
    229,196,56,165,169,233,40
    ,133,169,165,170,233
                            :rem 122
1160 DATA 0,133,170,76,187,196
    ,24,165,169,105,40,133,16
    9,165,170,105,0,133
                            :rem 62
1170 DATA 170,160,0,177,169,20
    1,32,208,3,76,221,196,201
    ,102,208,8,169,1 :rem 157
1180 DATA 141,132,3,76,229,196
    ,165,167,133,169,165,168,
    133,170,76,229,196,165
                            :rem 250
1190 DATA 170,133,168,165,169,
    133,167,160,0,169,81,145,
    167,165,168,72,165,167
                            :rem 246
1200 DATA 72,24,165,167,105,0,
    133,167,165,168,105,212,1
    33,168                  :rem 185
1210 DATA 169,1,145,167,104,13
    3,167,104,133,168,76,49,2
    34,70                   :rem 146
1220 DATA 70,68,66,64,62,60,58
    ,56,54,52,50,48,46,44,42,
    40,38                   :rem 152
1230 DATA 56,56,144,254,58,56,
    40,108,28,16,56,124,254,2
    54,124,56               :rem 94
1240 DATA 215,254,124,255,255,
    223,147,161,255,255,255,2
    55,255                  :rem 202
```

Horizons: Litter Patrol

(Article on page 60.)

```
100 GRAPHIC 0,1:COLOR 0,12:COL
    OR 4,6:GOSUB760 :DF=1:LV=5
    :R=RND(-TI):R=RND(0)
110 FORI=1TO40:SP$=SP$+" ":LN$
    =LN$+"-"
120 BL$=BL$+CHR$(210):UL$=UL$+
    CHR$(183):NEXT
130 BL$=CHR$(146)+BL$:UL$=CHR$
    (146)+UL$:SP$=CHR$(18)+SP$
140 FORI=1TO8:SPRITE I,0:MOVSP
    R I,0,0:NEXT
150 PRINTCHR$(147);:COLOR 5,6:
    PRINTSP$
160 TL=38:COLOR 5,7:PRINTLEFT$
```

```
    (SP$,40);:COLOR 5,6:PRINT"
     "SP$
170 PRINT:PRINT:COLOR 5,16:PRI
    NTLN$:PRINT:PRINT
180 COLOR 5,6:PRINT SP$SP$:PRI
    NT:PRINT:COLOR 5,16:PRINTL
    N$:PRINT:PRINT
190 COLOR 5,6:PRINT SP$SP$:PRI
    NT:PRINT:COLOR 5,8:PRINTBL
    $;UL$:PRINT:PRINT
200 COLOR 5,6:PRINTSP$LEFT$(SP
    $,40)CHR$(157)CHR$(148)CHR
    $(32);
210 COLOR 5,14:CHAR 1,12,0," L
    ITTER PATROL ",1:GOSUB720
    {SPACE}:GOSUB730
220 COLOR 5,6:FOR Y=2 TO 27 ST
    EP 7
230 FOR X=8 TO 32 STEP 12:CHAR
     1,X,Y,CHR$(215),1:NEXT:NE
    XT
240 M$="V1 O2 T0 IEGGEGGEGG .Q
     #E I DFFDFFDFF .QE"
250 M$=M$+"I EGGEGGEGG .Q A I
    {SPACE}AAFGGEFFD .Q CRRR"
260 SPRCOLOR 2,1
270 RESTORE1110 :FORI=2TO7:REA
    D SY,SN:SPRSAV SS$(SN),I
280 MOVSPR I,0,56+SY*8
290 SPRITE I,1,I+1,0,0,0,1
300 ANG%(I)=90-180*(SN=2):SPD%
    (I)=5*RND(1)+DF
310 MOVSPR I,ANG%(I)#SPD%(I)
320 NEXT
330 XP=102:YP=237:MOVSPR 1,XP,
    YP
340 SPRITE 1,1,11,0,0,0,1:SPRS
    AV SS$(0),1
350 COLLISION 1,580
360 IF DF=1 THEN:PLAY M$:SOUND
     1,0,0
370 IFTI-T>120THENCOLOR 5,6:CH
    AR 1,TL,1,CHR$(32),1:T=TI:
    TL=TL-1:IFTL<0THEN640
380 GET A$:IF A$<>"" THEN GOSU
    B740 :GETKEY A$:GOSUB750
390 IF RND(1)<.95 THEN420
400 S%=2+6*RND(1):X=RSPPOS(S%,
    0):Y=RSPPOS(S%,1)
410 IF X>31 AND X<336 THEN COL
    OR 5,2:CHAR 1,(X-24)/8,(Y-
    50)/8+1,"."
420 J=JOY(1):IF J=0 THEN370
430 IF J AND 128 THEN480
440 XP=XP+DX(J):IF XP<24 OR XP
    >343 THEN XP=XP-DX(J)
450 YP=YP+DY(J):IF YP<61 OR YP
    >237 THEN YP=YP-DY(J)
460 MOVSPR 1,XP,YP
470 GOTO370
480 X%=(XP-24)/8+1:Y%=(YP-50)/
    8:SP=1024+X%+40*Y%:C=PEEK(
    SP)
490 IF C=46 AND HT=0 THEN BEGI
    N:POKE 3584,65:POKESP,32:H
    T=1
500 :SOUND 1,700,20,0,600,10,3
    :SC=SC+1:GOSUB720 :BEND
510 IF HT AND C=215 THEN BEGIN
    :POKE SP,209:POKE 3584,64:
    SOUND 1,5000,5,,,,3
520 :HT=0:F=F+1:SC=SC+10:GOSUB
    720 :FL=FL+1:IF FL<12 THEN
    370
530 :GOSUB740 :FOR I=0 TO 63
540 :COLOR 5,(IAND15)+1:CHAR 1
    ,4,12,"BONUS 1000 POINTS F
    OR COMPLETION",1
550 ::NEXT:SC=SC+1000:DF=DF-(D
    F<3):FL=0:GOTO140
560 BEND
570 GOTO370
580 IF BUMP(1)=0 THEN RETURN
590 COLOR 5,9:CHAR 1,12,0,"OH!
     YOWEE OUCH!",1
600 FORI=1TO11:SPRITE 1,1,I:SO
    UND 1,2000+RND(1)*1000,1,,
    ,,3:NEXT
610 COLOR 5,14:CHAR 1,12,0," L
    ITTER PATROL ",1
620 XP=102:YP=237:MOVSPR 1,XP,
    YP:POKE 3584,64:HT=0:A=BUM
    P(1)
630 LV=LV-1:GOSUB730 :IF LV TH
    EN RETURN
640 COLLISION 1:PLAY "T0 O2 I
    {SPACE}C C E E G R B R A A
     F D Q C R R":SOUND 1,0,0
650 COLOR 5,16:CHAR 1,7,12,"GA
    ME OVER -- PRESS TRIGGER",
    1:C=0
660 IF JOY(1)=128 THEN660
670 IF JOY(1)=128 THEN690
680 COLOR 5,C+1:CHAR 1,7,12,"G
    AME OVER",1:C=(C+1)AND15:G
    OTO670
690 FORI=1TO8:SPRITE I,0:MOVSP
    R I,0,0:NEXT
700 RUN
720 COLOR 5,15:CHAR 1,0,0,"SCO
    RE:"+MID$(STR$(SC),2),1:RE
    TURN
730 COLOR 5,4:CHAR 1,30,0,"TRU
    CKS:"+STR$(LV),1:RETURN
740 FORI=2TO7:MOVSPR I,90#0:NE
    XT:RETURN
750 FOR I=2TO7:MOVSPR I,ANG%(I
    )#SPD%(I):NEXT:RETURN
760 FOR I=0 TO 8:READ DX(I),DY
    (I):NEXT
770 FOR I=0 TO 2:FOR J=1 TO 67
    :READ A$:SS$(I)=SS$(I)+CHR
    $(DEC(A$)):NEXT:NEXT
780 RETURN
790 DATA 0,0,0,-8,8,-8,8,0,8,8
    ,0,8,-8,8,-8,0,-8,-8
810 DATA 40,10,00,40,10,00,40,
    10,00,15,40,00,05,00,00,05
820 DATA 00,00,2A,80,00,EA,B0,
    00,EA,B0,00,2A,80,00,2A,80
830 DATA 00,EA,B0,00,EA,B0,00,
    00,00,00,00,00,00,00,00,00
840 DATA 00,00,00,00,00,00,00,
    00,00,00,00,00,00,00,00,17
850 DATA 00,14,00
900 REM CAR FACING LEFT
910 DATA 00,00,00,00,00,00,00,
    00,00,00,00,00,00,00,00,00
920 DATA 00,00,0F,00,3C,AB,96,
    A9,2B,AA,6A,3A,7D,6A,2A,7D
930 DATA 6A,3A,7D,6A,2B,AA,6A,
    AB,96,A9,0F,00,3C,00,00,00
940 DATA 00,00,00,00,00,00,00,
    00,00,00,00,00,00,00,00,17
950 DATA 00,14,00
1000 REM CAR FACING RIGHT
1010 DATA 00,00,00,00,00,00,00
     ,00,00,00,00,00,00,00,00
1020 DATA 00,00,00,3C,00,F0,6A
     ,96,BA,69,AA,E8,A9,7D,AC
1030 DATA A9,7D,A8,A9,7D,AC,69
     ,AA,E8,6A,96,BA,3C,00,F0
1040 DATA 00,00,00,00,00,00,00
     ,00,00,00,00,00,00,00,00
1050 DATA 00,00,00,17,00,14,00
1100 DATA POSITION AND DIRECTI
     ON OF EACH CAR
1110 DATA 2,1,5,1,9,2,12,2,16,
     1,20,2
```

VIC Emulator

(See instructions in article on page 84 before typing in.)

```
49152 :169,160,133,252,169,224,083
49158 :133,254,169,000,133,251,178
49164 :133,253,162,032,168,177,169
49170 :251,145,251,177,253,145,216
49176 :253,136,208,245,230,252,068
49182 :230,254,202,208,238,160,042
49188 :002,185,240,192,153,039,079
49194 :184,185,243,192,153,218,193
49200 :228,185,246,192,153,110,138
49206 :160,136,016,235,169,072,074
49212 :141,038,003,169,192,141,232
49218 :039,003,056,176,049,234,111
49224 :036,157,048,040,072,152,065
49230 :072,138,072,056,032,240,176
49236 :255,192,009,176,003,076,027
49242 :105,192,192,031,144,015,001
49248 :169,013,032,202,241,056,041
49254 :032,240,255,160,009,024,054
49260 :032,240,255,104,170,104,245
49266 :168,104,076,224,198,234,094
49272 :173,000,221,041,252,009,048
49278 :001,141,000,221,169,005,151
49284 :141,024,208,169,128,141,175
49290 :136,002,169,147,032,210,066
49296 :255,165,001,041,253,133,224
49302 :001,169,240,141,005,144,082
49308 :169,150,141,002,144,169,163
49314 :216,141,022,208,169,006,156
49320 :141,134,002,169,001,141,244
49326 :033,208,169,003,141,032,248
49332 :208,076,233,197,000,000,126
49338 :000,000,000,000,000,000,186
49344 :165,021,072,165,020,072,195
49350 :032,247,183,234,056,176,102
49356 :015,160,000,177,020,168,232
49362 :104,133,020,104,133,021,213
49368 :076,162,179,234,165,021,029
49374 :166,020,201,016,144,003,004
49380 :076,033,193,201,002,208,173
49386 :029,076,250,192,234,234,225
49392 :076,240,193,169,001,234,129
49398 :192,192,124,234,224,136,068
49404 :208,207,173,005,144,032,253
49410 :202,196,076,209,192,234,087
49416 :201,000,240,003,076,205,221
49422 :192,076,119,197,176,248,254
49428 :138,105,016,133,020,169,089
49434 :003,133,021,076,205,192,144
49440 :234,201,032,176,035,041,239
49446 :254,133,002,173,005,144,237
49452 :032,202,196,197,002,240,145
49458 :003,076,205,192,165,021,200
49464 :041,001,032,045,194,165,022
49470 :021,009,128,133,021,076,194
49476 :205,192,234,234,201,128,238
49482 :176,003,076,205,192,201,159
49488 :144,176,026,105,080,133,232
49494 :021,120,165,001,072,041,250
49500 :251,133,001,160,000,177,046
49506 :020,168,104,133,001,088,100
49512 :076,210,192,234,234,201,227
49518 :144,208,038,224,008,240,204
49524 :004,224,009,208,211,138,142
49530 :105,016,133,097,169,212,086
49536 :133,098,169,000,170,168,098
49542 :133,099,024,113,097,144,232
49548 :002,230,099,202,208,247,104
49554 :165,099,076,209,192,201,064
49560 :145,240,003,076,080,197,125
49566 :224,017,240,004,224,031,130
49572 :208,038,032,172,193,076,115
49578 :209,192,173,001,220,072,013
49584 :041,007,010,010,168,104,004
49590 :041,016,008,152,040,240,167
49596 :003,009,032,168,165,001,054
49602 :041,016,008,152,040,240,179
49608 :002,009,064,096,224,032,115
49614 :240,003,076,205,192,162,060
49620 :128,173,001,220,041,008,015
49626 :208,001,170,138,076,209,252
49632 :192,234,234,000,000,000,116
49638 :000,000,000,000,000,000,230
49644 :000,000,000,000,134,002,116
49650 :165,021,201,016,176,003,056
49656 :076,219,196,201,032,144,092
49662 :003,076,163,194,032,000,210
49668 :197,165,021,041,254,133,047
49674 :096,173,005,144,032,202,150
49680 :196,197,096,240,003,076,056
49686 :021,197,165,021,041,001,212
49692 :032,045,194,076,152,194,209
49698 :000,000,000,000,000,000,034
49704 :000,000,000,000,000,133,173
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49710 :099,165,020,133,098,173,222
49716 :093,192,056,237,086,192,140
49722 :133,096,169,000,133,097,174
49728 :032,071,194,056,176,042,123
49734 :234,169,000,133,100,133,071
49740 :101,162,016,006,098,038,241
49746 :099,038,100,038,101,165,111
49752 :100,056,229,096,168,165,134
49758 :101,229,097,144,006,230,133
49764 :098,133,101,132,100,202,098
49770 :208,227,096,234,234,234,059
49776 :169,000,133,021,165,098,186
49782 :010,010,010,133,020,162,207
49788 :004,024,101,020,144,002,163
49794 :230,021,202,208,246,024,037
49800 :101,100,144,002,230,021,222
49806 :024,105,009,144,002,230,144
49812 :021,133,020,096,169,128,203
49818 :024,101,021,133,021,076,018
49824 :000,197,234,201,148,176,092
49830 :003,076,202,194,201,152,226
49836 :144,003,076,000,197,032,112
49842 :000,197,165,021,041,253,087
49848 :056,233,148,133,021,032,039
49854 :045,194,169,216,024,101,171
49860 :021,133,021,076,000,197,132
49866 :201,144,240,003,076,183,025
49872 :197,166,002,165,020,201,191
49878 :015,208,018,138,041,007,129
49884 :141,032,208,141,034,208,216
49890 :138,032,057,197,076,000,214
49896 :197,234,234,201,014,208,040
49902 :007,142,024,212,076,066,253
49908 :197,234,201,010,176,003,041
49914 :076,132,195,233,010,162,034
49920 :032,201,003,208,002,162,096
49926 :128,168,185,090,195,072,076
49932 :165,002,201,128,176,009,181
49938 :104,168,138,153,004,212,029
49944 :076,000,197,041,127,133,086
49950 :096,185,094,195,133,097,062
49956 :032,109,195,152,010,168,190
49962 :185,098,195,101,098,133,084
49968 :098,200,185,098,195,101,157
49974 :099,133,099,234,104,168,123
49980 :165,098,153,000,212,165,085
49986 :099,153,001,212,169,000,188
49992 :153,005,212,169,240,153,236
49998 :006,212,138,009,001,153,085
50004 :004,212,076,000,197,234,039
50010 :000,007,014,000,033,058,202
50016 :117,058,024,002,048,004,093
50022 :097,008,048,004,234,234,215
50028 :234,169,000,160,008,070,237
50034 :096,144,003,024,101,097,067
50040 :106,102,098,136,208,243,245
50046 :133,099,096,234,234,234,132
50052 :201,005,240,003,076,006,151
50058 :196,165,002,205,005,144,087
50064 :208,001,096,165,002,041,145
50070 :015,208,004,169,004,208,246
50076 :083,201,002,208,004,169,055
50082 :006,208,075,056,233,012,240
50088 :176,003,076,006,196,133,246
50094 :096,010,010,009,016,133,192
50100 :099,169,000,133,098,133,044
50106 :100,168,169,136,133,101,225
50112 :162,008,177,098,145,100,114
50118 :136,208,249,230,101,230,072
50124 :099,202,240,023,224,004,228
50130 :208,238,165,096,201,003,097
50136 :208,232,120,165,001,041,215
50142 :251,133,001,169,208,133,093
50148 :099,208,219,165,001,009,161
50154 :004,133,001,088,169,002,119
50160 :133,096,173,024,208,041,147
50166 :240,005,096,141,024,208,192
50172 :076,006,196,234,234,234,208
50178 :234,234,234,234,165,020,099
50184 :201,002,240,027,201,005,172
50190 :240,003,076,000,197,165,183
50196 :002,041,240,133,097,173,194
50202 :005,144,041,240,197,097,238
50208 :208,022,076,000,197,234,001
50214 :234,165,002,041,127,201,040
50220 :048,144,001,096,105,009,191
50226 :141,093,192,173,005,144,030
50232 :032,202,196,133,169,032,052
50238 :000,197,173,005,144,032,101
50244 :202,196,133,098,169,000,098
50250 :133,097,133,168,133,106,076
50256 :133,108,169,128,133,100,083
50262 :169,216,133,171,169,009,185
50268 :234,234,234,234,133,099,236
50274 :133,170,165,169,032,117,116
50280 :196,133,107,165,098,032,067
50286 :117,196,133,109,056,176,129
50292 :011,162,148,041,002,240,208
50298 :002,162,150,138,096,234,136
50304 :162,022,173,093,192,233,235
50310 :008,133,101,164,101,136,009
50316 :177,099,145,168,177,097,235
50322 :145,099,177,170,145,106,220
50328 :177,108,145,170,136,016,136
50334 :237,165,097,024,101,101,115
50340 :133,097,133,168,133,106,166
50346 :133,108,144,008,230,098,123
50352 :230,169,230,107,230,109,227
50358 :165,099,024,105,040,133,236
50364 :099,133,170,144,004,230,200
50370 :100,230,171,202,208,193,018
50376 :096,234,041,240,056,233,076
50382 :192,074,074,009,016,044,103
50388 :002,144,016,002,009,002,131
50394 :096,165,021,166,020,201,119
50400 :002,208,010,224,136,208,244
50406 :003,096,234,234,076,000,105
50412 :197,201,000,208,249,224,035
50418 :243,176,245,224,217,144,211
50424 :001,096,224,003,176,236,216
50430 :144,008,165,002,160,000,221
50436 :145,020,096,234,138,105,230
50442 :016,133,020,169,003,133,228
50448 :021,076,000,197,234,032,064
50454 :000,197,173,005,144,041,070
50460 :015,056,233,012,176,001,009
50466 :096,010,010,009,016,133,052
50472 :097,165,021,056,229,097,193
50478 :176,001,096,105,135,133,180
50484 :021,076,000,197,234,074,142
50490 :074,074,074,141,033,208,150
50496 :096,234,138,074,074,074,242
50502 :074,141,035,208,076,000,092
50508 :197,234,234,234,169,148,012
50514 :044,002,144,016,002,169,203
50520 :150,133,002,165,021,041,088
50526 :254,197,002,240,003,076,098
50532 :205,192,165,021,041,001,213
50538 :032,045,194,165,021,024,075
50544 :105,216,133,021,076,205,100
50550 :192,224,197,240,007,224,178
50556 :003,076,018,193,234,234,114
50562 :165,197,201,064,144,003,136
50568 :076,205,192,072,041,007,217
50574 :168,185,164,197,133,002,223
50580 :104,074,074,074,168,165,039
50586 :002,024,121,172,197,076,234
50592 :209,192,234,234,007,015,027
50598 :023,063,039,047,055,031,168
50604 :000,250,251,252,253,254,152
50610 :255,249,234,234,234,201,049
50616 :145,240,003,076,000,197,077
50622 :166,020,224,028,240,003,103
50628 :076,000,197,165,002,041,165
50634 :008,208,013,169,001,133,222
50640 :192,165,001,009,032,133,228
50646 :001,076,000,197,169,000,145
50652 :133,192,165,001,041,223,207
50658 :133,001,076,000,197,234,099
50664 :234,162,008,134,097,160,003
50670 :000,132,098,185,102,198,185
50676 :200,190,102,198,168,024,102
50682 :032,240,255,164,098,200,215
50688 :200,190,102,198,200,185,051
50694 :102,198,032,210,255,200,235
50700 :202,208,246,198,097,208,147
50706 :220,032,207,255,201,049,214
50712 :144,249,201,054,176,245,069
50718 :056,233,049,010,010,168,044
50724 :185,080,198,133,044,141,049
50730 :130,002,185,081,198,133,003
50736 :056,141,132,002,185,082,134
50742 :198,141,005,144,185,083,042
50748 :198,141,002,144,169,013,215
50754 :032,210,255,032,210,255,036
50760 :076,011,199,234,234,234,036
50766 :234,234,016,030,240,150,214
50772 :004,030,240,150,018,064,078
50778 :192,022,018,096,192,022,120
50784 :018,128,192,022,000,000,200
50790 :013,002,012,086,073,067,099
50796 :032,069,077,085,076,065,000
50802 :084,079,082,011,005,016,135
50808 :066,089,032,070,065,085,015
50814 :083,084,079,032,073,066,031
50820 :065,082,082,065,003,008,181
50826 :012,049,032,085,078,069,207
50832 :088,080,065,078,068,069,080
50838 :068,003,010,009,050,032,066
50844 :086,073,067,032,043,051,252
50850 :075,003,012,009,051,032,088
50856 :086,073,067,032,043,056,013
50862 :075,003,014,010,052,032,104
50868 :086,073,067,032,043,049,018
50874 :054,075,003,016,010,053,141
50880 :032,086,073,067,032,043,013
50886 :050,052,075,005,019,017,160
50892 :069,078,084,069,082,032,106
50898 :083,069,076,069,067,084,146
50904 :073,079,078,058,032,000,024
50910 :000,000,072,133,002,152,069
50916 :072,138,072,165,002,201,110
50922 :157,240,008,104,170,104,249
50928 :168,104,076,202,241,056,063
50934 :032,240,255,192,009,208,158
50940 :240,172,093,192,234,202,105
50946 :024,032,240,255,076,237,098
50952 :198,234,234,169,000,133,208
50958 :043,133,055,141,129,002,005
50964 :141,131,002,168,145,043,138
50970 :230,043,032,068,166,165,218
50976 :055,056,229,043,170,165,238
50982 :056,229,044,032,205,189,025
50988 :169,096,160,228,032,030,247
50994 :171,120,169,066,141,020,225
51000 :003,169,199,141,021,003,080
51006 :088,076,116,164,032,172,198
51012 :193,141,031,145,141,017,224
51018 :145,162,128,173,001,220,135
51024 :208,001,170,138,141,032,002
51030 :145,173,025,212,141,008,022
51036 :144,173,026,212,141,009,029
51042 :144,169,047,133,000,169,248
51048 :053,133,001,076,049,234,138
51054 :000,160,003,200,177,043,181
51060 :208,251,200,200,152,160,007
51066 :000,145,043,165,044,200,207
51072 :145,043,133,060,160,000,157
51078 :132,059,162,000,200,208,127
51084 :002,230,060,177,059,208,108
51090 :245,232,224,003,208,242,020
51096 :200,208,002,230,060,132,216
51102 :045,164,060,132,046,096,189
51108 :000,000,000,000,000,000,164
51114 :000,000,000,000,000,000,170
51120 :255,013,013,013,013,013,240
```

Printer Wedge

(Article on page 80.)

Program 1: Printer Wedge—Main Program

```
10 BS=1358:S0=160:S1=32:D0=209
   :D1=81:M=1:MF(0)=1:FORJ=1TO
   6:M=M*2:MF(J)=M:NEXT:rem 11
20 PRINTCHR$(147)CHR$(5)"
   [3 SPACES]PRINTER WEDGE CHA
   RACTER DESIGNER"     :rem 22
30 PRINTCHR$(17)"MOVE WITH CUR
   SOR KEYS"            :rem 123
40 PRINT"PLACE DOT WITH F7":PR
   INT"ERASE DOT WITH F8"
                        :rem 86
50 PRINTCHR$(17)"ASSIGN CHARAC
   TER WITH F1"         :rem 245
60 FORI=1TO5:PRINTCHR$(17):NEX
   T:PRINT"ASSIGN CHARACTER ST
   RING WITH F3"        :rem 191
70 PRINT"ACTIVATE WEDGE WITH F
   2"                   :rem 169
80 CH=S0:FORI=0TO9:FORJ=0TO6:G
   OSUB110:AR(I,J)=0:NEXTJ:NEX
   TI                   :rem 50
90 I=0:J=0:CH=S1:GOSUB110:GOTO
   140                  :rem 234
100 I=0:J=0:CH=S1:GOSUB110:GOT
    O140                :rem 18
```

```
110 X=BS+I+J*40:POKEX,CH:POKEX
    +54272,1:RETURN      :rem 18
120 GETZ$:IFZ$=""THEN120
                         :rem 123
130 RETURN               :rem 116
140 GOSUB120:DC=0:REM *CHARACT
    ER EDITOR*           :rem 156
150 IFZ$=CHR$(29)THENDC=1
                         :rem 193
160 IFZ$=CHR$(157)THENDC=2
                         :rem 245
170 IFZ$=CHR$(17)THENDC=3
                         :rem 194
180 IFZ$=CHR$(145)THENDC=4
                         :rem 246
190 IFDC>0THENGOSUB370:GOSUB38
    0                    :rem 188
200 ONDCGOSUB290,310,330,350
                         :rem 23
210 GOSUB370:IFDC>0ANDLC=S0THE
    NCH=S1:GOSUB110      :rem 84
220 IFDC>0ANDLC=D0THENCH=D1:GO
    SUB110               :rem 227
230 IFZ$=CHR$(136)THENAR(I,J)=
    1:CH=D1:GOSUB110     :rem 206
240 IFZ$=CHR$(140)THENAR(I,J)=
    0:CH=S1:GOSUB110     :rem 216
250 IFZ$=CHR$(133)THEN410
                         :rem 142
260 IFZ$=CHR$(137)THENPRINTCHR
    $(147)CHR$(17)"PLEASE WAIT
    ":GOTO660            :rem 117
270 IFZ$=CHR$(134)THEN550
                         :rem 150
280 GOTO140              :rem 104
290 I=I+1:IFI>9THENI=0   :rem 52
300 RETURN               :rem 115
310 I=I-1:IFI<0THENI=9   :rem 45
320 RETURN               :rem 117
330 J=J+1:IFJ>6THENJ=0   :rem 48
340 RETURN               :rem 119
350 J=J-1:IFJ<0THENJ=6   :rem 50
360 RETURN               :rem 121
370 LC=PEEK(BS+I+J*40):RETURN
                         :rem 2
380 IFLC=S1THENCH=S0     :rem 244
390 IFLC=D1THENCH=D0     :rem 215
400 GOSUB110:RETURN      :rem 192
410 FORI=0TO9:REM *COMPUTE CHA
    RACTER*              :rem 42
420 CL(I)=128:FORJ=0TO6:CL(I)=
    CL(I)+AR(I,J)*MF(J):NEXTJ:
    NEXTI                :rem 188
430 PRINT"ASSIGN CHARACTER TO
    {SPACE}WHICH KEY?":rem 248
440 GOSUB120:Z=ASC(Z$):B=3000+
    Z*10:REM *PRINT DATA STATE
    MENTS*               :rem 207
450 PRINTCHR$(147)CHR$(17)CHR$
    (17)CHR$(17)B"DATA"Z"
    {4 SPACES}";         :rem 187
460 FORI=0TO9:IFCL(I)=128ANDCL
    (I+1)=128THEN480     :rem 216
470 PRINT","CL(I)CHR$(157);:NE
    XTI                  :rem 173
480 PRINT:FORDX=1TO5:PRINT3000
    +Z*10+DX:NEXT        :rem 6
490 PRINT"RUN"CHR$(19);:FORJ=1
    TO3:PRINTCHR$(17);:NEXT
                         :rem 62
500 FORJ=1TO14:PRINTCHR$(29);:
    NEXT:PRINT","ICHR$(19)
                         :rem 176
510 IFI>0THEN540         :rem 164
520 PRINTCHR$(19);:FORJ=1TO3:P
    RINTCHR$(17);:NEXT:rem 255
530 FORJ=1TO20:PRINTCHR$(32);:
    NEXT                 :rem 110
540 POKE198,9:FORI=0TO8:POKE63
    1+I,13:NEXT:END      :rem 18
550 PRINTCHR$(147)"ENTER CHARA
    CTER STRING":INPUTA$:L=LEN
    (A$):IFL<1ORL>39THEN550
                         :rem 164
560 PRINT"ASSIGN TO WHICH KEY?
    ":GOSUB120:DX=0:Z=ASC(Z$):
    I=1:B=3000+Z*10+DX:rem 186
570 PRINTCHR$(147)CHR$(17)CHR$
    (17)CHR$(17)B"DATA"Z"
    {4 SPACES},15,17";:LX=2
                         :rem 49
580 PRINT","ASC(MID$(A$,I,1))C
    HR$(157);:LX=LX+1:I=I+1
                         :rem 242
590 IFLX>9ANDI<=LTHENLX=0:DX=D
    X+1:B=3000+Z*10+DX:GOSUB65
    0                    :rem 28
600 IFI<=LTHEN580        :rem 255
610 PRINT:FORDX=DX+1TO5:PRINT3
    000+Z*10+DX:NEXT     :rem 200
620 PRINT"RUN"CHR$(19);:FORJ=1
    TO3:PRINTCHR$(17);:NEXT
                         :rem 57
630 FORJ=1TO14:PRINTCHR$(29);:
    NEXT:PRINT","L+2     :rem 88
640 PRINTCHR$(19):POKE198,9:FO
    RI=0TO8:POKE631+I,13:NEXT:
    END                  :rem 150
650 PRINTCHR$(13)B"DATA"ASC(MI
    D$(A$,I,1))CHR$(157);:LX=L
    X+1:I=I+1:RETURN     :rem 240
660 FORI=57344TO57452:REM POKE
     HI CODE             :rem 179
670 READA:POKEI,A:NEXT:rem 146
680 PRINTCHR$(147)"{2 SPACES}W
    HERE SHOULD PWEDGE BE LOCA
    TED?"                :rem 37
690 PRINTCHR$(17)"854
    {3 SPACES}= CASSETTE BUFFE
    R"                   :rem 30
700 PRINT"679{3 SPACES}= UNUSE
    D RAM (MAYBE)"       :rem 190
710 PRINT"49152 = RESERVED FOR
     ML PROGRAMS"        :rem 246
720 PRINTCHR$(17)"LOCATION
    {3 SPACES}854"CHR$(157)CHR
    $(157)CHR$(157)CHR$(157)CH
    R$(157);             :rem 4
730 INPUTBA:FORI=BATOBA+59:REA
    DA:POKEI,A:NEXT      :rem 197
740 IFBA=854THEN830      :rem 85
750 P=BA+60:GOSUB990:POKEBA+10
    ,L:POKEBA+11,H:POKEBA+49,L
    :POKEBA+50,H         :rem 98
760 P=BA+61:GOSUB990:POKEBA+13
    ,L:POKEBA+14,H:POKEBA+52,L
    :POKEBA+53,H         :rem 103
770 P=BA+62:GOSUB990:POKEBA+1,
    L:POKEBA+2,H:POKEBA+55,L:P
    OKEBA+56,H           :rem 9
780 POKE57354,L:POKE57355,H:PO
    KE57449,L:POKE57450,H
                         :rem 4
790 P=BA+64:GOSUB990:POKEBA+39
    ,L:POKEBA+40,H:POKE57409,L
    :POKE57410,H         :rem 83
800 POKE57425,L:POKE57426,H:PO
    KE57437,L:POKE57438,H
                         :rem 254
810 POKE57443,L:POKE57444,H
                         :rem 44
820 P=BA+25:GOSUB990:POKE57395
    ,L:POKE57396,H       :rem 113
830 P=BA:GOSUB990:POKE806,L:PO
    KE807,H              :rem 2
840 REM POKE CHARACTER DATA
                         :rem 86
850 I=57601:CT=0:Z=I+256
                         :rem 70
860 READC:IFC=0THENPOKEZ-257,C
    T:POKEZ+255,0:GOTO910
                         :rem 175
870 READL:IF(L+I+3)>=ZTHEN890
                         :rem 228
880 POKEI,C:POKEI+1,L:FORK=1TO
    L:READA:POKEI+1+K,A:NEXT:I
    =I+L+2:CT=CT+1:GOTO860
                         :rem 198
890 POKEZ-257,CT:CT=1:I=Z:Z=I+
    256:POKEI,C:POKEI+1,L
                         :rem 154
900 FORK=1TOL:READA:POKEI+1+K,
    A:NEXT:I=I+L+2:GOTO860
                         :rem 23
910 PRINTCHR$(147)"PWEDGE IS N
    OW INSTALLED."       :rem 115
920 PRINTCHR$(17)"DO YOU WANT
    {SPACE}A PRINTER TEST?"
                         :rem 212
930 GOSUB120:IFZ$<>"Y"THENEND
                         :rem 19
940 OPEN4,4,7:PRINT#4,"THE QUI
    CK BROWN FOX JUMPED OVER T
    HE LAZY DOG."        :rem 81
950 FORI=33TO64:PRINT#4,CHR$(I
    );:NEXT:PRINT#4      :rem 53
960 FORI=65TO96:PRINT#4,CHR$(I
    );:NEXT:PRINT#4      :rem 64
970 FORI=193TO218:PRINT#4,CHR$
    (I);:NEXT:PRINT#4:CLOSE4
                         :rem 131
980 END                  :rem 120
990 H=INT(P/256):L=P-H*256:RET
    URN                  :rem 232
1000 REM *HI CODE*       :rem 165
1010 DATA 172,0,225,192,0,240,
     32,162,1,173        :rem 247
1020 DATA 148,3,221,0,225,240,
     36,232,138,24       :rem 47
1030 DATA 125,0,225,170,232,13
     6,208,237,238,2     :rem 153
1040 DATA 224,238,14,224,238,2
     2,224,208,217,169   :rem 10
1050 DATA 225,141,2,224,141,14
     ,224,141,22,224     :rem 138
1060 DATA 76,111,3,173,2,224,1
     41,70,224,141       :rem 48
1070 DATA 79,224,169,8,141,150
     ,3,232,189,0        :rem 22
1080 DATA 225,141,109,224,160,
     1,232,189,0,225     :rem 154
1090 DATA 153,150,3,232,200,20
     6,109,224,208,243   :rem 248
1100 DATA 169,128,153,150,3,20
     0,169,15,153,150    :rem 204
1110 DATA 3,200,169,17,141,148
     ,3,208,186          :rem 169
1200 REM *LO CODE*       :rem 177
1210 DATA 141,148,3,165,154,20
     1,4,208,45,142      :rem 103
1220 DATA 146,3,140,147,3,120,
     165,1,41,253        :rem 252
1230 DATA 133,1,76,0,224,165,1
     ,9,2,133            :rem 56
1240 DATA 1,88,192,0,240,12,16
     2,0,189,150         :rem 212
1250 DATA 3,32,202,241,232,136
     ,208,246,174,146    :rem 207
1260 DATA 3,172,147,3,173,148,
     3,76,202,241        :rem 14
10000 DATA 0             :rem 59
```

Program 2: Character Set 1

```
2999 REM *NON PROPORTIONAL SPA
     CED- G, P AND Q MODIFIED*
                         :rem 174
3340 DATA 34,5,128,135,128,135
     ,128,71,5,136,212   :rem 7
3710 DATA 212,212,184,80,5,252
     ,148,148,148,136    :rem 223
3800 DATA 81,5,184,196,212,164
     ,216                :rem 145
```

Program 3: Character Set 2

```
3000 REM *PROPORTIONAL SPACED
     {SPACE}CHARACTERS WITHOUT
      DESCENDERS*        :rem 72
3010 DATA34,4,128,135,128,135,
     39,3,132,130        :rem 54
3020 DATA129,66,4,255,196,196,
     184,67,4,184        :rem 94
```

```
3030 DATA196,196,196,68,4,184,
     196,196,255,69    :rem 214
3040 DATA4,184,212,212,152,71,
     5,136,212,212     :rem 97
3050 DATA212,184,72,4,255,136,
     132,248,73,3      :rem 68
3060 DATA196,253,192,74,4,160,
     192,192,189,75    :rem 193
3070 DATA4,255,144,168,196,76,
     3,129,255,192     :rem 140
3080 DATA77,7,252,132,132,184,
     132,132,248,79    :rem 178
3090 DATA4,184,196,196,184,80,
     5,252,148,148     :rem 144
3100 DATA148,136,81,5,184,196,
     212,164,220,82    :rem 170
3110 DATA4,252,136,132,132,86,
     5,156,160,192     :rem 112
3120 DATA160,156,87,7,188,192,
     192,184,192,192   :rem 243
3130 DATA252,89,4,204,208,208,
     188,201,3,193     :rem 121
3140 DATA255,193,205,7,255,130
     ,132,152,132,130  :rem 253
3150 DATA255,215,7,255,160,144
     ,140,144,160,255  :rem 7
```

Program 4: Character Set 3

```
3000 REM *PROPORTIONAL SPACED
     {SPACE}CHARACTERS WITH DE
     SCENDERS*         :rem 80
3010 DATA17,5,129,133,148,208,
     192,33,1,175      :rem 65
3020 DATA34,3,135,128,135,37,6
     ,163,147,136      :rem 66
3030 DATA132,178,177,39,3,132,
     130,129,40,3      :rem 61
3040 DATA140,146,161,41,3,161,
     146,140,44,2      :rem 47
3050 DATA192,176,46,2,176,176,
     47,6,160,144      :rem 81
3060 DATA136,132,130,129,48,4,
     158,169,165,158   :rem 231
3070 DATA49,3,162,191,160,50,4
     ,162,177,169      :rem 76
3080 DATA166,51,4,146,161,165,
     154,52,4,140      :rem 65
3090 DATA138,137,191,53,4,167,
     165,165,153,54    :rem 184
3100 DATA4,158,169,169,144,55,
     4,177,137,133     :rem 132
3110 DATA131,56,4,154,165,165,
     154,57,4,134      :rem 67
3120 DATA169,169,158,58,1,148,
     59,2,192,180      :rem 90
3130 DATA60,4,136,148,162,162,
     61,4,148,148      :rem 69
3140 DATA148,148,62,4,162,162,
     148,136,63,5      :rem 75
3150 DATA130,129,217,133,130,6
     5,5,152,164,164   :rem 210
3160 DATA156,160,66,4,191,164,
     164,152,67,4      :rem 77
3170 DATA152,164,164,164,68,4,
     152,164,164,191   :rem 229
3180 DATA69,5,152,172,172,172,
     136,70,4,190      :rem 75
3190 DATA137,129,130,71,4,136,
     212,212,184,72    :rem 164
3200 DATA4,191,132,132,184,73,
     2,189,160,74      :rem 67
3210 DATA4,160,192,192,189,75,
     4,191,136,148     :rem 131
3220 DATA160,76,3,129,191,160,
     77,7,188,132      :rem 78
3230 DATA132,184,132,132,184,7
     8,5,132,184,132   :rem 215
3240 DATA132,184,79,5,152,164,
     164,164,152,80    :rem 176
3250 DATA4,252,148,148,136,81,
     5,136,148,148     :rem 131
3260 DATA248,192,82,4,188,136,
     132,132,83,4      :rem 79
3270 DATA200,212,212,160,84,3,
     132,190,164,85    :rem 156
3280 DATA5,156,160,160,156,160
     ,86,5,140,144     :rem 118
3290 DATA160,144,140,87,7,188,
     160,160,156,160   :rem 225
3300 DATA160,156,88,5,164,148,
     136,148,164,89    :rem 191
3310 DATA4,140,208,208,188,90,
     4,164,180,172     :rem 118
3320 DATA164,193,5,156,162,161
     ,159,160,194,4    :rem 176
3330 DATA191,165,165,186,195,4
     ,156,162,161,161  :rem 25
3340 DATA196,5,191,161,161,162
     ,156,197,4,191    :rem 181
3350 DATA165,165,161,198,4,191
     ,133,133,129,199  :rem 31
3360 DATA5,156,162,169,169,144
     ,200,4,191,132    :rem 172
3370 DATA132,191,201,3,161,191
     ,161,202,4,144    :rem 150
3380 DATA160,161,159,203,4,191
     ,132,138,177,204  :rem 13
3390 DATA4,191,160,160,160,205
     ,7,191,129,129    :rem 170
3400 DATA142,129,129,190,206,5
     ,129,190,129,129  :rem 17
3410 DATA190,207,4,158,161,161
     ,158,208,4,191    :rem 170
3420 DATA137,137,134,209,5,156
     ,162,169,145,174  :rem 24
3430 DATA210,5,191,137,137,150
     ,160,211,4,162    :rem 151
3440 DATA165,165,152,212,5,129
     ,129,191,129,129  :rem 22
3450 DATA213,5,159,160,160,159
     ,160,214,5,143    :rem 164
3460 DATA144,160,144,143,215,7
     ,159,160,160,156  :rem 12
3470 DATA160,160,191,216,5,177
     ,138,132,138,177  :rem 23
3480 DATA217,5,129,130,188,130
     ,129,218,5,161    :rem 173
3490 DATA177,169,165,163
                       :rem 227
```

Program 5: Graphics To Text Conversion

```
3000 REM *CHARACTER STRINGS FO
     R CONVERTING GRAPHICS SYM
     BOLS TO TEXT*     :rem 250
3010 REM *WHEN PRINTING A LIST
     ED FILE*          :rem 191
3020 DATA5,7,15,17,91,87,72,84
     ,93,17            :rem 39
3030 DATA8,15,17,91,68,79,87,7
     8,93,18           :rem 109
3040 DATA7,15,17,91,82,86,83,9
     3,19,8            :rem 45
3050 DATA15,17,91,72,79,77,69,
     93,28,7           :rem 105
3060 DATA15,17,91,82,69,68,93,
     29,9,15           :rem 100
3070 DATA17,91,82,73,71,72,84,
     93,30,7           :rem 89
3080 DATA15,17,91,71,82,78,93,
     31,7,15           :rem 87
3090 DATA17,91,66,76,85,93,129
     ,7,15,17          :rem 151
3100 DATA91,60,49,62,93,133,6,
     15,17,91          :rem 128
3110 DATA70,49,93,134,6,15,17,
     91,70,51          :rem 126
3120 DATA93,135,6,15,17,91,70,
     53,93,136         :rem 180
3130 DATA6,15,17,91,70,55,93,1
     37,6,15           :rem 79
3140 DATA17,91,70,50,93,138,6,
     15,17,91          :rem 130
3150 DATA70,52,93,139,6,15,17,
     91,70,54          :rem 132
3160 DATA93,140,6,15,17,91,70,
     56,93,144         :rem 182
3170 DATA7,15,17,91,66,76,75,9
     3,145,6           :rem 97
3180 DATA15,17,91,85,80,93,146
     ,7,15,17          :rem 139
3190 DATA91,79,70,70,93,147,7,
     15,17,91          :rem 146
3200 DATA67,76,82,93,149,7,15,
     17,91,60          :rem 142
3210 DATA50,62,93,150,7,15,17,
     91,60,51          :rem 118
3220 DATA62,93,151,7,15,17,91,
     60,52,62          :rem 124
3230 DATA93,152,7,15,17,91,60,
     53,62,93          :rem 131
3240 DATA153,7,15,17,91,60,54,
     62,93,154         :rem 180
3250 DATA7,15,17,91,60,55,62,9
     3,155,7           :rem 85
3260 DATA15,17,91,60,56,62,93,
     156,7,15          :rem 135
3270 DATA17,91,80,85,82,93,157
     ,8,15,17          :rem 146
3280 DATA91,76,69,70,84,93,158
     ,7,15,17          :rem 155
3290 DATA91,89,69,76,93,159,7,
     15,17,91          :rem 165
3300 DATA67,89,78,93   :rem 29
```

MLX

(Article on page 89.)

MLX: VIC Version

```
10 REM LINES CHANGED FROM VIC
   {SPACE}MLX VERSION 2.00 ARE
   581,582,765         :rem 166
100 PRINT"{CLR}{PUR}";CHR$(142
   );CHR$(8);          :rem 181
101 POKE 788,194:REM DISABLE R
   UN/STOP             :rem 174
110 PRINT"{RVS}{14 SPACES}"
                       :rem 117
120 PRINT"{RVS} {RIGHT}{OFF}
   £*₹£{RVS}{RIGHT} {RIGHT}
   {2 SPACES}£*₹{OFF}£*₹£
   {RVS}£{RVS} "       :rem 191
130 PRINT"{RVS} {RIGHT} £G₹
   {RIGHT} {2 RIGHT} {OFF}£
   {RVS}££*₹{OFF}£*₹{RVS} "
                       :rem 232
140 PRINT"{RVS}{14 SPACES}"
                       :rem 120
200 PRINT"{2 DOWN}{PUR}{BLK}MA
   CHINE LANGUAGE":PRINT"EDIT
   OR VER 2.02{5 DOWN}"
                       :rem 192
210 PRINT"{BLK}{3 UP}STARTING
   {SPACE}ADDRESS":INPUTS:F=1
   -F:C$=CHR$(31+119*F)
                       :rem 97
220 IFS<256ORS>32767THENGOSUB3
   000:GOTO210         :rem 2
225 PRINT:PRINT:PRINT:PRINT
                       :rem 123
230 PRINT"{BLK}{3 UP}ENDING AD
   DRESS":INPUTE:F=1-F:C$=CHR
   $(31+119*F)         :rem 158
240 IFE<256ORE>32767THENGOSUB3
   000:GOTO230         :rem 234
250 IFE<STHENPRINTC$;"{RVS}END
   ING < START{2 SPACES}":GOS
   UB1000:GOTO 230     :rem 176
260 PRINT:PRINT:PRINT :rem 179
300 PRINT"{CLR}";CHR$(14):AD=S
                       :rem 56
310 A=1:PRINTRIGHT$("0000"+MID
   $(STR$(AD),2),5);":";
                       :rem 33
315 FOR J=A TO 6       :rem 33
```

```
320 GOSUB570:IFN=-1THENJ=J+N:G
    OTO320              :rem 228
390 IFN=-211THEN 710    :rem 62
400 IFN=-204THEN 790    :rem 64
410 IFN=-206THENPRINT:INPUT"
    {DOWN}ENTER NEW ADDRESS";Z
    Z                   :rem 44
415 IFN=-206THENIFZZ<SORZZ>ETH
    ENPRINT"{RVS}OUT OF RANGE"
    :GOSUB1000:GOTO410:rem 225
417 IFN=-206THENAD=ZZ:PRINT:GO
    TO310               :rem 238
420 IF N<>-196 THEN 480
                        :rem 133
430 PRINT:INPUT"DISPLAY:FROM";
    F:PRINT,"TO";:INPUTT
                        :rem 234
440 IFF<SORF>EORT<SORT>ETHENPR
    INT"AT LEAST";S;"{LEFT}, N
    OT MORE THAN";E:GOTO430
                        :rem 159
450 FORI=FTOTSTEP6:PRINT:PRINT
    RIGHT$("0000"+MID$(STR$(I)
    ,2),5);":";         :rem 30
455 FORK=0TO5:N=PEEK(I+K):IFK=
    3THENPRINTSPC(10); :rem 34
457 PRINTRIGHT$("00"+MID$(STR$
    (N),2),3);",";      :rem 157
460 GETA$:IFA$>""THENPRINT:PRI
    NT:GOTO310          :rem 25
470 NEXTK:PRINTCHR$(20);:NEXTI
    :PRINT:PRINT:GOTO310
                        :rem 50
480 IFN<0 THEN PRINT:GOTO310
                        :rem 168
490 A(J)=N:NEXTJ        :rem 199
500 CKSUM=AD-INT(AD/256)*256:F
    ORI=1TO6:CKSUM=(CKSUM+A(I)
    )AND255:NEXT        :rem 200
510 PRINTCHR$(18);:GOSUB570:PR
    INTCHR$(146);       :rem 94
511 IFN=-1THENA=6:GOTO315
                        :rem 254
515 PRINTCHR$(20):IFN=CKSUMTHE
    N530                :rem 122
520 PRINT:PRINT"LINE ENTERED W
    RONG":PRINT"RE-ENTER":PRIN
    T:GOSUB1000:GOTO310
                        :rem 129
530 GOSUB2000           :rem 218
540 FORI=1TO6:POKEAD+I-1,A(I):
    NEXT                :rem 80
550 AD=AD+6:IF AD<E THEN 310
                        :rem 212
560 GOTO 710            :rem 108
570 N=0:Z=0             :rem 88
580 PRINT"{+}";         :rem 79
581 GETA$:IFA$=""THEN581
                        :rem 95
582 AV=-(A$="M")-2*(A$=",")-3*
    (A$=".")-4*(A$="J")-5*(A$=
    "K")-6*(A$="L")     :rem 41
583 AV=AV-7*(A$="U")-8*(A$="I"
    )-9*(A$="O"):IFA$="H"THENA
    $="0"               :rem 134
584 IFAV>0THENA$=CHR$(48+AV)
                        :rem 134
585 PRINTCHR$(20);:A=ASC(A$):I
    FA=13ORA=44ORA=32THEN670
                        :rem 229
590 IFA>128THENN=-A:RETURN
                        :rem 137
600 IFA<>20 THEN 630    :rem 10
610 PRINTCHR$(146);:GOSUB690:I
    FI=1ANDT=44THENN=-1:PRINT"
    {LEFT} {LEFT}";:GOTO690
                        :rem 155
620 GOTO570             :rem 109
630 IFA<48ORA>57THEN580
                        :rem 105
640 PRINTA$;:N=N*10+A-48
                        :rem 106
650 IFN>255 THEN A=20:GOSUB100
    0:GOTO600           :rem 229
660 Z=Z+1:IFZ<3THEN580 :rem 71
670 IFZ=0THENGOSUB1000:GOTO570
                        :rem 114
680 PRINT",";:RETURN    :rem 240
690 S%=PEEK(209)+256*PEEK(210)
    +PEEK(211)          :rem 149
692 FORI=1TO3:T=PEEK(S%-I)
                        :rem 68
695 IFT<>44ANDT<>58THENPOKES%-
    I,32:NEXT           :rem 205
700 PRINTLEFT$("{3 LEFT}",I-1)
    ;:RETURN            :rem 7
710 PRINT"{CLR}{RVS}*** SAVE *
    **{3 DOWN}"         :rem 236
720 F$="":INPUT"{DOWN} FILENAM
    E";F$:IFF$=""THEN310
                        :rem 128
730 PRINT:PRINT"{2 DOWN}{RVS}T
    {OFF}APE OR {RVS}D{OFF}ISK
    : (T/D)"            :rem 228
740 GETA$:IFA$<>"T"ANDA$<>"D"T
    HEN740              :rem 36
750 DV=1-7*(A$="D"):IFDV=8THEN
    F$="0:"+F$:OPEN15,8,15,"S"
    +F$:CLOSE15         :rem 212
760 T$=F$:ZK=PEEK(53)+256*PEEK
    (54)-LEN(T$):POKE782,ZK/25
    6                   :rem 3
762 POKE781,ZK-PEEK(782)*256:P
    OKE780,LEN(T$):SYS65469
                        :rem 109
763 POKE780,1:POKE781,DV:POKE7
    82,1:SYS65466       :rem 69
765 K=S:POKE254,K/256:POKE253,
    K-PEEK(254)*256:POKE780,25
    3                   :rem 17
766 K=E+1:POKE782,K/256:POKE78
    1,K-PEEK(782)*256:SYS65496
                        :rem 235
770 IF(PEEK(783)AND1)OR(191AND
    ST)THEN780          :rem 111
775 PRINT"{DOWN}DONE.":GOTO310
                        :rem 96
780 PRINT"{DOWN}ERROR ON SAVE.
    {2 SPACES}TRY AGAIN.":IFDV
    =1THEN720           :rem 171
781 OPEN15,8,15:INPUT#15,E1$,E
    2$:PRINTE1$;E2$:CLOSE15:GO
    TO720               :rem 103
782 GOTO720             :rem 115
790 PRINT"{CLR}{RVS}*** LOAD *
    **{2 DOWN}"         :rem 212
800 F$="":INPUT"{2 DOWN} FILEN
    AME";F$:IFF$=""THEN310
                        :rem 144
810 PRINT:PRINT"{2 DOWN}{RVS}T
    {OFF}APE OR {RVS}D{OFF}ISK
    : (T/D)"            :rem 227
820 GETA$:IFA$<>"T"ANDA$<>"D"T
    HEN820              :rem 34
830 DV=1-7*(A$="D"):IFDV=8THEN
    F$="0:"+F$          :rem 157
840 T$=F$:ZK=PEEK(53)+256*PEEK
    (54)-LEN(T$):POKE782,ZK/25
    6                   :rem 2
841 POKE781,ZK-PEEK(782)*256:P
    OKE780,LEN(T$):SYS65469
                        :rem 107
845 POKE780,1:POKE781,DV:POKE7
    82,1:SYS65466       :rem 70
850 POKE780,0:SYS65493 :rem 11
860 IF(PEEK(783)AND1)OR(191AND
    ST)THEN870          :rem 111
865 PRINT"{DOWN}DONE.":GOTO310
                        :rem 96
870 PRINT"{DOWN}ERROR ON LOAD.
    {2 SPACES}TRY AGAIN.{DOWN}
    ":IFDV=1THEN800     :rem 172
880 OPEN15,8,15:INPUT#15,E1$,E
    2$:PRINTE1$;E2$:CLOSE15:GO
    TO800               :rem 102
1000 REM BUZZER         :rem 135
1001 POKE36878,15:POKE36874,19
     0                  :rem 206
1002 FORW=1TO300:NEXTW:rem 117
1003 POKE36878,0:POKE36874,0:R
     ETURN              :rem 74
2000 REM BELL SOUND     :rem 78
2001 FORW=15TO0STEP-1:POKE3687
     8,W:POKE36876,240:NEXTW
                        :rem 22
2002 POKE36876,0:RETURN
                        :rem 119
3000 PRINTC$;"{RVS}NOT ZERO PA
     GE OR ROM":GOTO1000
                        :rem 89
```

MLX: 64 Version

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

```
420 IF N<>-196 THEN 480
                        :rem 133
430 PRINT:INPUT"DISPLAY:FROM";
    F:PRINT,"TO";:INPUTT
                        :rem 234
440 IFF<SORF>EORT<SORT>ETHENPR
    INT"AT LEAST";S;"{LEFT}, N
    OT MORE THAN";E:GOTO430
                        :rem 159
450 FORI=FTOTSTEP6:PRINT:PRINT
    RIGHT$("0000"+MID$(STR$(I)
    ,2),5);":";         :rem 30
451 FORK=0TO5:N=PEEK(I+K):PRIN
    TRIGHT$("00"+MID$(STR$(N),
    2),3);",";          :rem 66
460 GETA$:IFA$>""THENPRINT:PRI
    NT:GOTO310          :rem 25
470 NEXTK:PRINTCHR$(20);:NEXTI
    :PRINT:PRINT:GOTO310
                        :rem 50
480 IFN<0 THEN PRINT:GOTO310
                        :rem 168
490 A(J)=N:NEXTJ        :rem 199
500 CKSUM=AD-INT(AD/256)*256:F
    ORI=1TO6:CKSUM=(CKSUM+A(I)
    )AND255:NEXT        :rem 200
510 PRINTCHR$(18);:GOSUB570:PR
    INTCHR$(146);       :rem 94
511 IFN=-1THENA=6:GOTO315
                        :rem 254
515 PRINTCHR$(20):IFN=CKSUMTHE
    N530                :rem 122
520 PRINT:PRINT"LINE ENTERED W
    RONG : RE-ENTER":PRINT:GOS
    UB1000:GOTO310      :rem 176
530 GOSUB2000           :rem 218
540 FORI=1TO6:POKEAD+I-1,A(I):
    NEXT:POKE54272,0:POKE54273
    ,0                  :rem 227
550 AD=AD+6:IF AD<E THEN 310
                        :rem 212
560 GOTO 710            :rem 108
570 N=0:Z=0             :rem 88
580 PRINT"{£3}";        :rem 81
581 GETA$:IFA$=""THEN581
                        :rem 95
582 AV=-(A$="M")-2*(A$=",")-3*
    (A$=".")-4*(A$="J")-5*(A$=
    "K")-6*(A$="L")     :rem 41
583 AV=AV-7*(A$="U")-8*(A$="I"
    )-9*(A$="O"):IFA$="H"THENA
    $="0"               :rem 134
584 IFAV>0THENA$=CHR$(48+AV)
                        :rem 134
585 PRINTCHR$(20);:A=ASC(A$):I
    FA=13ORA=44ORA=32THEN670
                        :rem 229
590 IFA>128THENN=-A:RETURN
                        :rem 137
600 IFA<>20 THEN 630    :rem 10
610 GOSUB690:IFI=1ANDT=44THENN
    =-1:PRINT"{OFF}{LEFT}
    {LEFT}";:GOTO690    :rem 62
620 GOTO570             :rem 109
630 IFA<48ORA>57THEN580
                        :rem 105
640 PRINTA$;:N=N*10+A-48
                        :rem 106
650 IFN>255 THEN A=20:GOSUB100
    0:GOTO600           :rem 229
660 Z=Z+1:IFZ<3THEN580  :rem 71
670 IFZ=0THENGOSUB1000:GOTO570
                        :rem 114
680 PRINT",";:RETURN    :rem 240
690 S%=PEEK(209)+256*PEEK(210)
    +PEEK(211)          :rem 149
691 FORI=1TO3:T=PEEK(S%-I)
                        :rem 67
695 IFT<>44ANDT<>58THENPOKES%-
    I,32:NEXT           :rem 205
700 PRINTLEFT$("{3 LEFT}",I-1)
    ;:RETURN            :rem 7
710 PRINT"{CLR}{RVS}*** SAVE *
    **{3 DOWN}"         :rem 236
715 PRINT"{2 DOWN}(PRESS {RVS}
    RETURN{OFF} ALONE TO CANCE
    L SAVE){DOWN}"      :rem 106
720 F$="":INPUT"{DOWN} FILENAM
    E";F$:IFF$=""THENPRINT:PRI
    NT:GOTO310          :rem 71
730 PRINT:PRINT"{2 DOWN}{RVS}T
    {OFF}APE OR {RVS}D{OFF}ISK
    : (T/D)"            :rem 228
740 GETA$:IFA$<>"T"ANDA$<>"D"T
    HEN740              :rem 36
750 DV=1-7*(A$="D"):IFDV=8THEN
    F$="0:"+F$:OPEN15,8,15,"S"
    +F$:CLOSE15         :rem 212
760 T$=F$:ZK=PEEK(53)+256*PEEK
    (54)-LEN(T$):POKE782,ZK/25
    6                   :rem 3
762 POKE781,ZK-PEEK(782)*256:P
    OKE780,LEN(T$):SYS65469
                        :rem 109
763 POKE780,1:POKE781,DV:POKE7
    82,1:SYS65466       :rem 69
765 K=S:POKE254,K/256:POKE253,
    K-PEEK(254)*256:POKE780,25
    3                   :rem 17
766 K=E+1:POKE782,K/256:POKE78
    1,K-PEEK(782)*256:SYS65496
                        :rem 235
770 IF(PEEK(783)AND1)OR(191AND
    ST)THEN780          :rem 111
775 PRINT"{DOWN}DONE.{DOWN}":G
    OTO310              :rem 113
780 PRINT"{DOWN}ERROR ON SAVE.
    {2 SPACES}TRY AGAIN.":IFDV
    =1THEN720           :rem 171
781 OPEN15,8,15:INPUT#15,E1$,E
    2$:PRINTE1$;E2$:CLOSE15:GO
    TO720               :rem 103
790 PRINT"{CLR}{RVS}*** LOAD *
    **{2 DOWN}"         :rem 212
795 PRINT"{2 DOWN}(PRESS {RVS}
    RETURN{OFF} ALONE TO CANCE
    L LOAD)"            :rem 82
800 F$="":INPUT"{2 DOWN} FILEN
    AME";F$:IFF$=""THENPRINT:G
    OTO310              :rem 144
810 PRINT:PRINT"{2 DOWN}{RVS}T
    {OFF}APE OR {RVS}D{OFF}ISK
    : (T/D)"            :rem 227
820 GETA$:IFA$<>"T"ANDA$<>"D"T
    HEN820              :rem 34
830 DV=1-7*(A$="D"):IFDV=8THEN
    F$="0:"+F$          :rem 157
840 T$=F$:ZK=PEEK(53)+256*PEEK
    (54)-LEN(T$):POKE782,ZK/25
    6                   :rem 2
841 POKE781,ZK-PEEK(782)*256:P
    OKE780,LEN(T$):SYS65469
                        :rem 107
845 POKE780,1:POKE781,DV:POKE7
    82,1:SYS65466       :rem 70
850 POKE780,0:SYS65493  :rem 11
860 IF(PEEK(783)AND1)OR(191AND
    ST)THEN870          :rem 111
865 PRINT"{DOWN}DONE.":GOTO310
                        :rem 96
870 PRINT"{DOWN}ERROR ON LOAD.
    {2 SPACES}TRY AGAIN.{DOWN}
    ":IFDV=1THEN800     :rem 172
880 OPEN15,8,15:INPUT#15,E1$,E
    2$:PRINTE1$;E2$:CLOSE15:GO
    TO800               :rem 102
1000 REM BUZZER         :rem 135
1001 POKE54296,15:POKE54277,45
     :POKE54278,165     :rem 207
1002 POKE54276,33:POKE 54273,6
     :POKE54272,5       :rem 42
1003 FORT=1TO200:NEXT:POKE5427
     6,32:POKE54273,0:POKE5427
     2,0:RETURN         :rem 202
2000 REM BELL SOUND     :rem 78
2001 POKE54296,15:POKE54277,0:
     POKE54278,247      :rem 152
2002 POKE 54276,17:POKE54273,4
     0:POKE54272,0      :rem 86
2003 FORT=1TO100:NEXT:POKE5427
     6,16:RETURN        :rem 57
3000 PRINTC$;"{RVS}NOT ZERO PA
     GE OR ROM":GOTO1000
                        :rem 89
```


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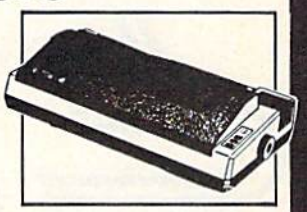

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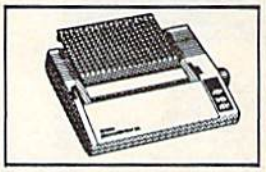

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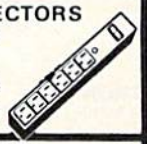

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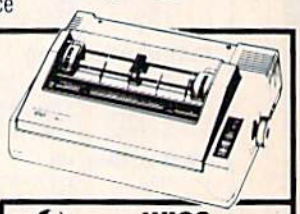

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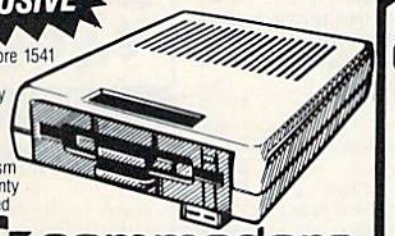

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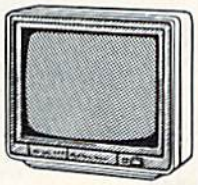

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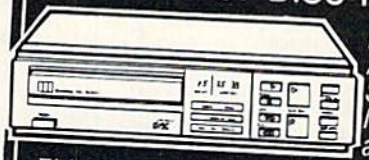

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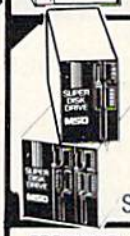

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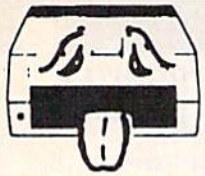

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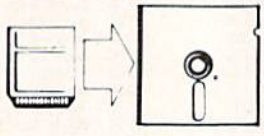

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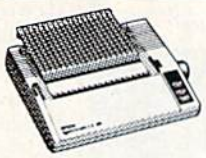

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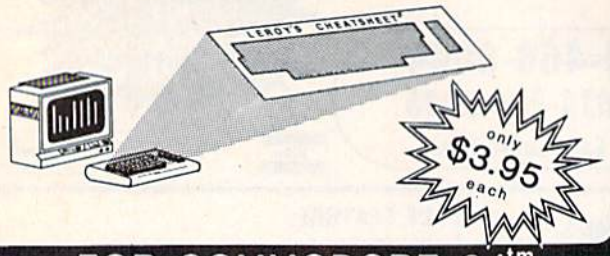

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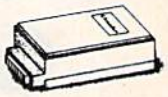

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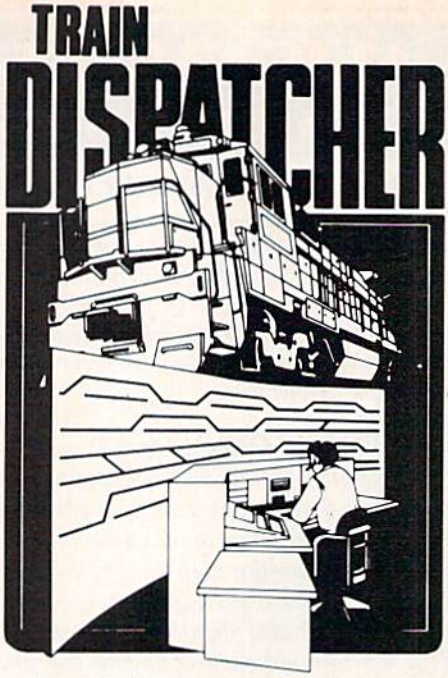

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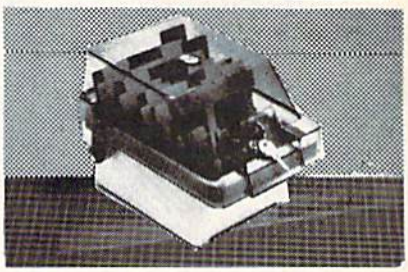

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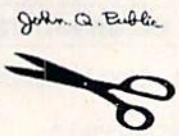

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