The New Commodore Plus/4: A Hands-On Preview

COMPUTE!

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The Leading Magazine Of Home, Educational, And Recreational Computing

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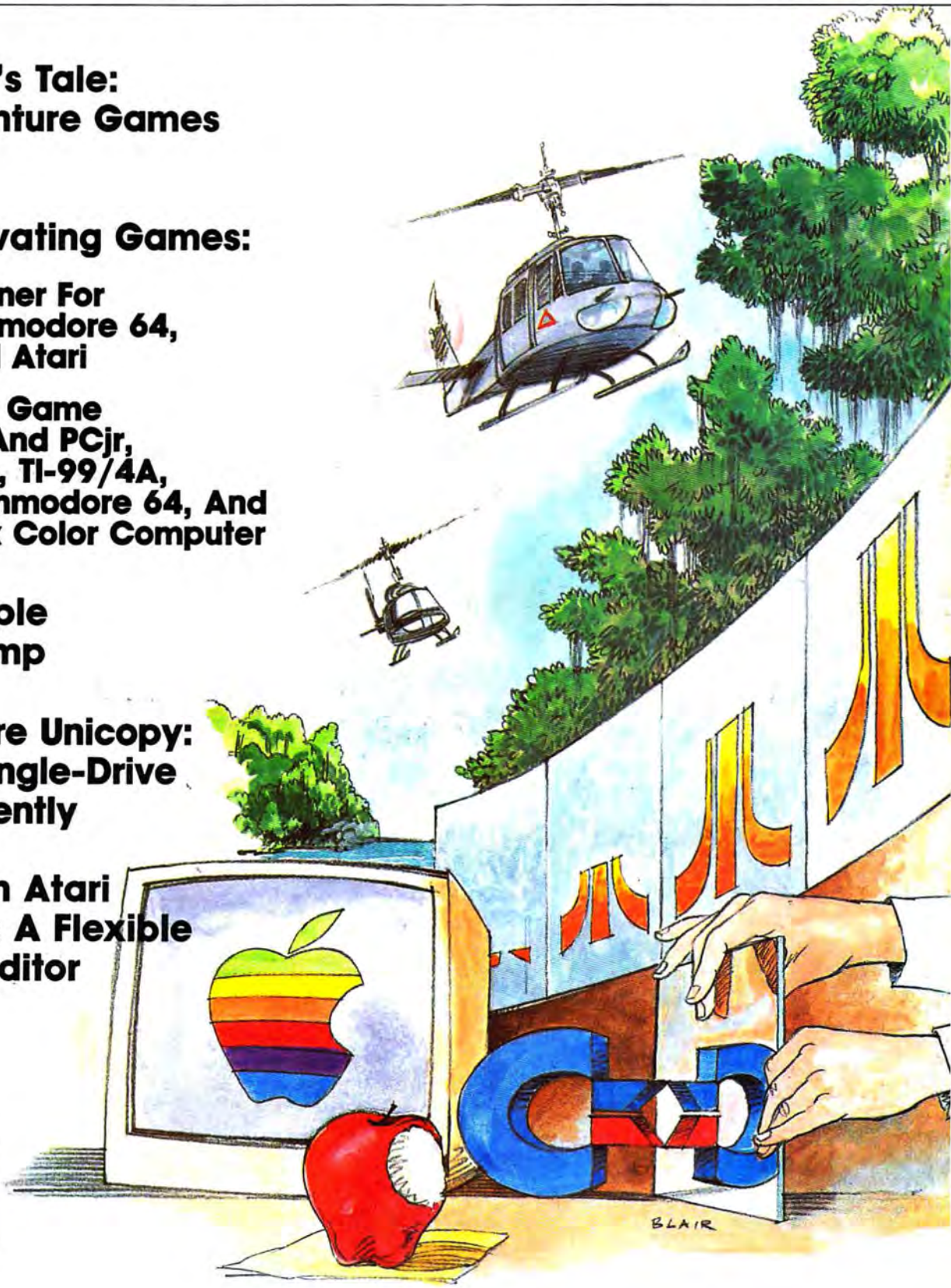

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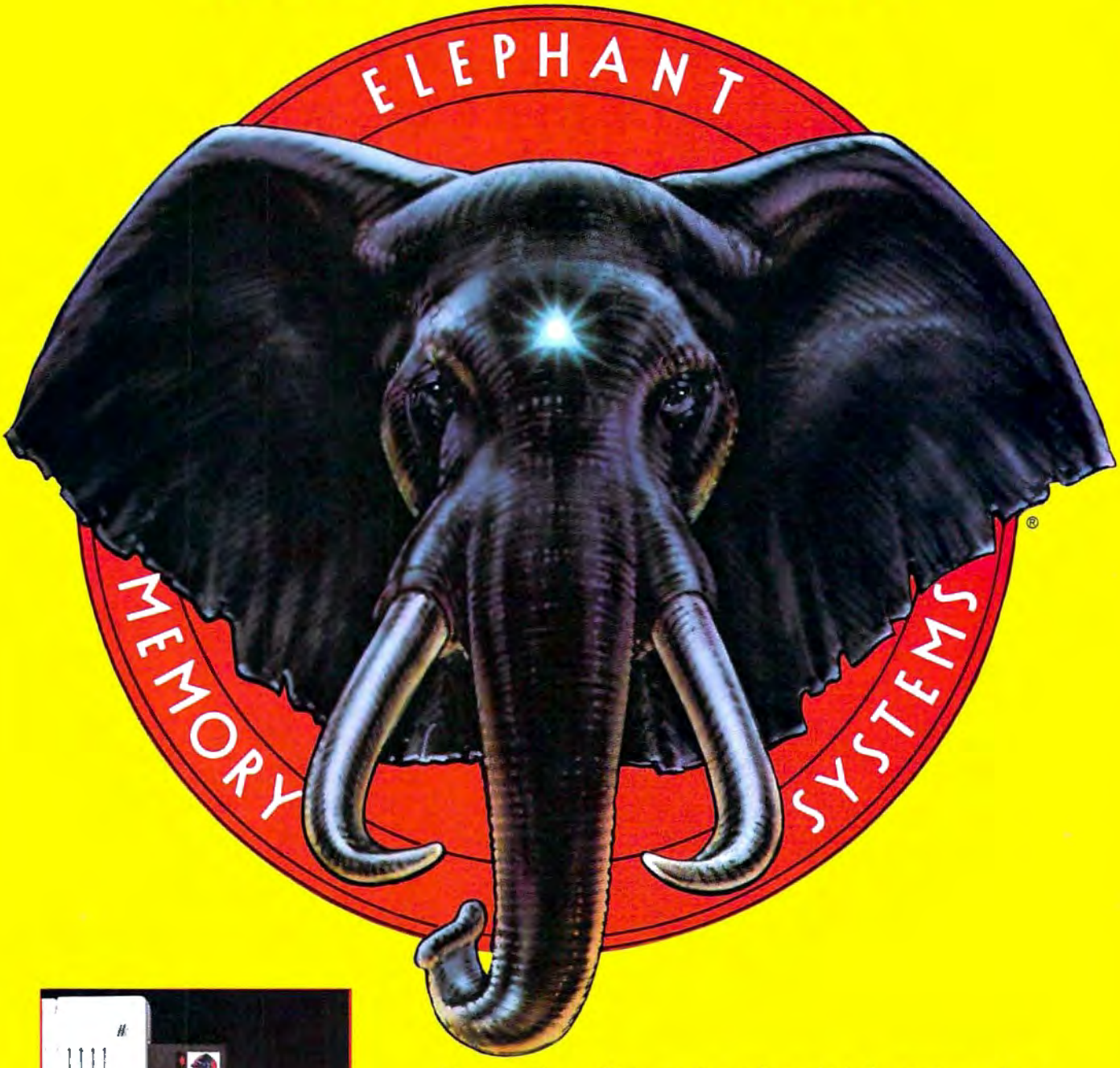

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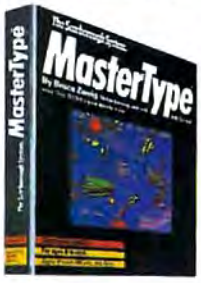

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October 1984 Vol. 6, No. 10

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EDITOR'S NOTES

The Editor's Notes this month are written by Tom R. Halfhill, new editor of COMPUTE!.

Robert Lock
Editor In Chief,
COMPUTE! Publications

A New Beginning

Nearly two and a half years ago, Robert Lock hired me as features editor of COMPUTE!. At that time the editorial staff consisted of four full-time people. We occupied a few offices in an old building near downtown Greensboro, and the circulation of COMPUTE! was about 75,000.

Today COMPUTE! Publications has an editorial staff of more than 50 full-time people. Together with about 70 employees of other departments, we occupy an entire floor in a new office building, with warehouse and shipping facilities across town. COMPUTE! is approaching 400,000 circulation. Our second magazine, COMPUTE!'s GAZETTE, has gained more than 300,000 readers in just over a year of existence, and our Book Division consistently places titles on computer-book bestseller lists. In mid-1983, COMPUTE! Publications became a part of ABC Publishing, a subsidiary of the American Broadcasting Company.

Obviously, we have gone through a great many changes in the past two and a half years. Hundreds of other companies in the computer industry have experienced the same kind of phenomenal growth, of course. But now that the industry is maturing, the spectacular growth of those first few years is leveling off and is becoming more like the steady, sustainable growth common to other industries. Some companies which became accustomed to annual growth rates of 50 percent, 100 percent, or even more are suddenly finding themselves in trouble because they assumed the roller coaster would keep speeding forever. That's partly why some of those companies are cutting back, laying off, and even going out of business. In an industry where the market changes almost monthly, you have to be quick on your feet to survive.

At COMPUTE!, so far we've managed to keep pace with the changes. There have been plenty of growing pains which have demanded much from our staff, but we've always remained flexible and succeeded in pulling together.

My own path shows how fast things change around here. After less than a year as features editor, I was appointed founding editor of our second magazine, COMPUTE!'s GAZETTE. The first few months were a struggle, but with lots of hard work, together we built the GAZETTE into the most successful new magazine in the industry. Then, just as things started rolling along smoothly, I was assigned to another new project—COMPUTE!'s PC & PCjr magazine. The new IBM PCjr was arriving on the market and it seemed destined to become the success story of 1984.

As you probably know by now, things didn't quite work out that way. The PCjr didn't sell, so neither did our new magazine. We decided to stop publication with the October 1984 issue.

But that's not all bad. After more than a year's absence, I'll be returning full-time to our flagship magazine, COMPUTE!—this time as its new editor. Richard Mansfield, who has handled COMPUTE!'s daily duties for more than three years, will continue as senior editor of COMPUTE Publications, helping to supervise editorial operations for both our magazines and our Book Division.

And we have a number of improvements planned for COMPUTE! to strengthen its position as the leading magazine for home, educational, and recreational computing. For one thing, we'll be merging our IBM coverage into COMPUTE! to serve both our existing IBM subscribers and several thousands of new readers joining us next month from COMPUTE!'s PC & PCjr. More programs will be translated for the PC and PCjr, and there'll be some IBM reviews and stand-alone articles as well. We're also adding a new column next month, "IBM Personal Computing," by Donald B. Trivette.

Apple readers can expect more attention, too. With the introduction of the Apple IIc and Macintosh, plus heavily discounted prices on the Apple IIe, we've noticed a resurgence of interest in Apple coverage. More of our programs will be translated for the Apple, and we're beefing up coverage in other areas also.

If you use a Commodore, Atari, or TI, don't despair. You still make up the bulk of our readership and therefore deserve the most coverage in COMPUTE!. We won't let you down. If anything, we plan to strengthen our coverage of your computers.

You might be wondering how it's possible to increase coverage for everybody without taking something away from somebody. That's always a concern in a multimachine magazine. Our solution: We'll be reorganizing our regular columns, streamlining the articles, and taking great pains to make sure the articles and programs we publish continue to be of the highest possible quality.

For example, in coming issues you'll notice that some columns will be consolidated and new ones will be added. Programs will be translated to run on as many computers as possible. And we'll make a renewed commitment to minimize errors and publish the best computer magazine on the market.

You'll begin noticing these improvements within the next few issues—we're making them as fast as possible. That's the way things happen in the computer industry.

(A subtle merchandising ploy)

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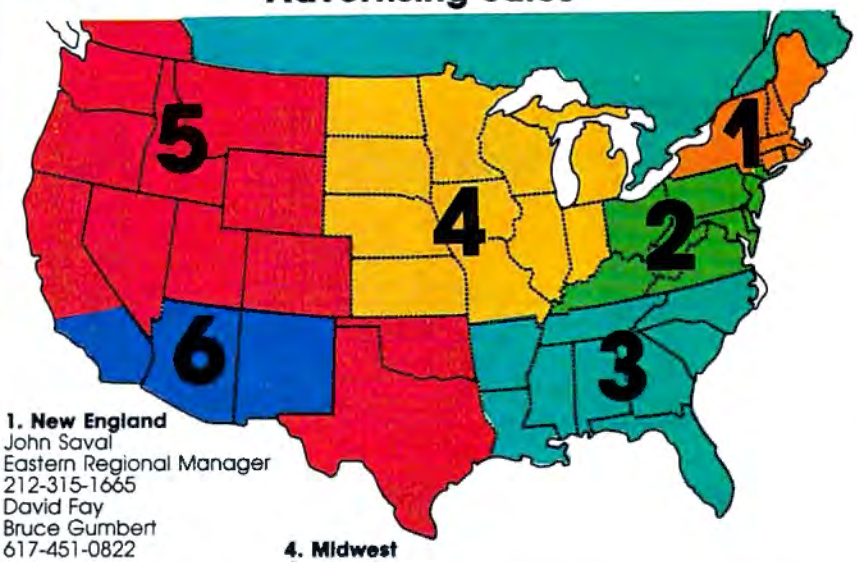

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"Game of the Month" —Byte: February, 1984

"I've developed this aversion for computer games—until **T.A.C.** I can play this game and like it—lots!" Gameplay Magazine

"It's the best simulation of tank warfare this reviewer has seen on or off a computer screen." —Electronic Games

T.A.C. is a game of World War II tactical armored combat. **You** pick a nation (from among the four major combatants—Britain, U.S.A., Germany and Russia). **You** build a combat team from their most powerful tanks, assault guns and tank destroyers. **You** command the team you've created in major operations against like forces of the enemy.

All the famous vehicles of the second world war are here—Tigers, Panthers, Shermans and JS II's; Jagdpanthers, SU 152's, Fireflies and T 34's, just to name a few. They have all been thoroughly researched and their important features programmed into the game. Each vehicle is distinguished by such elements as armor thickness (rear and flanks as well as front), fire power, speed, acceleration and gun traverse. Even minor points like fuel tank location can be critical.

Here are just some of the exciting features:

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BY RALPH BOSSON

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The Editors and Readers of COMPUTE!

What's An EPROM?

I would like to know what an EPROM is. What can an EPROM do for my computer?

Scott Szurgot

An EPROM is a special kind of computer memory. Like ROM (Read Only Memory), it retains information even when the power is turned off. However, it can also be erased or changed, like RAM (Random Access Memory).

EPROM stands for Erasable Programmable Read Only Memory. It can be overwritten, but only by a special device called a burner.

The most frequent use of EPROMs is for creating cartridges at home. With an EPROM and an EPROM burner, the device that writes to the EPROM, you can store a frequently used program on the EPROM and put the EPROM on a cartridge board. Then every time you need to use the program, you can just plug it into the cartridge port. It will be immediately available.

Machine Language Commands

Has COMPUTE! ever published a list of all the 6502 machine language commands? If you have, please let me know in which issue, and if not, please do so. At least, please tell me where I could get such a list.

Steve Brush

Machine Language for Beginners *(COMPUTE! Books) has the list that you are looking for and also includes detailed explanations of how to use the commands. Also, two new COMPUTE! books on machine language are being published this fall.* The Second Book of Machine Language *is a follow-up to* Machine Language for Beginners. *It includes demonstrations of many sophisticated programming techniques and a very powerful, label-based assembler for VIC, Commodore 64, Apple, Atari, and Commodore PET.* Machine Language Routines for the Commodore 64 *contains many instructive example programs and ready-to-use subroutines.*

Commodore 1541 *PRG Problems

I am the owner of a Commodore 64 and a 1541 disk drive. I was recently trying to save a program, but my disk would not accept it. When I tried saving it, I got a READ ERROR 20. I tried saving the program on another disk and had no problems. Can you please tell me what can cause a READ ERROR 20? I also have had problems with files that show up on my directory with an asterisk (*) before the PRG. What causes these asterisks to appear and how do I get rid of them?

Steven Swartzlander

The error you are getting indicates that what's called a block header *has been destroyed on your disk. This may mean that your particular disk* was *ruined by a magnet or even some dust or a hair that slipped into the disk case. Error 20 usually happens when you try to write to a damaged block using the BLOCK-WRITE command. Since you say that you are just trying to save to the disk, it must mean that block 0 of track 18 is damaged. The disk controller always reads this particular block when it is about to save something to the disk. Block 0 on track 18 contains a map, called the BAM (for Block Allocation Map), of the entire disk showing which blocks are used and which are still available.*

The best solution to your problem is to format another disk and try to transfer all the programs stored on the defective disk to the other one, using a disk duplicating program.

Your other problem with file type abbreviations preceded by an asterisk is very common. It occurs when a file has not been properly closed. The file usually cannot be salvaged. To get rid of these files, just place the disk containing them in the drive and type the following line:

```
OPEN 15,8,15,"V":CLOSE 15
```

Your disk will spin for some time and it will even make some noise, and when the red light goes off you will have a disk with usable files. All the asterisk files will have been erased. It is quite important to erase such files lest they corrupt other files on a disk.

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Erasing Cassettes

How can someone erase cassettes that already have programs on them?

Todd Butcher

Cassettes can be easily erased. The simplest way is to just record something new on top of the old information. Alternatively, if you want to erase a cassette entirely, you could put a computer cassette into an ordinary music tape player and, after turning the volume down, press the play and record buttons simultaneously. Another way to do it is to use a bulk eraser, a device that uses a strong magnetic field to erase tape. These devices are available at record and electronics stores.

Atari CLOAD Problems

I own an Atari 800 with an Atari cassette recorder. I have used my 800 to type in and save programs from COMPUTE! to cassette tape. All of these programs used to load and run properly, but recently I have not been able to CLOAD the same tapes into my computer. I have tried different Atari recorders and even my friend's computer, but have only succeeded in loading in one of the programs. When I attempt to CLOAD a program on my recorder, I get an error 138 or 143. What can I do?

James L. Jenkins

The problem you are experiencing is a very common one. Usually this happens when the Atari recorder has been in use for some time. The reason it happens is that the recorder head needs to be either cleaned or demagnetized, or both. There are several tricks that you can use to see if you might be having other problems. Try connecting the recorder directly to the computer instead of through another peripheral. If this clears up the problem, it could mean that the connection in your other peripheral (disk drive, printer, or expansion box) is soiled or loose.

You can also try completely rewinding the tape and then fast-forwarding it past the tape header. Set the tape counter to zero, and try CLOADing from there. If you still get an error, rewind again and this time try CLOADing from tape counter position 1. Keep doing this in one-step increments until the tape loads.

The last trick is to insert your computer tape into an audio cassette player and listen to it until you hear a screeching sound. Once you hear the sound, you are at the beginning of the program on the tape. Try to get as close as possible to the beginning without passing it, and then try CLOADing it on your Atari recorder. If this does not work, try demagnetizing and cleaning your recorder's head. This is an easy procedure and should be done regularly anyway. Kits are available at any record store.

Once you do manage to CLOAD your programs, you should consider LISTing them to tape instead of CSAVEing them. The advantage: LISTing, combined with the ENTER command, is a more reliable method of loading from cassette than CLOAD. The LIST command takes up more tape and is also slower, but that's a small price to pay for greater reliability.

Disk Density

I recently purchased a disk drive. The instructions specify that you should use single-density disks. However, I have some double-density disks which I would like to be able to use. Will it cause any problems?

James P. Simson

Double-density disks will not cause any problem. Using a product of higher quality than specified never hurts. However, using single-density disks on a drive that specifies double-density could cause difficulties.

Speech For VIC And Atari

I recently bought an Atari 800 and VIC-20 computer. I want to know if there is any way to generate speech on them without spending a small fortune on a speech synthesizer. If it is possible, please explain how.

Mel Barries

To our knowledge there is no easy way to program speech on the VIC or Atari. Usually, special add-ons are necessary to accomplish this task. The S.A.M. *speech program works well, although the number of words you can use at any given time is limited. Many schemes have been invented to simulate speech through software, but all of them require extensive amounts of memory. One such scheme requires a microphone and a board for entering the sounds that you want the computer to mimic. Specially designed software takes volume readings thousands of times for each word, and records the readings in RAM memory. The speech software then uses these volume changes to simulate the sound through your computer's sound chip. COVOX manufactures a good implementation of this technique for the Commodore 64.*

TI Peripheral Expansion Box

Could you please tell me what the peripheral expansion box is needed for and give me some advice on whether I should purchase one or not? I'm a little apprehensive about investing a lot of money in my TI to find out that no one is going to support it. Do you have any suggestions about this?

Todd M. Aube

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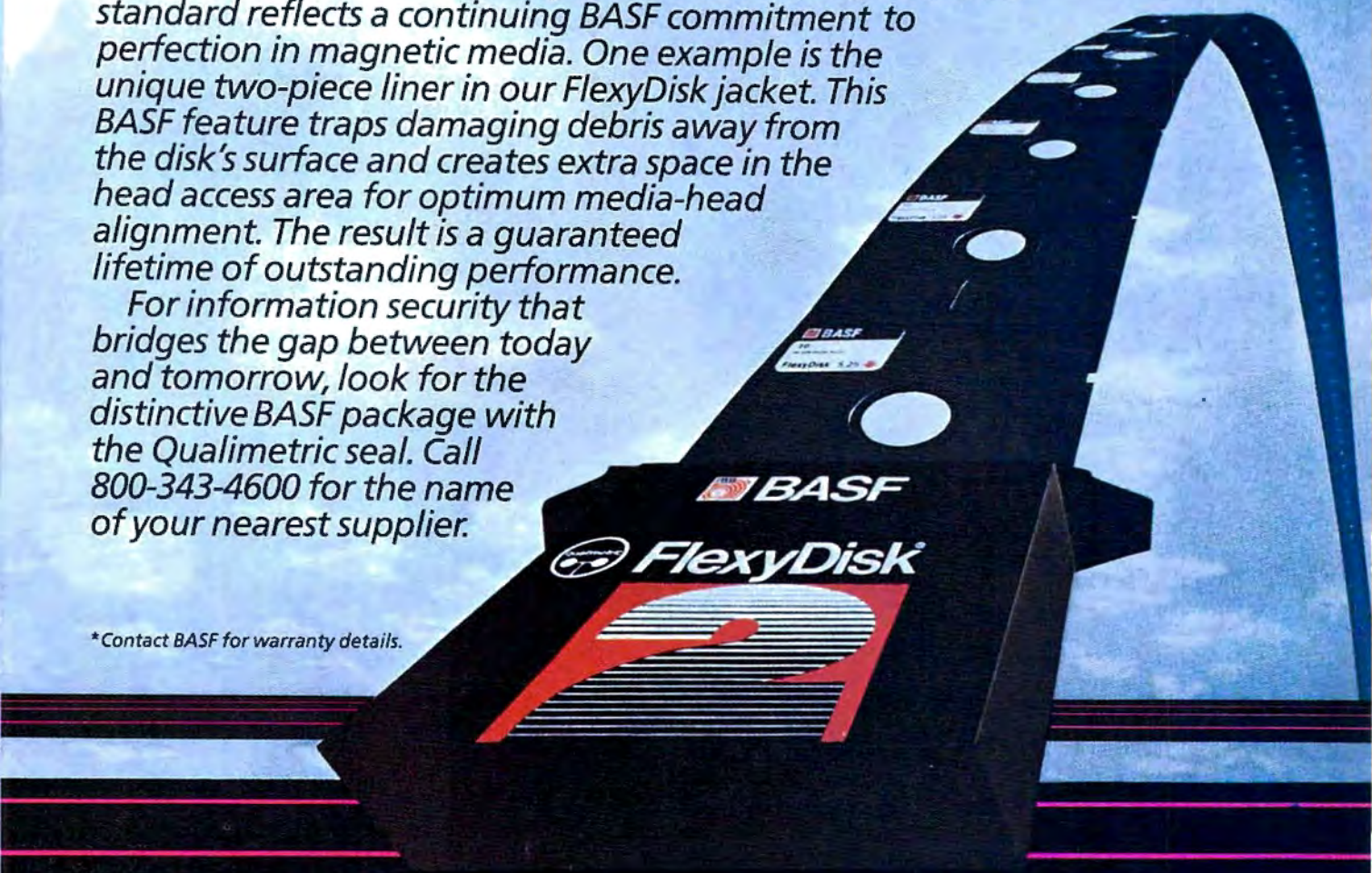

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Since Texas Instruments decided to discontinue the TI, third-party support for this computer is expected to decline. COMPUTE!, *however, will continue to support the TI with new software each month.*

If you have not bought an expansion box yet, you probably won't even be able to find one. Many people who bought TIs early on realized that they would need an expansion box, and consequently most stores have already sold out. The expansion box is required to use the TI peripherals, such as disk drives and printer.

Atari Hex-To-Decimal Conversion

The hex to decimal conversion program in "Readers' Feedback" in the July 1984 COMPUTE! by Frank Sgabellone is quite powerful. However, the modifications necessary to make it run on an Atari might not be too obvious. The following translation will work on Ataris. The value of C in line 20 can be changed, to vary the number of leading zeros.

H. Earl Hill

```
GN 10  DIM A$(16),C$(1)
JN 20  A$="0123456789ABCDEF":? "INPUT
       DEC/HEX (0-65535)":INPUT A:B=
       1:C=3:D=16^C:? A;" = $";:A=A+1
JP 30  IF A-D>1 THEN A=A-D:B=B+1:GOTO
       30
CA 35  J=1
JO 40  C$=A$(B,B+J-1):? C$;:B=1:C=C-1
       :D=16^C:IF C>-1 THEN 30
DG 50  ? "(5 SPACES)":? :GOTO 20
```

Apple Trigonometry

I have an Apple II+ on which I was hoping to be able to do some trigonometry homework. I was testing the SIN, TAN, and COS functions and discovered that when I provided a number within parentheses for these functions to evaluate, the number never matched a set of answers that I have in a chart. I looked up these functions in my Apple manual, and all it gave was an explanation of radians and other things I could not comprehend. Could you give me an understandable explanation of what these functions do?

Chuck Knakal

On computers such as the Apple, TI, Commodore, and many others, the trigonometric functions are always expressed in radians. *Radians are just another way to measure an angle. For example, instead of expressing an angle as 180 degrees, you would say it was one pi radians.*

A complete circle is 360 degrees. In radians, that would be exactly two pi radians (pi is approximately 3.1416). If what you are looking for, though, is an easy way to get answers in degrees from your computer, all you have to do is multiply the angle that you want evaluated by pi and divide that by 180. If you then input that number into the SIN, TAN, or COS functions of your computer, you should get the right answer in degrees.

For example, let's take 90 degrees. The sine of 90 degrees should give you an answer of 1, but since the computer does not work in degrees, PRINT SIN (90) will give you another answer. To get the answer in degrees, just take the 90 and multiply it by 3.1416, then divide the answer by 180. Now take the SIN of that answer and you should get 1. If your computer has a built-in key for pi, use that instead of the approximation because it will give more precise results. For example, on the Commodore VIC and 64, pressing SHIFT and the up-arrow (↑) key will print a pi symbol which can be used in expressions as a constant with the value of pi. On the Atari there's an even simpler way. You can use the DEG statement to switch all calculations to degrees.

64 Reverse Lines

I would like to display 40 reverse spaces per line. But the printed fortieth character causes a line to be skipped before the next line of text is printed. Therefore, I must leave the fortieth column unprinted to. How may I accomplish this feat in 64 BASIC without skipping a line?

Philip A. Egan

Try PRINTing 39 reverse characters on the screen per line, and then add a routine that will POKE reverse characters into the fortieth column of each line. The following should help on the 64:

```
90 FOR X= 1053 TO 2023 STEP 40: POKE X,160:
POKE X+54272,COLOR: NEXT
```

The variable COLOR can be any of the 64's colors.

Program Conversions

I used to own a PET Commodore Computer. Since then, I have been a subscriber to COMPUTE! magazine. COMPUTE! once published a program that would help in converting 64 and VIC-20 programs to the PET. I now own a 64 and need to convert some of my PET software into 64 format. Can you help?

Darren Storkamp

Conversions from one computer to another can sometimes become very involved because of the problems that POKEs or SYSs to machine-specific ROM routines can cause. The best way to attempt something like this might be to try to write a program on the new machine, in your case the 64, that follows the logic and flow of the old program. Even doing it this way, though, does not guarantee that the program will work properly. Some very simple

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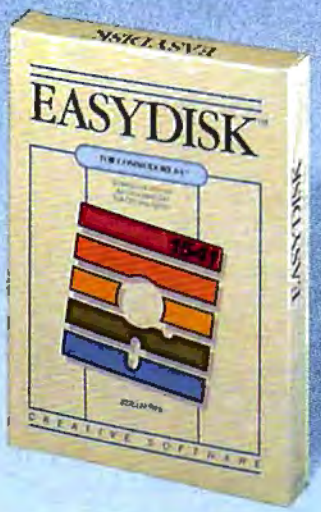

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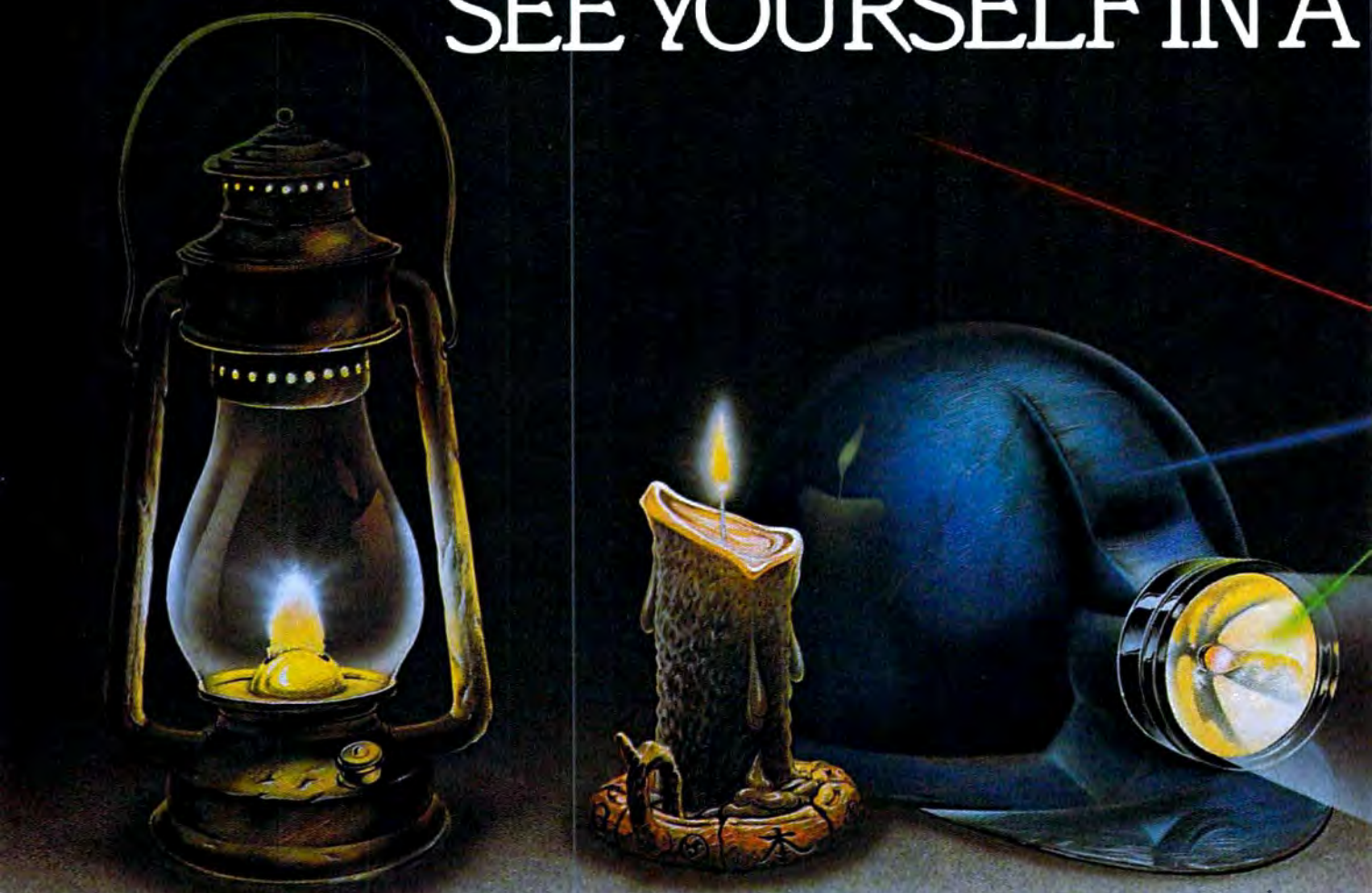
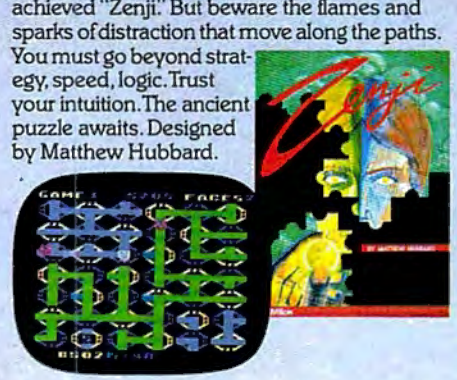


You leave the sun behind as you lower yourself down into the unexplored caverns beneath the Peruvian jungle. Deeper and deeper you go. Past Amazon frogs, condors, and attacking bats. Across eel-infested underground rivers. From cavern to cavern, level to level. Swimming, running, dodging, stumbling, you search for the gold, the Raj diamond and the thing you really treasure...adventure. Head for it. Designed by David Crane.

You have heard the elder speak of one central source and a maze of unconnected grey paths. As you connect each grey path to the central source, what was grey becomes the green of life. When all are connected, then you have achieved "Zenji." But beware the flames and sparks of distraction that move along the paths. You must go beyond strategy, speed, logic. Trust your intuition. The ancient puzzle awaits. Designed by Matthew Hubbard.



You strap on your helicopter prop-pack, check your laser helmet and dynamite. There's no predicting what you'll have to go through to get to the trapped miners. Blocked shafts, molten lava, animals, insects, who knows what lies below. But you'll go, you're in charge of the Helicopter Emergency Rescue Operation. The miners have only one chance. You. The opening shaft is cleared now, it's time to go. Designed by John Van Ryzin.

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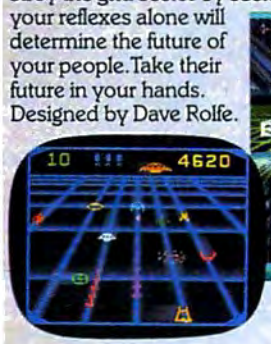

You can almost hear the quiet. And it's your job to keep it that way. A toy factory at midnight. Did you hear something? Guess not. Wrong! Suddenly balloon valves open, conveyor belts move and a whole factory full of toys goes wild. Even the robot, their latest development, is on the loose and after you. Capture the runaway toys. Restore order. Restore peace. Restore quiet. Do something! Hurry! Designed by Mark Turmell.

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PET programs can be used on the 64 if you first load a program called a PET emulator into the 64. This program is available from Commodore.

Atari Paddle Programming

I own an Atari 1200XL computer. Can I use the paddle controllers from my Atari 2600 game machine in my own 1200XL programs?

Eric Sneed

Yes. All controllers used on the 2600 game system are compatible with the Atari computer line. As a matter of fact, the 2600 game controllers have become a de facto standard. Atari joysticks also work on the Commodore VIC-20 and 64, Coleco Adam, and on some other game machines. Atari paddles work on the VIC-20 and 64, but give a slightly different range than Commodore paddles. Atari BASIC has two functions, PADDLE and PTRIG, for supporting up to eight paddles on the 400 and 800, and four paddles on the XL series.

VIC Game Loader

In the June issue of COMPUTE!, two recreational programs were presented for the VIC-20, "Pest" and "Olympiad." Both of these programs require 8K expansion and several POKEs before loading. It is quite easy to forget these POKEs and also very inconvenient when you just want to be able to load and run the program. Because of this, I wrote the following routine. It does all the necessary POKEing and then loads either Pest or Olympiad. You can choose by hitting either the P or the O key.

Shawn K. Smith

```
5 PRINT"{CLR}{DOWN}{3 SPACES}{RVS}O{OFF}L
  YMPIAD{4 SPACES}{RVS}P{OFF}EST":rem 141
7 GETA$:IFA$<>"O"ANDA$<>"P"THEN7  :rem 99
10 PRINT"{CLR}{3 DOWN}POKE43,1:POKE44,32:
   POKE8192,0:":PRINT:PRINT:Q$=CHR$(34)
                                  :rem 83
15 IFA$="P"THENA$="{4 SPACES}"+Q$+"OLYMPI
   AD"+Q$+",8{3 UP}":GOTO20       :rem 169
17 A$="{4 SPACES}"+Q$+"OLYMPIAD"+Q$+",8
   {3 UP}"                        :rem 226
20 PRINT"POKE36869,240:POKE36866,150:POKE
   648,30:PRINTCHR$(147)"         :rem 187
30 POKE631,13:POKE632,13:POKE633,63:POKE6
   34,65:POKE635,36:POKE636,13:POKE637,13
   1                              :rem 133
32 POKE198,7                      :rem 153
35 PRINT"{HOME}"                   :rem 76
```

VIC Tape Directory

We bought my VIC-20 a couple of months ago. With it, we also purchased a Commodore Datassette. Our question is: Does the Datassette have a directory? If not, is there any way to obtain something similar to one?

Sharon and Veronica Miller

Computer recorders do not have a directory. A disk, however, must have a directory because it is a random access device—information can be read from anywhere on the surface of the disk. The directory stores information that the drive needs to know in order to get the right program from the right place.

The difference between disk and cassette can be compared to the difference between an audio record and an audio cassette. You can choose to play a specific song if you know on which groove it starts on the record, but on a cassette you would have to search through the tape for the song (tape counters help, but it still is not the same nor as speedy as a record).

On the VIC, however, you can obtain a screen listing of what is on the tape by typing a LOAD command followed by a nonsense name. Here is an example:

```
LOAD "& #$"
```

The computer will search through the tape looking for the nonexistent file and, in the process, print on the screen the names of everything it finds on the tape.

Atari Machine Language

I would like to know how to create an AUTORUN.SYS program in machine language using the Atari *Assembler Editor* cartridge. Also, how do you generate a random number in machine language?

Paul Stach

An AUTORUN.SYS file is much like any machine language binary object file. When DOS boots up, though, it checks for AUTORUN.SYS, and loads it during the boot process. But to make it run automatically, you must append a special run vector at the end of your file. Atari files can load in several stages, each stage going to a different part of memory. After a file is loaded, an attempt is made to execute it by jumping through the address found at $02E0/$02E1. In order to have your machine language run after it has been loaded, the starting address of your program must be loaded into $02E0. This is easily accomplished in the source code. At the end of your listing, include two lines:

```
*=$02E0
.WORD START
```

*This *= is in addition to the original *= at the top of your program. When this is assembled, the assembler appends to your file the initialization address of your program. The label START should be assigned to the RUN address of your program.*

Location 53770 ($D01A) is the hardware random number generator. A LOAD instruction (or a

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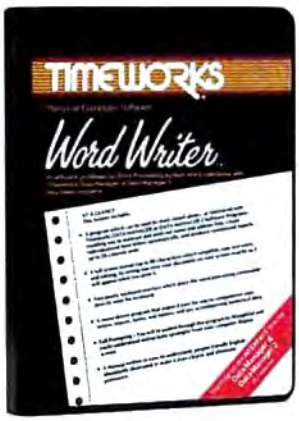

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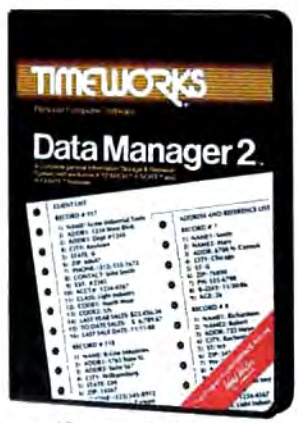

Arithmetic calculation of your mathematical data is possible, allowing you to perform Payroll calculation, cost estimates and more. Data Manager 2 also produces the Sum, Average and Standard Deviation of statistical data entered into the system, along with Frequency Charts.

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PEEK in BASIC) will return a random number from 0 to 255. In reality, 53770 is a very high speed counter. It goes so fast, the output seems random. If you need bigger numbers, get two bytes. For smaller ranges, you can chop off the unwanted portion with AND. For example, LDA $D01A/AND #$0F would give you a random number from 0 to 15. Another way to limit the random number is by rejecting unwanted values. For example, if you wanted a random number from 1 to 10, use a loop like:

```
REJECT LDA $D01A     ;Get the random number
       BEQ REJECT    ;If zero, get another
       CMP #11       ;Is the number 11 or
                      higher?
       BCS REJECT    ;If so, the carry will be set
       RTS           ;Return the number in the
                      accumulator
```

Tokenized BASIC

I own a Commodore 64 and would like to know if there is any way of converting tokenized BASIC into regular BASIC. What do I have to do?

Philip Wright

Most computers store BASIC statements and commands as tokens. *A command such as PRINT (five characters, or bytes, long) is converted into a number (one byte) which the computer can later understand to mean PRINT. This saves memory space. As you enter a BASIC program, it is compacted into tokens. Regular BASIC* is *tokenized BASIC, but if what you need is a file that contains every letter of every command in ASCII, there is an easy way to do this on Commodore computers. With the program in the computer's memory, type in the following lines:*

```
OPEN2,8,2,"program name,S,W":CMD2:LIST
CLOSE2
```

You can insert the name of the file you would like created instead of "program name." After typing the lines and hitting RETURN, you will have a sequential file on your disk that can be read by most word processors. All the letters to commands such as PRINT will be contained in that file.

Rattling Commodore 1541

I have owned a 64 and a 1541 disk drive for some time now and have heard some loud rattling noises coming from my drive. I often hear this noise when finding errors in copy-protected programs. Is this noise harmful to the disk drive?

Harvard Prossfete

The noise that you have been hearing is the disk

drive's head rattling while attempting to read a block with an error. Usually the drive will attempt to read a bad block three times before giving up and printing an error message. This kind of rattling will eventually knock your disk drive's head out of alignment, causing problems with SAVEs and LOADs.

It is best to avoid searching for errors in copy-protected programs.

XL Upgrade For Atari 800?

I would like to know if it would be possible to build a new ROM Operating System board that would duplicate the XL operating system on my Atari 800. Is it true that Atari will offer a ROM Revision C?

Joseph Fried

If you had access to the ROMs used in an XL computer, you could in theory replace the ROMs on your OS board. You still would not be able to take advantage of many XL features. Bank-switched memory requires more than a new operating system, since there have been some hardware changes in the XL computer series. We know of no plans to offer an upgrade to existing Atari 400 and 800 owners, but some third-party companies market add-on boards with 64K RAM and limited compatibility with the Atari XL computers.

Apple Binary On Ataris

I have used binary with the Apple computer by entering CALL −151 and found it very interesting. How can you do this on the Atari? Please add a little program.

James J. Brennan, Jr.

We assume you are referring to the machine language monitor built into the Apple II. An ML monitor lets you examine and change memory locations, and interact directly with the 6502 microprocessor. A monitor is a tool to help you debug machine language programs. Although there is no built-in ML monitor (sometimes called a debugger) on the Atari, there is one built into the Atari Assembler Editor *cartridge. Several companies sell ML monitors, or build them into their utility packages.*

What Is Binary?

I have heard a lot about binary load and save. This may seem like a silly question, but what is binary, what does it do? Can you write a binary program using a BASIC cartridge on the Atari 400?

S. Jonas

Beginners are often confused by the deluge of

computer terminology. In theory, all files are binary files, since binary numbers (mathematically, base two numbers) are the lifeblood of a computer. Binary numbers are another way of expressing quantity, but they are limited to the digits 1 and 0. The number six, for example, is 0110 in binary.

When people talk about binary files, they are usually referring to a machine language program on disk. On some machines, such as the Apple II, a binary file is special, not interchangeable with BASIC or text files. On the Atari, there really is no distinction. Any BASIC program could be called a binary file. It is possible to create loadable machine language files from BASIC. For a full explanation of binary numbers, take a look at the machine language tutorials in our magazines and books.

Daisychaining

I have just purchased a 1541 disk drive, and I am preparing to buy a printer. I have noticed that a disk drive attaches to the serial port on the back of the 64. How would I hook up a printer if the serial port is already being used by the drive? Would I also have to buy an expansion interface so that I could have more than one thing connected to the serial port at one time?

Jim Eller, Jr.

It is very easy to connect both a printer and a disk drive to the 64 through the serial port. All you have to do is plug the disk drive in the back of the 64 and then plug the printer into the back of the disk drive. There is a serial port on the back of the 1541. This is commonly referred to as daisychaining *because you are chaining the printer to the drive and the drive to the computer. Fortunately, expansion interfaces are not needed for this purpose on the 64.*

WordPro 3 Plus/64 Modification

We've received several letters regarding incompatibility between WordPro *for the 64 and the new Commodore 1526 printer. Apparently, due to modifications in the 1526, many users are encountering problems when printing with it.*

The following is a memo sent to us from Professional Software, distibutors of WordPro. *If you are having problems with* WordPro *and the 1526, enter and run the program below. It will change the* WordPro *program for use with the 1526.*

"Due to the internal timing differences between the new Commodore 1526 printer and most other printers on the market, *WordPro 3 Plus/64* must wait longer than 'normal' before attempting to print on the 1526 printer. Because of this timing difference, your *WordPro 3 Plus/64* program will need to be modified before attempting to use it with the 1526 printer.

"The BASIC program below will perform this modification. Since the modification is performed right on the *WordPro 3 Plus/64* disk, once the modification program is run, it does not ever need to be run again. Note that the program *must be entered exactly as shown,* as it may damage the *WordPro* program if entered incorrectly.

"For your protection, this program *does not* modify the backup program supplied on the *WordPro 3 Plus/64* system disk. Again, since this program modifies the *WordPro* program itself, we *strongly urge* that this program be checked carefully before being run.

"To modify the *WordPro 3 Plus/64* program so that it will operate a Commodore 1526 printer, turn on your Commodore 64 system and type in the following program, pressing <return> at the end of each line. Watch for the proper use of spaces, ones, zeros, commas, and punctuation. DO NOT use any capital letters."

```
10 rem copyright 1984 professional
   software inc
20 open 1,8,15,"i0"
30 open 5,8,5,"#"
40 print#1,"u1 5 0 13 11"
50 print#1,"b-p:5 30"
60 print#5,chr$(208);chr$(51);
70 print#1,"u2 5 0 13 11"
80 print "done":close 1:close 5
```

"Next type LIST and press <return> to list the program. *After carefully checking to see that the program has been correctly entered,* remove the write protect tab from the *WordPro 3 Plus/64* system disk, and insert the system disk into a 1541 and close the door. Type RUN and press <return>.

"The drive activity light should momentarily go on and the disk should spin. After a few seconds, the words 'done' and 'ready.' should appear on the screen and the cursor will reappear. The modification should now be complete. Remember to replace the write protect tab to protect the system disk from accidental erasure. Once the modification has been performed, the program does not need to be rerun.

"If an error message (and not the word 'done') appears on the screen or the disk activity light flashes, the program has been incorrectly entered or the write protect tab has not been removed. Carefully recheck the program for accuracy and repeat the previous steps."

If you would like further information on this modification, or a copy of the modification memo for yourself, you may contact Professional Software at:

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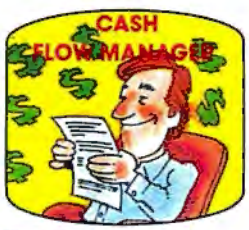

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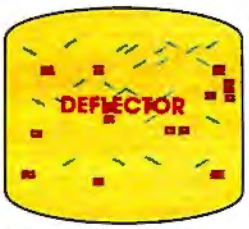

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A Parser's Tale

How Adventure Games Work

Charles Brannon, Program Editor

We all know that so far computers are not truly intelligent. Like all machines, computers operate in a consistent, logical, and straightforward way. Unlike people, computers are unable to make arbitrary decisions. Everything is black and white. That's why so many programmers, bent by weeks of midnight programming, cry, "Do what I mean, not what I say!"

Computers make decisions much like your home thermostat. The thermostat does not know that it is too warm, and therefore it needs to turn on the air conditioner. Two dissimilar metals, bound together, twist as one metal expands farther than the other. The metal plates make contact with the air conditioner switch, and separate when they cool down, releasing the air conditioner. A computerized thermostat would be no more aware of its function than the mechanical one. Machines operate in a predictable fashion.

Yet adventure games appear to be smart. In an adventure, you are playing in a specialized world, created by a programmer and administered by the computer. The descriptions paint a mental picture, and as you play you get the illusion that the adventure world is a complete, though tiny, universe. The computer seems to understand what you say, as long as you use the right vocabulary. You can open doors, light lamps, fight with trolls, converse with aliens, question criminals, dig for treasure, even ask for help. While you are playing an adventure, you can remain unaware that you are solving and rearranging a complex data base.

Adventure games, sometimes described as interactive fiction, have a basic story line, characters, and a setting. The setting may be a medieval dungeon, a distant planet (in a

galaxy far, far away), an alien spaceship, or even a modern shopping mall. You are usually the protagonist, but you are not there in person. Instead, you command your alter ego, who acts out your commands.

Your persona may be a sword-wielding treasure seeker, a detective, or an average, hapless urbanite. You control your character by giving it commands like GO WEST or EAT HOUSE. In fact, you are commanding the computer to carry out your actions. Some adventures let you be more detailed, as in OPEN THE MANILA ENVELOPE, TAKE OUT THE LETTER, AND READ IT TO ME. In order to follow your orders, the computer must break the sentence into subcommands by checking for commas, periods, and conjunctions. Words like IT must be replaced with the most recent object. Adjectives and articles should be discarded. The sentence would become OPEN ENVELOPE/[REMOVE] LETTER/READ [LETTER].

Parsing

The process of breaking down and interpreting your command is called *parsing*. A parser routine within the program breaks each subcommand into an action verb (such as GO, OPEN, or READ) and an object (LETTER, HOUSE). The verb is then looked up in a dictionary of commands and replaced by a number. Most adventure games offer several synonyms. EXAMINE and LOOK are assigned the same number. The number causes the computer to jump to a specific subprogram that handles that action.

The object of a sentence is also turned into a number. This is a little more difficult. For example, the adventure might describe a room with an "old brown bag on the table." The player might say OPEN BAG, or GET THE BROWN BAG, or even TAKE OLD SACK. But BROWN BAG, BAG, and OLD SACK are all reduced to the same number. The GET/TAKE/PICK UP routine then uses that number to handle the request. For example, EAT POISON and EAT TREE must be handled in very different ways.

The more advanced parsers have even more to deal with. If you entered SEE WHAT'S IN THE BAG, the adventure could break it down to SEE BAG. SEE is synonymous with EXAMINE. The EXAMINE routine checks its data base to see just what a BAG is, noting qualities such as the fact that a bag must be opened to see what's inside. You may then be told to open the bag first, or the adventure could assume that's what you've implied.

The Game Data Base

In a way, an adventure is an application like a disk operating system (DOS). In DOS, you use commands to manipulate files, for example, ERASE TEST. An adventure is no different, except you are manipulating the adventure's data base. An adventure data base consists of a map

RAID ON BUNGELING BAY

When you shopped for a computer, you wanted one with a lot of intelligence. This game may lead you to regret that choice, as your friendly little computer becomes the brains behind the most fantastic enemy you will ever face: The War Machine.

A monstrous artificial intelligence directs an endless army of self-replicating robot weapons and a complex of factories hidden on six heavily defended islands. Even as you strike at one island, robots beyond your field of vision continue to multiply...to repair the damage you've done...to attack and destroy.

Before all of Humankind is crushed beneath the Bungeling Empire's iron heel, one faint hope remains: you in your helicraft.

THE CASTLES OF DOCTOR CREEP

Ever dream that you were locked in a haunted castle, wandering blindly through darkened corridors, never knowing what ghastly demons await you? Then you'll feel right at home in *The Castles of Doctor Creep.*

It's a maddening maze of 13 separate castles, more than 200 rooms in all. Sinister surprises await you behind every door: mummies and monsters, forcefields and death rays, trap doors and dead—*very* dead—ends. Remember where you've been and watch where you're going...there's got to be a way out *somewhere*!

Better hurry, or you'll wind up playing a rather unpleasant role in one of Doctor Creep's experiments.

SPELUNKER

Who knows what fabulous treasures—and unspeakable dangers—await you in the world's deepest cave? This is one game you can really get into... and into...and into.

Wander through miles of uncharted passageways, swinging on ropes and ladders, tumbling over subterranean falls and plunging to the very depths of the earth on an abandoned mine railroad. Deadly steam vents and boiling lava pits threaten you at every turn. Chattering bats and the Spirits of dead Spelunkers beg you to join them, permanently.

Let's face it: you're in deep, deep trouble.

WHISTLER'S BROTHER

You're the star of a full-fledged arcade adventure—and the big question is whether it'll turn out to be a comedy or a tragedy. That's because your co-star and beloved brother, Archaeologist Fenton Q. Fogbank, is rather absent-minded and extremely accident-prone.

As you search for priceless treasures in steaming tropical jungles, ancient cliff villages, musty old tombs and glittering crystal caverns, you control both your character and your brother. The only way to keep him on track and out of trouble is to whistle and pray that he follows you to safety.

Poison arrows, runaway boulders, fearsome frogs and mysterious mummies are only a few of the hazards that'll make you wish you weren't your brother's keeper.

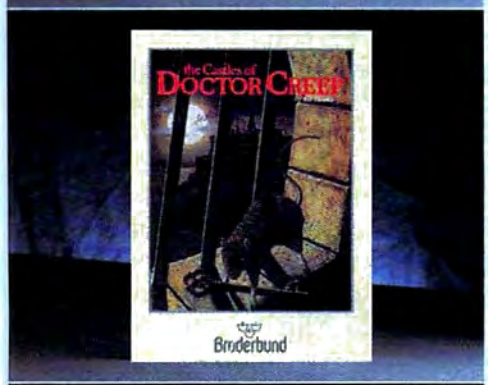
STEALTH

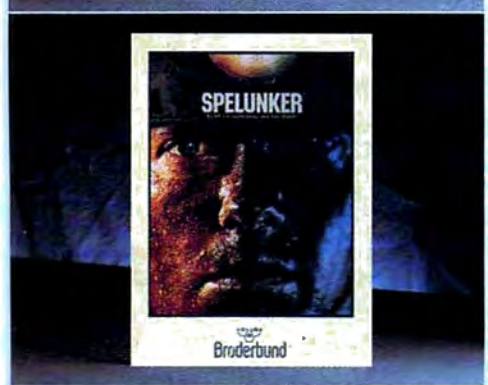
You're all alone on a strange and forbidding planet. On the distant horizon, looming thousands of meters above the blasted landscape, lies your destination: The Dark Tower, home of the mysterious Council of Nine, cruel overlords of a conquered world.

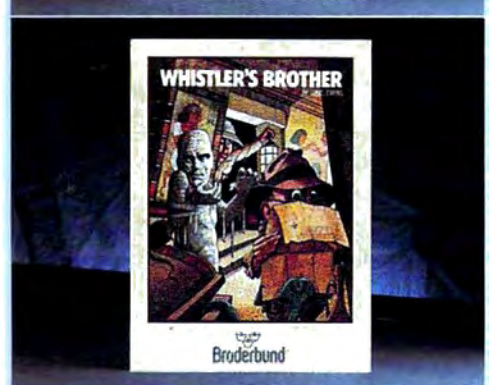
You must maneuver your Stealth Starfighter through an unending assault by the Council's automated arsenal—jets and heat-seeking missiles, photon tanks and anti-aircraft batteries, vaporizing volcanoes and deadly energy fields. Outgunned and outmanned, you must press ever onward, with only your stealth to rely on.

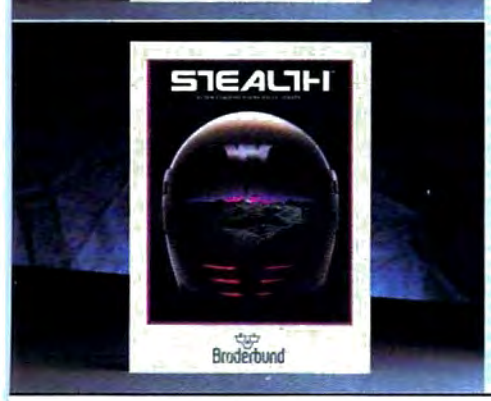
You must reach the Tower. You must destroy it. There's no turning back.

All titles available on Commodore 64. Championship Lode Runner *also available on Apple II+, IIe, IIc.* Whistler's Brother, Spelunker *and* Stealth *also available for Atari Home Computers. Commodore 64 is a trademark of Commodore Electronics, Ltd. Apple is a trademark of Apple Computer, Inc. Atari is a trademark of Atari Corporation.*



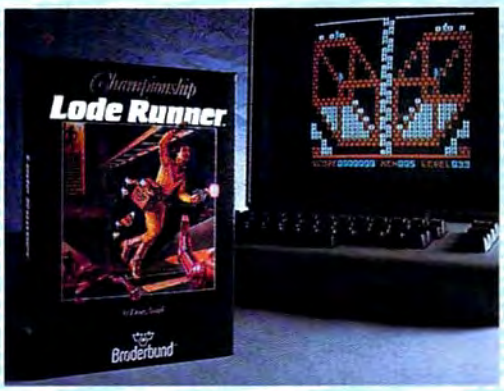






NO MERCY

FOR COMMODORE.



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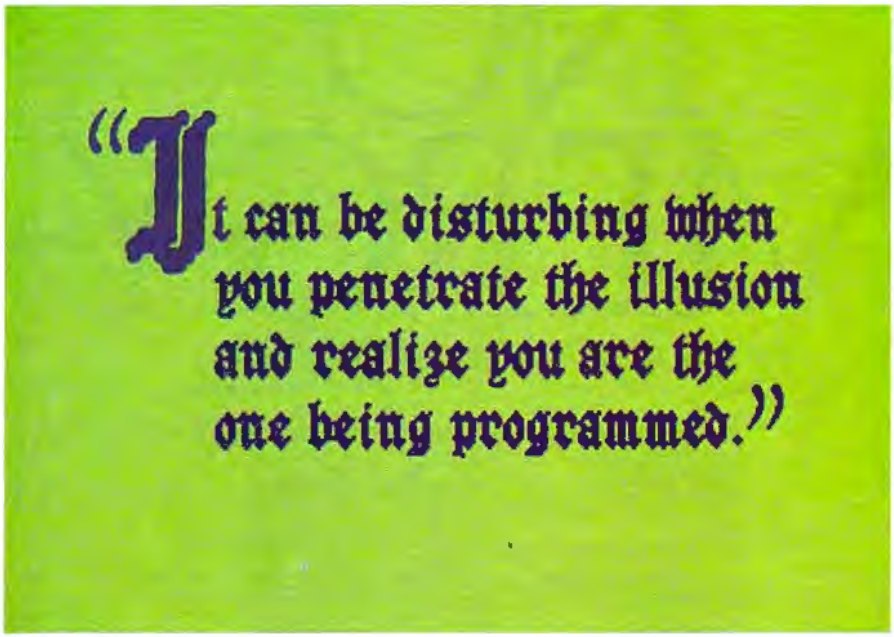
which describes how rooms or locales are linked together, objects such as treasure, and the status of various objects and situations.

You may be right next to another room, but unless the map allows direct movement to it (through a door, window, or transporter beam), you have to take another route. A room description includes legal exits and where the exits lead to, what objects the room contains, and room status, such as whether it's dark or lit. When you remove an object from a room, the room "forgets" that object. When you drop an object, the object is added to the room's description. Your player's status also has to be updated when you pick up an object, lose an object, gain powers, or get hurt. Some realtime adventures (where the clock keeps ticking and action keeps happening while you are deciding what to do) even take into account player fatigue. Your alter ego must sleep to regain energy.

Objects must be monitored. A lamp has a certain fuel supply, which is used up over time. The lamp can be either on or off, which temporarily affects the room description, lighting up a dark room. Some objects are incomplete in themselves, and must be assembled with other objects. For example, you could separately collect a bottle, some string, and some cooking oil. If it occurred to you to MAKE LAMP, the three items would become a crude lamp. A new object has been created, replacing the three separate ones. Don't think that you can make anything you want, though. Unless the programmer planned ahead to specifically allow you to create a lamp, you couldn't assemble one, even if you had all the necessary parts.

There are also variables for global status, such as the time of day. In a space adventure, there may be a status for the entire ship, like fuel and shields remaining. In more complex adventures, other people are like independent objects, with their own characteristics and descriptions. All these qualities, though, are numbers, and these numbers let a computer make arbitrary decisions. You can't GO NORTH if there is no north exit. If you have no sword, you can't fight with it. Unless you have a lamp, you cannot see within a dark room. The computer does not decide these things as a person would. It just understands statements like:

```
IF OBJECT=10 THEN PRINT
"YOU CANNOT SEE HERE."
```



Anticipated Actions

The most difficult part of designing an adventure is not creating the basic plot and world, but in anticipating the actions the player might take. Again, there is nothing open-ended in an adventure. Every possible action you may try has to have been predicted and programmed for. Some players become frustrated by the illusion, and don't understand why they can't get the computer to do what they want. Certain synonyms just aren't in the adventure dictionary. You may be faced with a locked door, but without a key. "But, aha!," you say, "I have a crowbar that worked on another door." You try the crowbar, and it doesn't work. The programmer either forgot about the crowbar, or never intended it to be that easy.

It can be disturbing when you penetrate the illusion and realize you are the one being programmed. The adventure may have many solutions, but you are just trying to figure out one of the predetermined actions planned for you. No action you take could be described as creative or innovative, since the programmer already knew that you would try it. An adventure tries to make you feel that you are participating and affecting the outcome of the adventure, but you are really just solving a complex puzzle or maze. If you realize this, the frustration may disappear, and you can concentrate on cracking the programmer's schemes. You aren't really playing against the computer, but trying to unravel a cleverly contrived mystery. ©

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Is A Picture Worth A Thousand Words?

Selby Bateman, Features Editor

A debate is raging between proponents of traditional, text-based computer adventure games and the new graphics adventure games. Welcome to the ultimate adventure: A titanic struggle is underway for your attention and your money. At stake, the fate of major software companies and the careers of computer programmers. What will you choose: Text or Graphics?

A killer stalks Hampstead Manor. You are confronted in the Troll Room; your sword glows with a strange light. The people of Sosaria look to you to save them once again. The half-light of a dank dungeon corridor stretches before you. King Edward of Daventry lies dying; you are the last hope in all the land.

What adventurer worth his steel could turn away from such challenges? Thousands of computer owners have already answered the call in scenarios like the ones above. And if you haven't yet ventured forth on any of these quests, the chances are good that you will sometime in the future.

The scenes described represent a wide range of popular adventure games: *Ripper* (Microcomputer Games, division of Avalon Hill), an all-text adventure in which you track the infamous Jack the Ripper; *ZORK I: The Great Underground Empire* (Infocom), the first installment in an immensely popular all-text series; *Exodus: Ultima III* (Origin Systems), a highly successful role-playing, graphics-and-text adventure series; *Wizardry: Proving Grounds of the Mad Overlord* (Sir-Tech), one of the most complex and popular text-and-minimal-graphics, fantasy role-playing games ever made; and *King's Quest* (Sierra), a breakthrough in graphics-oriented adventure games.

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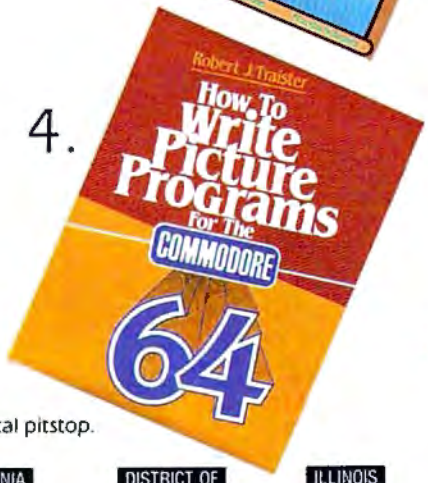
4. 

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major genre in computer games. Other companies with adventure game products include Adventure International, Black Knight Industries, Electronic Arts, Epyx, FTL Games, Harper and Row, Muse, Pryority Software, Screenplay, Strategic Simulations, Inc., and Sunrise Software.

New Worlds, New Identities

Although these games are usually lumped together as computer adventure games, the differences often outweigh the similarities. Such programs attempt to engage the player in solving puzzles, exploring new worlds, and trying on new identities.

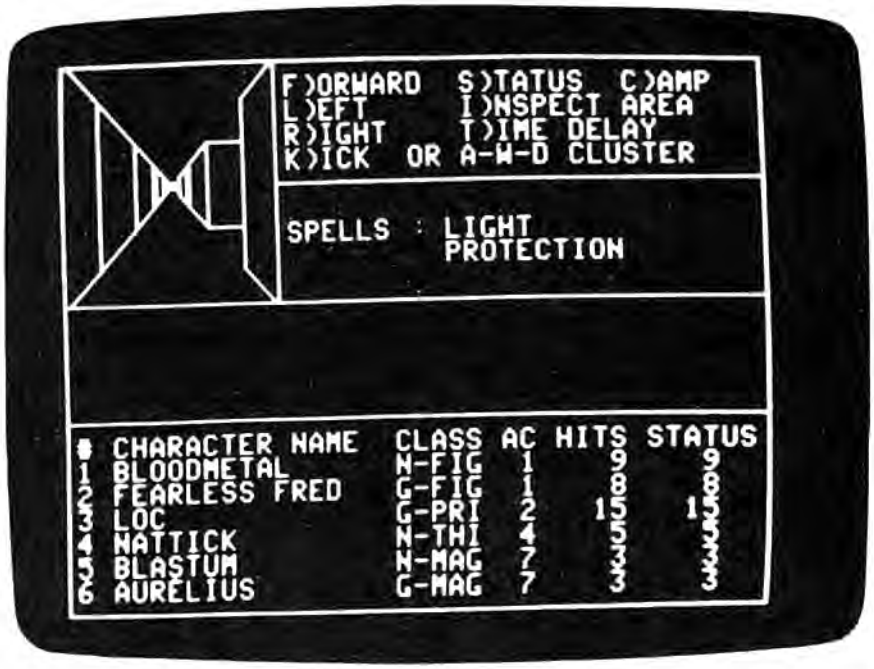
While arcade-style action games reward a sense of quick-reflex timing, superior hand-eye coordination, and visual perception, adventure games usually require patience, intelligence, curiosity, imagination, and the capacity to immerse yourself temporarily in another world—a willing suspension of disbelief.

Beyond these characteristics there are differences which attract some players. Does the adventure game have only text, omitting colorful graphics completely? Is there a balance between text and graphics? Or, finally, do graphic images actually carry the game itself, leaving text in a subservient role or completely absent?

The Graphics-Text Tradeoff

What do these differences mean to adventure game players?

"The fact of the matter is that whenever you put graphics into a program, you've got to take something out because you've only got a limited amount of space on the diskette," says Robert Woodhead, coauthor of Sir-Tech's *Wizardry*, one of the all-time best-selling games for Apple II computers.



In Sir-Tech's Wizardry, *a three-dimensional maze outline appears onscreen alongside status and command text information.*

"The Infocom people have said, 'We won't have any graphics at all so we can concentrate on the content of the adventure, the substance of it. We'll let people think up their own scenes,'" says Woodhead. "The hi-res adventure people—and we've done one [*Crypt of Medea* for Apple computers]—have said, 'We think the graphics are important, so we're going to have lots of nice graphics. Our adventure won't be as complex, but we think the graphics will make up for that.'

"And individual consumers have to decide. Generally, they like both," he adds. "In a program like *Wizardry*, we decided that we wanted a lot of content, but that we could put in a little graphics. And the graphics are of a special form—maze plotting. Because the [memory] resources required to do that are not incredibly huge, it works out very well. It conveys the desired information and it's sufficiently sparse so that people embellish it in their own minds. It reaches a little bit of a happy medium."

200,000 Wizards

The "happy medium" Woodhead and coauthor Andrew Greenberg sought with *Wizardry* obviously worked. To date, they have shipped over 200,000 copies of the complex fantasy role-playing game. And out of the thousands of letters they've received from players, Woodhead says that only a half-dozen have been negative.

From one to six players may take part, and a total of 50 different magical spells can be cast. The game takes a minimum of 70 hours to complete as you and your compatriots wander through a ten-level, 3-D mazelike dungeon fighting monsters, finding treasure, and seeking clues to the game's puzzles. As with almost all adventures, games can be saved to disk since time requirements for each program are lengthy.

So complex and rich an imaginary world is *Wizardry* that it has been used for everything

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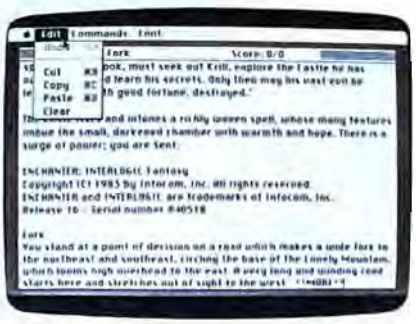
On To Qyntarr

Sir-Tech Software's next game, says Woodhead, will be an all-text adventure called *The Mines of Qyntarr*, in the tradition of the original *ZORK* created by Infocom.

"It's an extremely complex and involved adventure game. And the major effort we're making right now is to make it a lot more user-friendly in terms of its command parser. [See "The Parser's Tale" in this issue.] I hope to get a command parser running that understands more complex grammar than *ZORK*," adds Woodhead.

In speaking with programmers and designers of adventure games, the name Infocom almost invariably comes into the conversation. It's widely acknowledged that the Cambridge, Massachusetts, based company is the uncontested leader in the production of sophisticated, all-text adventure games.



Infocom's adventures are considered the standard for quality in all-text formats. Here, on the Macintosh, a pull-down menu can be seen in the upper left corner.

ZORK Forever!

ZORK, for example, has a command parser vocabulary in excess of 600 words, allowing significant variety in the kinds of sentences that the game can understand. Infocom's new release, *Sorcerer*, a sequel to another Infocom game, *Enchanter*, has a vocabulary in excess of a thousand words.

Infocom has spent its time and efforts developing the plot, the writing, the puzzles, and the parsing rather than on sound and graphics—the latter two of which Infocom vice president and master programmer Marc Blank calls "bells and whistles."

And the results have demonstrated the popularity of well-done all-text games. The *ZORK* series, which Blank coauthored, has already well surpassed the quarter million mark in number of disks sold. A now-defunct *ZORK* User Group (ZUG) boasted more than 20,000 members nationwide. *ZORK* T-shirts, bumper stickers, posters, and special clue books have all flourished. Infocom's games are available in versions for most personal computers.

When game historians give credit for the development and the legitimization of the term *interactive fiction* as applied to a certain type of computer adventure game, it will be Infocom which will get the laurels.

Seeing The Movie Vs. Reading The Book

But what about the future of all-text adventure games as computers become powerful enough to have sophisticated parsers *and* colorful graphics all at the same time?

"For the next year or so there'll still be a market for the incredibly well-done text adventures," says Richard Garriott, coauthor of Origin Systems' *Ultima* series of fantasy role-playing games, available for Apple, Atari, and Commodore machines. "Anybody other than the Infocom style cannot succeed at this point. Infocom has put together a very, very sophisticated parser, and the non-player characters within the game actually have some intelligence to their movements.

"I really think that as we develop better computer systems that surely this same kind of technique—if not the quality that Infocom is putting into their games—can also then have the added feature of the realtime graphics and animation put on top as well," he says.

"The standard argument is

Origin Systems' Exodus: Ultima III *offers graphic images of the game at left while game information is displayed at right.*

that the game with graphics is like going to see the movie and the game with text is like reading the book," adds Garriott. "Some people will still have some preference between the two. But the vast majority of the marketed products will almost have to turn to graphics because of the demand of the public."

"You Can Do Anything You Want"

Garriott, 23, has been writing computer fantasy-adventure games since his sophomore year in high school. He completed 28 fantasy games while still in high school, learning more about the genre with each attempt.

Origin Systems' *Ultima* fantasy role-playing series is a testament to the strength of Garriott's game-designing talents. "The key to the *Ultima* se-

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ries is really just the way the role-playing gives the player a great deal of freedom with what his options are at any point in the game," says Garriott. "It's basically a game in which you're living out your life. And you can do anything you want."

Are You Man Or Fuzzy?

In *Exodus*, the third game in the *Ultima* series, evil again walks the land of Sosaria. Will you confront this evil as Human, Elf, Dwarf, Bobbit, or Fuzzy? Now determine your strength, dexterity, intelligence, and wisdom. Choose your profession from among about a dozen possible types ranging from Cleric to Thief. Then, with a band of cohorts, go forth. But be quick about it: *Ultima IV* is already well along in development.

Quite a different approach has been taken—and very successfully—by Sierra in its graphic adventure game, *King's Quest*, for the IBM PC and PCjr.

Requiring 128K of memory and the use of a color monitor, the adventure game actually lets you control the movements of an onscreen knight, Sir Grahame, as he moves about the colorful kingdom of Daventry.

The movement is smooth, the screens are redrawn rapidly, and Sir Grahame is seen walking in front of, behind, and even between objects. He climbs, jumps, ducks, swims, and can be warned of impending danger by sound effects. The command parser for such a game is necessarily much smaller than that used in an Infocom game, but the play requirements are not based on having a huge volume of words.

There are helpful fairies, elves, condors, and a godmother. But there are also unfriendly sorcerers, dwarfs, ogres, wolves, and an airborne witch.

Roberta Williams, who designed *King's Quest* for Sierra, admits that the game represents a big change from what has been done with computer adventure games in the past. "There's nothing like it," she says. "It's innovative."

Sierra's King's Quest, *for the PC and PCjr with 128K, offers the best quality graphics in an adventure thus far.*

The interaction between the text and the onscreen graphics is clearly the way many future adventure games will be constructed. One element complements the other.

Bowing And Doffing

For example, as Sir Grahame stands before King Edward, type in the words BOW TO THE KING. As you hit the RETURN key, Sir Grahame can be seen bowing and doffing his cap.

And, Williams adds, subtle clues can be built visually into the game that an all-text adventure couldn't have. When Sir Grahame stumbles upon the house of a poor woodcutter and his wife, the screen shows an old and pitifully thin couple in a rundown house. The room is bare of food, a subtle clue to the player that an offering of something to eat might be very much appreciated by this mysterious couple.

While *King's Quest* uses text to supplement its high-quality graphics in the adventure, such action-adventure games as Electronic Arts' *Seven Cities of Gold*, Epyx's *Temple of Apshai*, and Muse's *Castle Wolfenstein* offer a range of adventure and strategy combinations primarily without text. The gradations in type of game play—as well as quality of play—being offered to computer owners today are already staggering in number. There is, it seems, something for just about anyone.

The tradeoff which programmers and game designers now must make because of computer memory limitations will not always be a problem, notes Dave Albert, executive vice president of Penguin Software.

Penguin has released such adventures and fantasy role-playing games as *Transylvania* (Apple II, Macintosh, Atari, Commodore 64), *The Coveted Mirror* (Apple II family), and *Expedition Amazon* (Commodore 64).

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"The Consumer Wants Pictures"

"In order to have the graphic images, you have to cut back on the amount of text. But that's becoming less of a reality, both through text compaction methods and because all of a sudden 128K seems to be starting to become a standard. And pretty soon, 512K will become a standard, and then it will become irrelevant," says Albert.

Penguin's newest fantasy role-playing game is *Xyphus* for the Apple II. Players may create characters who continue through different scenarios. The game also offers four-player independent movement, a variety of magical spells, and a mixture of graphics with text that reveals information about the status of the game.

Agreeing with Albert is Mike Cullum, new product director for Avalon Hill's Microcomputer Games division: "We've just released an all-text adventure game, *Ripper*, for the Commodore 64. Personally, I like the text games," he says. "But we have found that the averate consumer wants the pictures."

No Excuses

"As machines grow with more and more memory and sophistication, there won't be any excuse [not to have graphics]," he says.

One very popular game for Avalon Hill has been its all-text adventure *Empire of the OverMind*, for Apple II and Atari computers, which is still selling well, notes Jack Dodd, Avalon Hill's director of marketing. But with another of their releases, *Jupiter Mission 1999*, for Atari and Commodore 64 computers, the company mixed graphics and text in a very complex adventure.

"Of course, it took us four disks to do it," Dodd says with a laugh. "But it has all the meat of a text-type adventure."

Penguin Software's Transylvania *(at left) offers graphics alongside the text, here on the Macintosh version.* Xyphus *(at right), also from Penguin, is a graphics-based fantasy role-playing game for the Apple II computers.*

Trillium For Apple, Commodore

One of the most recent trends in the computer adventure genre is the use of well-known writers and the conversion of popular books into computer-game formats. No one is so far doing this more aggressively than Spinnaker Software's Trillium line of adventure games.

"We're trying to make a game that is based on plot and characterization—the way a book is—not puzzles," says Seth Godin, Trillium product manager. The Trillium series, which uses graphics and text, seeks to minimize the frustration factor, which has turned many would-be adventurers away from some computer games, adds Godin. To help achieve this, each of the games focuses on plot and characterization more than puzzles, and also includes a hint book and a list of the words that the game understands.

"If you read *Fahrenheit 451*, you don't get stuck on page 50. And if you play the game, you don't get stuck on frame 50, because the whole idea is that you're interested in the game because of the characters and the plot and what's happening," he says.

In addition to Ray Bradbury's *Fahrenheit 451*, the Trillium line will initially consist of adventure games based on such popular books as Arthur C. Clarke's *Rendezvous With Rama*, Michael Crichton's *Amazon*, Byron Preiss and Michael Reeves's *Dragonworld*, and Robert A. Heinlein's *Starman Jones*.

One of the games, *Shadowkeep*, actually preceded the book, which was later written by Alan Dean Foster, author of *Alien* and the Spellsinger series. The games are expected to be in stores by the end of Sep-

Spinnaker's Trillium adventure-game series offers graphics and text as shown from two of its titles, Dragonworld *(at left) and* Rendezvous With Rama *(at right).*

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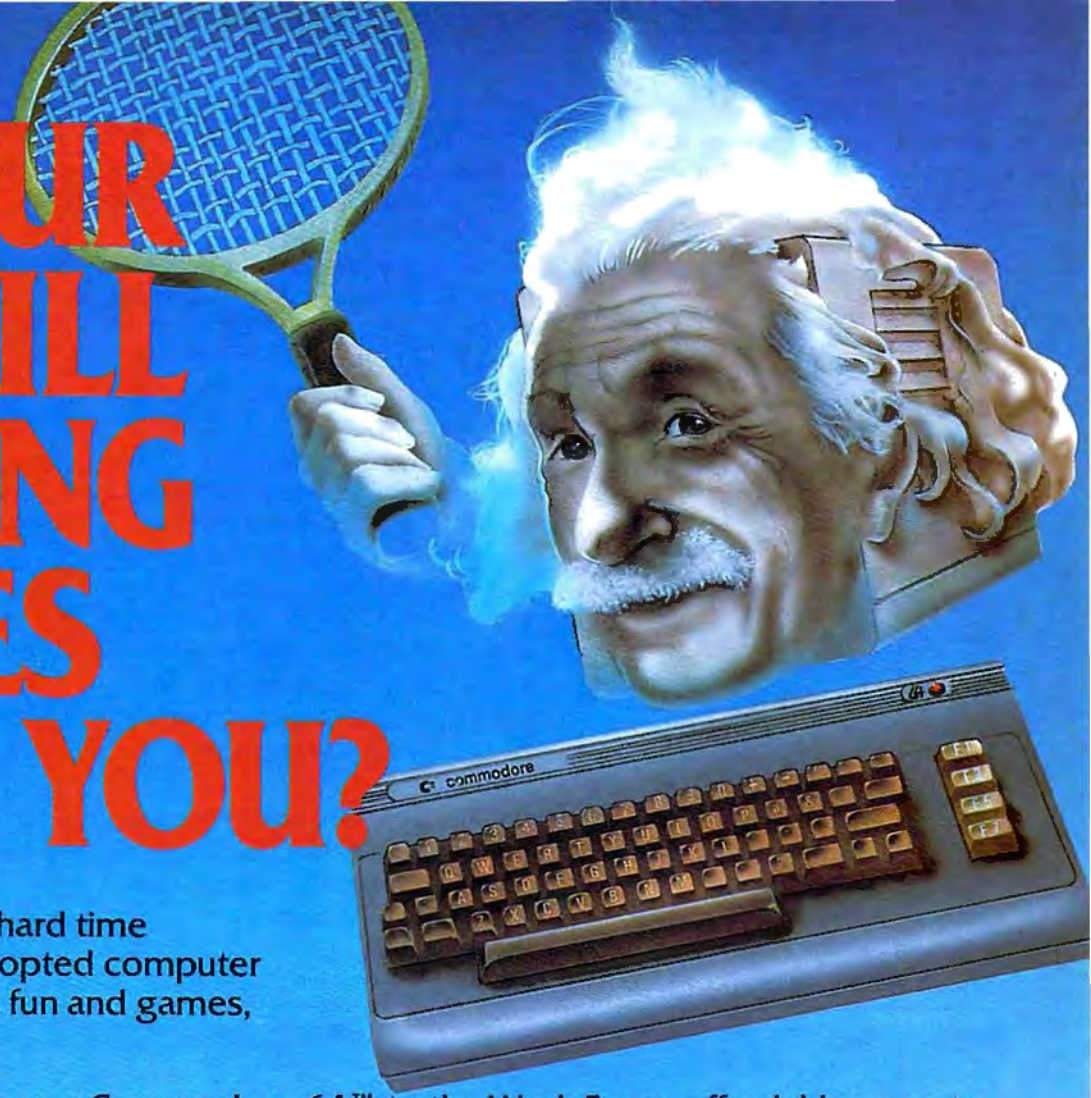

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tember or the first of October for the Commodore 64 and the Apple II line. Later conversions will follow.

Enthusiasm Is The Key

Although some adventure-game companies privately complain that signing a big-name author doesn't necessarily mean a first-rate game, Godin believes Spinnaker has found a good combination of talent and procedure.

"In every case, we worked with the authors to create the world [of the book] again," he says. "In the case of *Dragonworld* and *Amazon*, Byron Preiss and Michael Crichton wrote every word of the game. In the case of *Fahrenheit 451* and *Rendezvous With Rama*, we worked with the authors on the editings and the way it worked. We didn't just buy their names."

All of the games use graphics with text, and allow interaction between the two. For example, as *Amazon* opens, a research station somewhere along the Amazon River has obviously been attacked. Suddenly, as your mock video transmission fades, you briefly glimpse an intruder. To find out what's happened and who the intruder is, you must travel to the Amazon and explore.

As microcomputers continue to grow more powerful, a generation of avid adventure-game designers and programmers is growing more sophisticated. And, while the debate over text versus graphics will surely continue, there is a fundamental enthusiasm shared by all the best adventure-game producers.

This enthusiasm is the key, they all admit, to the continuing improvement of computer-based adventures. As Robert Woodhead says of his *Wizardry* game: "It's a good game that was a labor of love, and we didn't write it for anyone else but ourselves. People appreciate that."

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Commodore Prepares To Roll Out The Plus/4

Selby Bateman, Features Editor
Tom R. Halfhill, Staff Editor

Here's a hands-on report on Commodore's new Plus/4, a $300 64K computer with built-in productivity software scheduled for release this fall. Commodore calls it "The Productivity Machine."

Commodore's new Plus/4 computer is an interesting hybrid: part programming machine and part productivity package.

Commodore says the Plus/4 is not a replacement for the popular Commodore 64, but instead addresses a new market with an emphasis on practical applications for home and small business. It will be accompanied by a new line of peripherals—some of which are compatible with the 64 and VIC-20—plus a scaled-down 16K version, the $100 Commodore 16, which replaces the discontinued VIC.

At the heart of the Plus/4 and Commodore 16 is the new 7501 microprocessor, an eight-bit chip which is machine language-compatible with the 6502/6510 found in the VIC and 64. However, because of memory differences, practically no VIC and 64 software will run on the Plus/4 and Commodore 16.

Since announcing the Plus/4, Commodore has wavered about whether it will actually market the computer. As of this writing (mid-August), Commodore began shipping review units to major magazines and was preparing to launch a national advertising campaign October 8, so it appears the Plus/4 will hit the shelves barely in time for the Christmas season.

Improved Features

As a programming machine, the Plus/4 has several advantages over the two-year-old 64. It has a new, more powerful BASIC (BASIC 3.5) with over 75 commands, including more than a dozen for sound and graphics. There's a built-in machine language monitor with 17 commands. There are 16 primary colors, just like the 64, but each color now has eight luminances (shades), for a total of 128 hues. You can define an independent window anywhere on the screen by specifying its upper-left and lower-right corners, and all subsequent screen output will be redirected to this window. And a new bank-switching technique leaves the 64K computer with a spacious 60K RAM for BASIC programming.

As a productivity machine, the Plus/4 has four application programs built into ROM: a word processor, a spreadsheet, a file manager, and a business graphics generator. All the programs are integrated with each other. For example, a portion of the spreadsheet can be cut and pasted into a document on the word processor. There's also a windowing capability so you can display two of the programs on screen at once. Commodore's marketing strategy for the Plus/4 centers on these built-in applications, titled *3-Plus-1*. They were developed for Commodore by International Tri Micro.

DSAVE, SCNCLR, And HELP

The Plus/4's keyboard differs slightly from those on the 64 and VIC. Above the keyboard are four special function keys with eight predefined functions: RUN *3-Plus-1*, DLOAD (disk load), DIRECTORY, SCNCLR (screen-clear), DSAVE, RUN, LIST, and HELP. The new KEY command lets you display the functions currently programmed

The Commodore Plus/4 may finally reach dealers this fall.

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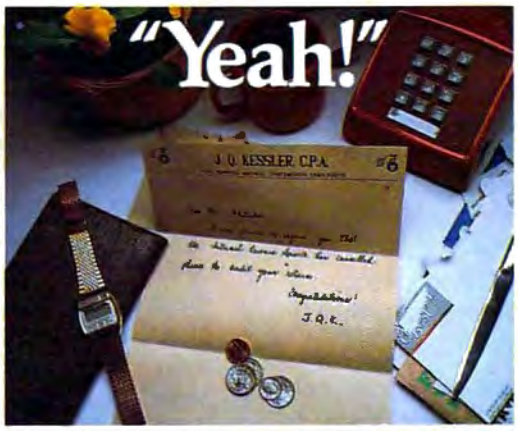

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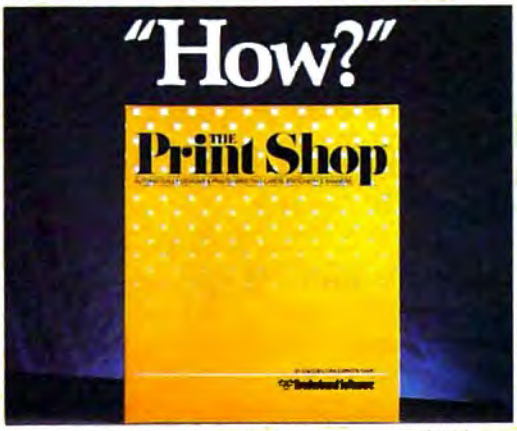

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for each key and easily reprogram them yourself.

The main keyboard has 59 typewriter-like keys and four separate arrow-shaped cursor keys. All of the standard PET/VIC/64 graphics characters have been retained on the front of the keycaps, with two additions: FLASH ON and FLASH OFF, to display flashing characters on the screen. The Plus/4 keyboard feels looser and springier than a 64 keyboard, very much like the Commodore SX-64 transportable.

There's also a reset button next to the power switch. It's a cold-start reset that normally wipes out any program held in memory, but if you hold down the RUN/STOP key while pressing it your program will not be harmed.

Peripheral interfaces have been changed on the Plus/4. While it can use the same 1541 disk drive and serial printers designed for the VIC and 64, the Plus/4 has a parallel port for a much faster drive, the SFS-481. The Plus/4's cassette port and two joystick ports are not compatible with current Commodore cassette recorders and game controllers. Another port resembles a Commodore 64 expansion port and is labeled "Memory Expansion," although no expanders for the Plus/4 have been announced. Finally, there are two video output jacks: one for standard composite monitors (including the Commodore 1701/1702), and another which feeds RF signals to a TV.

Despite these improvements, the Plus/4 lacks a few significant features found on the less expensive 64. There's no sound synthesizer chip—just two tone-generators which do not offer the flexibility of the 64's SID chip. And although the Plus/4 has 128 colors and a high-resolution graphics mode of 320 × 200 pixels, it has no sprites. So the Plus/4 and Commodore 64 are differentiated by more than just $100 in price. The Plus/4 is better suited to more "serious" applications and programming, while the 64 has superior graphics and sound.

Instant Software

When you turn on the Plus/4, you can immediately run the built-in software by pressing the F1 function key and then RETURN. Since *3-Plus-1* is in ROM, there's no waiting for a disk or tape to load. The computer runs the software instantly, defaulting to the word processor.

You control *3-Plus-1* by typing two-letter commands at a special screen prompt. The prompt appears when you press the Commodore logo key and C key. For example, to leave the word processor and enter the spreadsheet, you type the command TC ("To Calculator").

Although having four integrated programs instantly available is a powerful feature, not all of the programs are as powerful as software available separately. The word processor may be the weakest link. For one thing, it limits you to only 99 lines of text, so extended documents are beyond its scope.

Second, the word processor's editing functions are a bit unusual. When you insert characters, the entire document is pushed forward on the screen, not just the text up to the next carriage return. You can disable this movement, but then words start wrapping around into half-lines. Also, the text scrolls horizontally as it's entered to simulate an 80-column (actually 77-column) screen. This can take some getting used to unless you've previously worked with horizontal scrolling. Your text marches off the screen to the left as you type, and then wraps around at the start of the next line. Therefore, you can't view a whole sentence on the screen at once, unless it's less than 40 characters long.

New Name, Same Machine

The Plus/4 was originally announced at the Winter Consumer Electronics Show (CES) in January as the Commodore 264. Although the name has changed, the design is essentially the same—with one important difference. The 264 was going to be offered in several different configurations. Buyers could pick what applications software they wanted built into the computer.

By the Summer CES in June, Commodore had abandoned that concept. Apparently dealers had rebelled against the idea of installing their own ROM chips or stocking many models of the same computer. Commodore also dropped plans to introduce the Commodore 364, a deluxe version of the 264 with a speech synthesizer and numeric keypad.

Commodore plans to release about 30 programs for the Plus/4 to coincide with the computer's introduction. These will consist primarily of productivity packages, with some educational programs and a few of the most popular games available for the 64.

The on-again, off-again history of the Plus/4 means it's possible that Commodore may decide at the last moment not to release the computer. However, a source working with the company claims "all systems are go."

Commodore is obviously banking on its assessment that the next large segment of the computer-buying population wants a productivity-oriented machine at an affordable price. At the same time, the company will closely watch how the new computer affects the Commodore 64, a phenomenally popular computer which continues to sell briskly. ©

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IBM's New & Improved PCjr

Tom R. Halfhill, Staff Editor

As expected, in late July IBM finally announced a new keyboard and memory expansion option for the PCjr. Coupled with June's price cuts and some more hardware and software, the improvements make Junior much more competitive in the marketplace. The next few months will be crucial: Can IBM turn the PCjr around? Here's an analysis of the new developments.

Déjà vu was unavoidable. For the second time in nine months, with only 24 hours' notice, IBM had summoned dozens of editors, reporters, and photographers from all over the country to New York for a press conference. This one was scheduled for 10 a.m. on July 31 at IBM's Gallery of Science & Art in midtown Manhattan—the same spot where, almost exactly nine months to the hour before, IBM had staged a similar media event to unveil its new PCjr.

Debarking from cabs, press people signed in at the same table set up in the same glass-walled lobby overlooking Madison Avenue. From there they passed the guards and descended the curving stairs to the same lower lobby, where the same tables adorned with white tablecloths and gleaming silverware served up the same selection of breakfast rolls, coffee, and tea. PCjrs were set up at the far end of the same long hallway, barely within view, and the same velvet ropes and business-suited guards held the crowd back until the official stroke of ten.

But not everything was the same. Nine months before, the excited gathering of journalists had buzzed with anticipation about the long-awaited "Peanut" that was sure to conquer the home computer market, legitimize a confused industry, and establish new standards for others to follow. This time, the journalists had come to see how IBM would respond to months of criticism, bad press, and disappointing sales.

Something else was different, too—this time there seemed to be little room for surprise. For months, rumors had been circulating about a new typewriter-style keyboard and a memory expansion option that would make the PCjr more palatable to the public. Only the details remained in doubt.

When the clock struck ten and the velvet ropes were finally dropped, everyone hurried down the hall for their first glimpse of the new PCjr, just as they had on November 1. But a surprise awaited them after all. The PCjrs were set up where everyone expected, busily running various demo programs, but the keyboards were missing. And IBM's public relations people were ushering everybody into an auditorium off the hallway. The waiting wasn't over yet; no one would be allowed to see the keyboard until after the press conference.

During the next hour, IBM downplayed the PCjr improvements. Dozens of people had traveled thousands of miles to see the rejuvenated Junior, but IBM insisted that the main reason for the press conference was to formally announce its Writing to Read project, a new computer-aided method for teaching kindergartners how to read and write. IBM showed a ten-minute film on Writing to Read, then introduced some teachers, parents, and children flown in from three school districts around the country which had successfully tested the system.

Meanwhile, reporters who had grabbed press kits on their way down the hall were flipping through the photos and press releases to find something about the PCjr keyboard. The information and pictures were there, but at the very back of the kit.

Finally, after a question-and-answer session with Philip D. Estridge, president of IBM's Entry Systems Division, the press conference was over. The journalists spilled out into the hallway and descended on the PCjrs, hooked up to their new keyboards at last. Hundreds of fingers began drumming on the keys, assessing the "feel." Now it was IBM's turn to hold its breath.

A minute later, heads started nodding in approval. Compliments were offered. Lenses focused on the new keyboards, shutters began clicking, and videotape started rolling. IBM employees began to smile. Perhaps, if they were lucky, the mistake of the old keyboard would soon be forgotten.

Then it happened. A man walked up to one PCjr and identified himself as a reporter from *The New York Times*. As he experimented with the new keyboard, the IBM publicist as-

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white house. A table
ly for the preparation
est, and a dark stair-
d. A dark chimney
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signed to that particular PCjr waited in obvious suspense for the verdict. After a few moments, it came: "What was the old keyboard like?" said the reporter. "Do you have one in the back room you could show me?"

The new and improved IBM PCjr with its typewriter-style keyboard.

Spectacle aside, the media event in New York came as real relief to those who had been closely following the PCjr for the past nine months. For the microcomputer industry, IBM's entry into the home computer market was one of the biggest stories of 1983. Likewise, IBM's troubles with the PCjr threatened to become one of the biggest stories of 1984. Since late March, when the first reports of poor sales began trickling in, rumors of price cuts, new keyboards, and memory expanders were traded faster than computer stocks on Wall Street. For months everything seemed suspended in limbo. Now that the price has been cut, the keyboard replaced, and the memory expanded, IBM can stop denying rumors and go back to selling computers. And consumers—IBM hopes—can go back to buying them.

IBM did more on July 31 than just introduce a new keyboard. A new keyboard alone would have been an anticlimax, as IBM realized. Computer manufacturers have been making good keyboards for years. So IBM also promised to give a free keyboard to all current owners of PCjrs, and to those who buy remaining inventories of PCjrs with old keyboards.

This generous offer was perhaps the biggest surprise of the day. Plenty of computer companies have made mistakes in the past, but very few have offered free retrofits on such a scale. Still, the offer wasn't solely an outburst of altruism. It both protects and reinforces IBM's all-important reputation for dependability and service. And as an IBM publicist confided, it's also IBM's way of acknowledging that it should have designed the PCjr with the new keyboard in the first place.

(Implicitly, at least, the free keyboard offer also was a clue to how poorly the PCjr had sold in its first six months; it will cost IBM an estimated $5 million to replace approximately 60,000 keyboards. Soon after the PCjr was unveiled in November 1983, some industry experts were predicting that IBM would sell 250,000 to 480,000 units in that same period.)

Wisely, then, IBM figured the keyboard giveaway would compensate for a lot of bad publicity and make present owners happy that they had bought an IBM in the first place. As Estridge admitted, the criticism had been stinging: "We were puzzled about the reaction to the PCjr, puzzled because it

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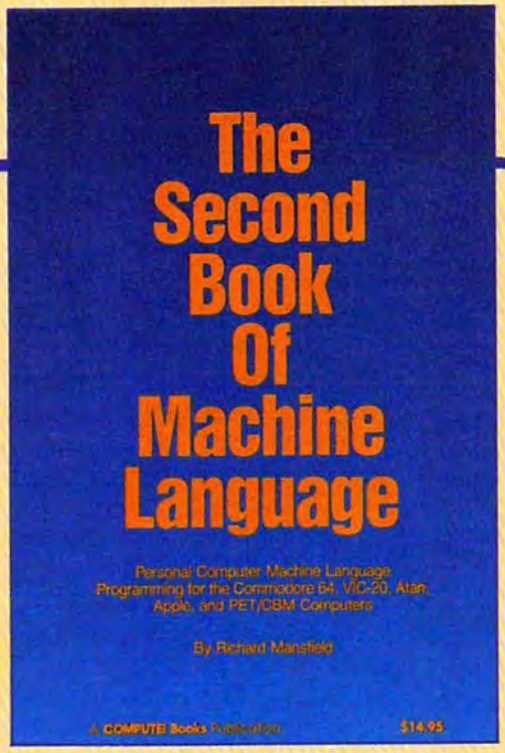

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was so intense....You can't wake up and eat breakfast every morning and read in the paper that you have a crummy keyboard and not be impressed."

But apparently IBM also faced a public relations dilemma. Judging from the way the event was organized, IBM didn't want the keyboard announcement to monopolize *too* much attention. Essentially, they were patching up what has been an embarrassing episode for the world's largest computer company. So IBM surrounded the keyboard announcement with a press kit full of other announcements—all of which were interesting, but none of which would have drawn the same number of journalists to New York on 24 hours' notice.

It was a futile effort, however. The new keyboard was the talk of the day.

Here's what IBM announced on July 31:

• PCjr typewriter-style keyboard. Available now, the new cordless keyboard is a significant improvement over the old chiclet-style "Freeboard." Except for the new keys and the lettering on the keycaps, it's virtually identical to the old model. In fact, it's made for IBM by the same outside company and built into the same case. IBM says the infrared link has been slightly improved. The F and J keycaps have raised ridges so your fingers can more easily find the home row without glancing away from the screen. Although the keyboard isn't quite as good as you might expect for a computer in the PCjr's price range—there's still no separate special function keys or numeric keypad—it should satisfy the vast majority of complaints about the old keyboard.

• Optional memory expansion to 512K RAM. The expanders are snap-on modules which attach to the right side of the PCjr system unit. Each module contains 128K; snapping three of them together yields a total of 512K, counting the 128K already installed inside an Enhanced Model PCjr. The extra memory requires a specially configured version of DOS 2.1. Configuration programs are included with the modules. You can configure the memory to act like contiguous RAM (as in the PC) or as a RAMdisk. When the memory is set up as a RAMdisk, addressed as drive C:, a PCjr with only one physical disk drive can run some PC software designed for two-drive systems. IBM's memory modules will retail for $325 each. Although memory expansion to as much as 640K was already available from several outside companies, IBM knows that many owners prefer to stick with pure IBM equipment when expanding their machines. The expansion option also shows that IBM itself is addressing the complaint that the PCjr is not as PC-compatible as promised. Furthermore, it signals a shift in IBM's marketing orientation for the PCjr, as we'll explain below.

• Power expansion attachment. This is an auxiliary power supply required if more than one 128K memory expander is added to a PCjr. It snaps onto the right side of the system unit between the expanders and the computer. It has its own power transformer that plugs into a wall socket. The retail price is $150.

• *Lotus* 1-2-3 on cartridge. Strictly speaking, this wasn't an IBM announcement, but it was announced simultaneously in Boston by Lotus Development Corp. The extremely popular spreadsheet/data base/business graphics package will be available on plug-in ROM cartridge for the PCjr in the fourth quarter of 1984. Actually, the PC disk version of *Lotus* 1-2-3 will run on a PCjr if you add one of the new memory expanders for a system total of 256K, but the cartridge version will work on a standard 128K PCjr. That means you'll be able to run best-selling *Lotus* on a computer that costs less than $1000.

• PCjr speech attachment. Like the memory expanders, this is a module for the right side of the system unit. It has a 196-word vocabulary in ROM and a microphone jack so you can record your own words and sounds on disk. Output is routed through the TV speaker or the audio jack. Programs incorporating speech and other sounds can be written for the attachment. The retail price is $300.

• *PCjr Colorpaint* on cartridge. This is a $99 graphics-drawing program very similar to Apple's *MacPaint* for the Macintosh, except it lets you draw in 16 colors. Like *MacPaint*, it works with a mouse controller (not included) that lets you select drawing options by pulling out hideaway menus and pointing to icons.

• *Managing Your Money* on cartridge and disk. Written by financial expert Andrew Tobias, this budgeting program has proven very popular on the IBM PC. It runs on a 128K PCjr and retails for $199.

• PCjr educational discounts for schools and full-time teachers. Two systems are being offered: an Enhanced Model PCjr with DOS 2.1, Cartridge BASIC, an RF modulator, and keyboard cord will cost $700 in quantities of one to 14, and $675 for 15 or more; and the same system with an IBM PCjr Color Display (RGB monitor) instead of the RF modulator will cost $950 in quantities of one to 14, and $900 for 15 or more.

• Eight new educational programs for homes and schools.

• Writing to Read. This is a language laboratory for schools

Closeup of the keyboard. You'll notice that the key layout is exactly the same—but the "feel" is certainly different.

consisting of IBM personal computers, speech attachments, Selectric typewriters, special software, workbooks, cassette tapes, and other materials. It teaches kindergartners and first-graders how to read by encouraging them to write original stories and essays. The system was tested over the last two years by more than 22,000 pupils in 225 schools and declared a success by some leading educators.

Now for the $64K question: Will IBM's long-awaited improvements finally make the PCjr the popular computer it was supposed to be?

We probably won't know for sure until Christmas. But one thing is certain—at $999 list, the new and improved PCjr is now a solid contender in the marketplace. Its closest competitors are the Apple IIe and IIc. For a list price of $995, the IIe offers only 64K RAM, no disk drive, and only 40 columns in text mode. It can be expanded to a maximum 128K and 80 columns. For $1295, the IIc includes 128K RAM, switchable 40/80 columns, and a built-in disk drive. But Apple disk drives have less than half the capacity of IBM drives. Also, neither Apple can match the PCjr's graphics, sound, and memory expansion capabilities.

Apple II series computers do have a larger software base, especially in terms of home and educational programs. But IBM is rapidly catching up, and the new memory expansion modules allow the PCjr to run hundreds of PC programs which were incompatible before.

Of course, list prices don't tell the whole story. With typical discounts, you can usually buy an Apple IIe system with a disk drive and monochrome monitor for under $1000. But the PCjr also is being aggressively discounted. In early August, a local ComputerLand was selling the Enhanced Model PCjr for only $699—a full $300 off the list price. At $699 for 128K, a 360K double-sided disk drive, and the new keyboard, the PCjr will be hard to beat.

The improved PCjr will probably even cut into sales of the IBM PC. This is what IBM tried to avoid when it first introduced the PCjr, but IBM seems less concerned now. For one thing, IBM was almost forced to upgrade the PCjr after all the resistance it met. And second, IBM is preparing to introduce a new machine that will likely displace the PC as IBM's top-line personal computer.

Following is a breakdown of how much money could be saved by purchasing a PCjr instead of a PC (the computers are equipped to approximate each other's capabilities). All amounts are retail list prices for IBM products.

Standard IBM PC with 256K RAM, one 360K disk drive:	*$1995*
Asynchronous communications adapter:	*100*
Color/graphics adapter:	*244*
Game control adapter:	*45*
Printer adapter:	*75*
DOS 2.1:	*65*
TOTAL:	*$2524*

Enhanced Model PCjr with 128K RAM, one 360K disk drive:	*$ 999*
128K RAM memory module:	*325*
Cartridge BASIC:	*75*
DOS 2.1:	*65*
TOTAL:	*$1464*

Although the two systems are similarly equipped, there are still some differences, of course. Even with the color/graphics adapter, the PC lacks some of the PCjr's graphics and sound capabilities. But the PC runs programs faster, has faster disk input/output, and provides simultaneous disk I/O with its DMA (Direct Memory Access) controller. The PCjr has a cordless keyboard, but the PC's keyboard has separate special function keys, a numeric keypad, and better feel. Both computers could be expanded to 640K RAM, multiple floppy disk

drives, and a hard disk—though you'd have to buy non-IBM products for the PCjr.

All things considered, the new and improved PCjr is very nearly as powerful as a PC and can save you more than $1000. It seems likely that many people will opt for the PCjr.

It also seems probable that the PCjr's market will shift somewhat. IBM is no longer pushing the PCjr as a home computer—at least, not to the same extent it was before. Some journalists at the July 31 press conference noticed the difference as soon as they saw the roomful of Juniors running demo programs. Nine months earlier, nearly all the PCjrs were running games and other home applications. This time, the computers were running more "serious" programs, including business software. A couple of reporters put the question to Philip Estridge, the Entry Systems Division president: Is the PCjr still a home computer, or not?

Estridge wouldn't answer yes or no. Instead, he said IBM perceives that leisure use of home computers is declining and that more people are demanding serious applications. Recent IBM research, he added, indicates that 75 percent of the people who buy a PCjr have access to an IBM PC at work. Therefore, IBM assumes these people want a computer at home that can run PC programs from the office.

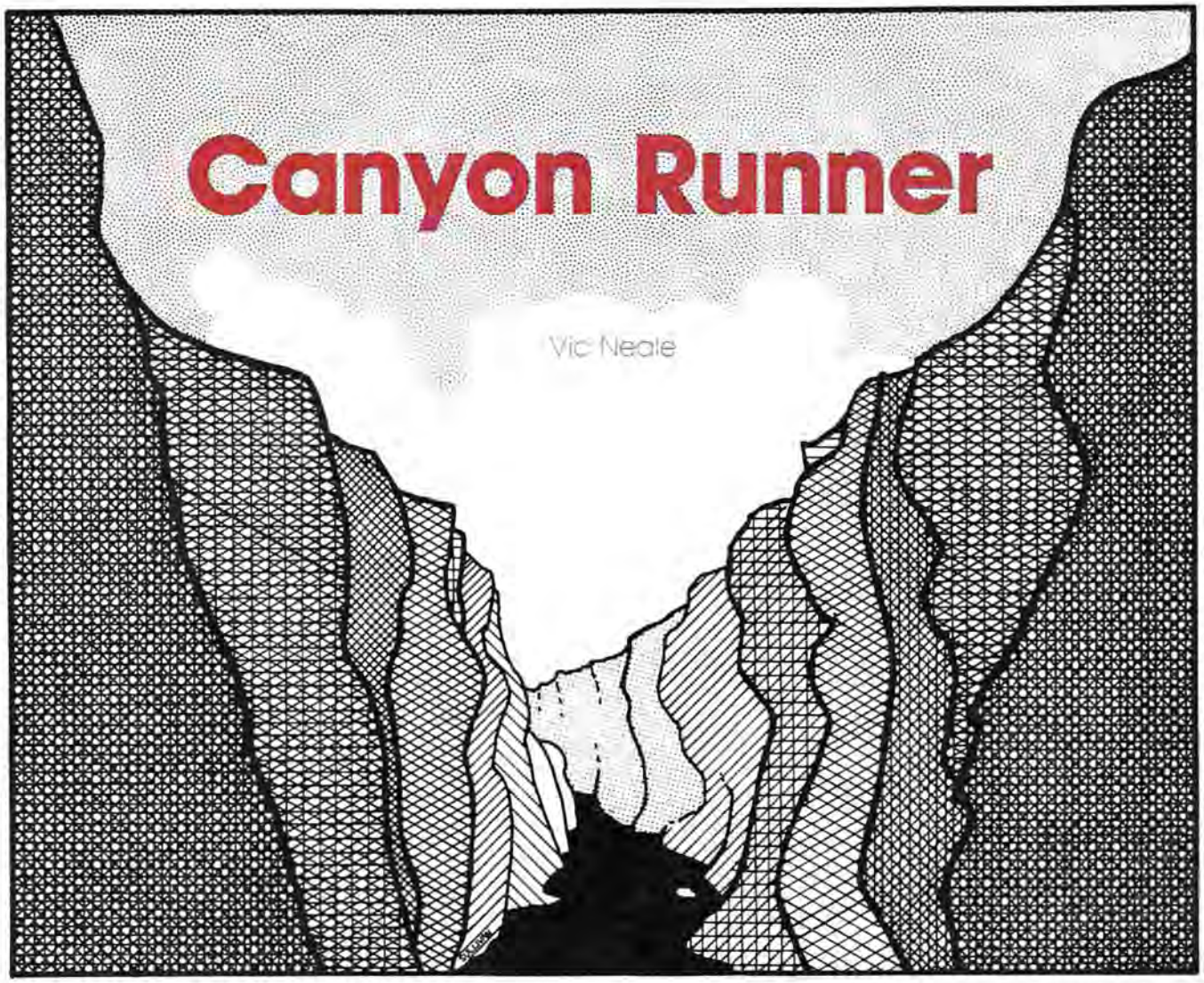
To reach that market, Estridge said IBM's new advertising for the PCjr will emphasize that it's a general-purpose computer which can be adapted to a variety of applications. "Trying to describe a computer as a 'home computer' or a 'business computer' or an educational computer,' I don't think the statistics are there to support such a niche," said Estridge. "People buy a computer because they have a purpose for it."

Of course, practically any computer these days can be adapted to home, educational, or business applications. It's just that some computers are more powerful for certain applications than others. But these distinctions could blur as even the low-end computers grow increasingly powerful. (In fact, some machines for less than $500 will soon appear which offer more processing power than a $4000 PC-XT.) At that point, prices, target strategies, and software libraries may stratify the personal computer market more than computing power.

In the final analysis, it will be the consumers who'll decide where—or if—the PCjr fits in.©

Canyon Runner

Vic Neale



In "Canyon Runner" you are a pilot on a mission through a very perilous canyon. You must survive this test. The only way to do so is by maneuvering your tiny plane through the endlessly scrolling canyon. Versions for VIC-20, Commodore 64, Atari, and Apple.

At first, it's easy. But chunks of rock and other obstacles soon get in your way as you maneuver through the canyon. Any of these could lead to the destruction of your plane.

To avoid disaster, you have to avoid all the dark areas and hit all the areas marked BONUS. When you begin to think that everything is going to be fine and that you are home safe, things suddenly become difficult and you encounter a mind-boggling time warp. The time warp has enveloped part of the canyon. The pulsing colors of the time warp can easily distract you, so be careful. If you make it through this time warp, you will be faced with a narrower canyon.

The game is joystick-controlled. At the start of the game, you may choose at which skill level you would like to begin. The easiest level is number 5 and the hardest is number 1. Between 1 and 5 there are other degrees of difficulty. Every time you make it through a color zone, you advance a level, so it might be best to start at the easiest level just to get some practice. You gain points in the game according to how long you can manage to survive.

The VIC version of the game is divided into two parts so that it will fit into the limited memory of the unexpanded VIC. The first part (Program 1) will automatically load and run the second part (Program 2), provided you save Program 2 with the filename CR. If you are using tape instead of disk, be sure to change the 8 to a 1 in line 50 of Program 1. Be sure to save Program 2 immediately following Program 1 on the same tape. When you load and run Program 1, leave the PLAY button on the Datassette depressed to load and run Program 2.

Commodore 64 And Atari Notes

Kevin Mykytyn, Editorial Programmer

In the Commodore 64 and Atari versions of "Canyon Runner," you are trying to guide your helicopter through an ever-changing canyon, shoot your opponent's helicopter, and avoid the salvos your opponent may fire at you.

Both programs are written entirely in machine language and must be entered using the MLX machine language editor. Be sure you read and understand the MLX article elsewhere in this issue before you begin typing.

The Commodore 64 version of MLX will ask you for the starting and ending address of the machine language. For Canyon Runner (Program 3), the starting address is 49152 and the ending address is 51720. To run the program, load it by filename followed by ,1,1 for tape or ,8,1 for disk, then SYS 49152.

Atari MLX also asks for several addresses. The starting and ending addresses are 8192 and 9904, respectively. The run/init address is 8192. MLX will allow disk users to create either a boot disk or a binary file. If you select the binary file option, the program must be loaded with DOS menu selection L (binary load). If you use the filename AUTORUN.SYS for the binary file, the game will automatically load and run when you boot the system. Tape owners should create a boot tape using the appropriate MLX option.

The game requires two joysticks and has many options. You may choose the type of shot by pressing A for altitude bombs or D for detonation bombs. Altitude bombs will always explode at the altitude they are fired, while detonation bombs will change their altitude as you change the altitude of your helicopter. On the Commodore 64, you may also choose the solo option. This allows player 1 to practice flying through the canyon, although firing will not work properly.

At the bottom left and bottom right of the screen are the numbers from 1 to 9. The present difficulty level will be highlighted. These numbers indicate each player's individual difficulty level. The lower, the more difficult. Each player can change his difficulty level by moving his joystick from side to side.

The width of the canyon is also selectable, with three widths to choose from. On the 64, make your selection by pressing the 1, 2, or 3 key. On the Atari, use the SELECT key. Choosing width 3 will give a very narrow canyon that can challenge even an experienced player.

After the options have been chosen, begin the game on the 64 by pressing both joysticks up simultaneously, or on the Atari by pressing the START key. All action is controlled with the joysticks. You can change your altitude by moving the joystick back and forth and fly from side to side by moving the joystick left and right. The 64 version provides a graphic altimeter at the bottom of the screen to indicate your altitude, while the Atari version's altimeter has a digital readout.

To fire a bomb at your opponent, simply press the joystick button. The flight of the bomb can be heard as a whistling sound. The Commodore 64 version utilizes sprite priorities to simulate explosions above and below the target. The Atari version achieves the same effect with player/missile graphics.

Program 1: Canyon Runner, VIC Loader

Refer to the "Automatic Proofreader" article before typing this program in.

```
10 POKE51,0:POKE55,0:POKE52,28:POKE56,28:
   CLR:POKE36869,255                :rem 173
15 PRINT"{CLR}{9 DOWN}{4 RIGHT}CANYON RUN
   NER"                             :rem 121
16 PRINT"{3 DOWN}{5 RIGHT}PLEASE WAIT
   {WHT}"                           :rem 240
20 FORI=7168TO7679:POKEI,PEEK(I+25600):NE
   XT                               :rem 99
30 FORI=7384TO7399:READA:POKEI,A:NEXT
                                    :rem 84
40 DATA 255,255,255,255,255,255,255,255,1
   95,231,231,231,0,0,165,231       :rem 229
50 S$="LO"+CHR$(34)+"CR"+CHR$(34)+",8:"+C
   HR$(131):REM CHANGE 8 TO 1 FOR TAPE US
   ERS                              :rem 214
60 FORI=1TOLEN(S$):POKE630+I,ASC(MID$(S$,
   I)):NEXT:POKE198,I:END           :rem 93
```

Program 2: Canyon Runner, VIC Main Program

Refer to the "Automatic Proofreader" article before typing this program in.

```
5 SYS 65017:POKE36869,255           :rem 120
10 PRINT"{CLR}":POKE36879,8:POKE36878,15:
   S5=36875:S1=36877:C=30720:S2=36876
                                    :rem 132
11 DEFFNR(X)=INT(RND(1)*X)+1:DEFFNP(X)=X+
   (PEEK(1)-PEEK(2)):DIMB$(15),T%(5),P(7)
```

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A computer can help your child learn but the keyboard often gets in the way. It's a jumble of keys that's confusing and hard for little fingers to operate. And it's not much fun.

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The first computer keyboard made especially for young children. And the *only* keyboard with Kermit, Miss Piggy and the Muppet gang right on it—ready to introduce your child to the magic of letters, numbers, and colors.

Imagine you're five years old. Now pick a keyboard.

An easy choice, isn't it? That's because Muppet Learning Keys was created by education specialists to make learning an adventure for your child.

Unlike conventional keyboards, all the letters and numbers are in order. So a child can find A-B-C and 1-2-3 without hunting all over the keyboard.

Press any key on the keyboard and something always happens. Kermit flies a kite. Miss Piggy eats a pretzel. Fozzie puts out a fire.

That's how the fun begins. But soon, your child starts to explore and experiment. How many kites can Kermit fly? In how many colors? What do the other letters mean?

Muppet Learning Keys has things that every child knows and loves—a compass, a ruler, an eraser and a blackboard. Lots of stuff that a kid can't wait to get his hands on.

All-consuming tests.

When it came time to test this new marvel, we turned to the experts.

Children.

We let them do their worst to it. Peanut butter. Teeth. Even Ketchup.

Then we wiped its washable mylar surface with a sponge, and plugged it in.

And those kids did their best with it—having fun while they experienced the joy and wonder of learning.

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Muppet Learning Keys. The hands-on keyboard for kids.

For the Apple IIc, Apple IIe, and Commodore 64 computers.

In-box software by Sunburst Communications. Muppet Learning Keys works with software that is designed or modified for it.

Jim Henson's Muppet Learning Keys™

```
   ,L(7)                                :rem 0
20 FORX=0TO7:READL(X):NEXT              :rem 203
40 FORX=1TO6:READC%(X):NEXT             :rem 202
100 GOSUB815:FORX=828TO871:READA:POKEX,A:
    NEXT                                :rem 136
110 FORX=1TO15:READB$(X):NEXT:FORX=1TO5:R
    EADT%(X):NEXT                       :rem 214
115 PRINT"{CLR}{DOWN}ENTER LEVEL":PRINT"
    {2 DOWN}5 EASY..HARD 1"             :rem 66
116 GETSK$:SK=VAL(SK$):IFSK>5ORSK<1THEN11
    6                                   :rem 146
120 B=0:P=7910:SC=0:S=7:X2=1:DL=SK*(15+(S
    K-5)):R=(SK*4)+20:H=SK*5            :rem 171
130 PRINT"{CLR}"SPC(S)"{WHT}{RVS} READY
    {2 SPACES}":FORX=1TO21:PRINTSPC(S)B$(
    1):NEXT:POKEP,28:FORD=1TO1500:rem 124
135 NEXT:TI$="000000"                   :rem 116
140 POKES5,128+(100-DL):POKES1,128+(100-D
    L):FORX=1TO5                        :rem 26
220 FORY1=1TO40:FORY=1TO5:J=X:J1=X:IFFNR(
    H)=1THENJ1=((X*2)+3+FNR(2))         :rem 130
230 GOSUB780                            :rem 180
270 IFPEEK(P)=32THEN630                 :rem 88
280 TU=0:GOSUB810:NEXT                  :rem 124
290 IFFNR(R)=1THENK=X:K1=K:GOTO400
                                        :rem 117
305 TU=230:J=X:J1=X:FORY=1TO25:GOSUB800
                                        :rem 186
310 IFPEEK(P)=32THEN630                 :rem 83
315 GOSUB810                            :rem 178
320 IFY=13ANDX=5THENJ1=1:TU=0:GOSUB760:S=
    S-4:IFS<2THENS=2                    :rem 115
325 IFY=13ANDX=5THENNEXT                :rem 46
330 IFY=13THENJ1=J1+1:TU=0:GOSUB760:NEXT
                                        :rem 253
370 NEXT:R=R-5:H=H-4:DL=DL-10:IFDL<0THEND
    L=0:R=10:H=3:GOTO140                :rem 248
380 GOTO140                             :rem 105
400 FORZ=1TO13:J=X:J1=X:GOSUB800        :rem 255
410 IFPEEK(P)=32THEN630                 :rem 84
420 TU=240:GOSUB810:NEXT:POKES5,228:POKES
    1,228                               :rem 76
430 FORZ1=1TO10:FORZ=KTO1STEP-1:J=Z:J1=Z:
    GOSUB780                            :rem 172
470 IFPEEK(P)=32THEN630                 :rem 90
480 POKEP,28:FORD=1TODL/2:NEXT:NEXT:K=4
                                        :rem 0
490 FORZ=2TO5:J=Z:J1=Z:GOSUB780         :rem 229
530 IFPEEK(P)=32THEN630                 :rem 87
540 POKEP,28:FORD=1TODL/2:NEXT:NEXT:NEXT
                                        :rem 128
550 FORZ=4TOK1:IFS>INT((Z+11)/2)THENS=S-2
                                        :rem 11
560 IFS<INT((Z+11)/2)THENS=S+1          :rem 252
570 J=Z:J1=Z:GOSUB800                   :rem 27
580 IFPEEK(P)=32THEN630                 :rem 92
590 TU=0:GOSUB810:NEXT                  :rem 128
600 FORZ=1TO13:J=X:J1=X:GOSUB800        :rem 1
610 IFPEEK(P)=32THEN630                 :rem 86
620 TU=240:GOSUB810:NEXT:SC=SC+5000
                                        :rem 115
625 POKES5,128+(100-DL):POKES1,128+(100-D
    L)                                  :rem 99
627 POKEP+C,T%(X):POKEP,27:PRINTSPC(S)"
    {WHT}{RVS}BONUS":POKEP,28:GOTO290
                                        :rem 184
630 E$=TI$:POKES5,0:POKES1,0:POKES2,0:POK
    EP+C,2                              :rem 101
640 FORX=180TO220STEP2:POKES2,X:FORD=1TO5
    0:NEXT:NEXT                         :rem 147
650 POKES2,0:FORX=0TO7:P(X)=P+L(X):POKEP,
    42:NEXT:POKES1,175                  :rem 197
660 FORX=15TO7STEP-1:FORY=0TO7:POKEP(Y),4
    6:P(Y)=P(Y)+L(Y):POKEP(Y)+C,1:POKEP(Y
    ),90:NEXT                           :rem 215
670 POKE36878,X:NEXT                    :rem 217
700 POKES1,0:POKE36878,15               :rem 177
710 S9=((VAL(MID$(E$,5,2)))+((VAL(MID$(E$
    ,3,2)))*60)):SC=SC+(S9*10)          :rem 234
720 PRINT"{CLR}{6 RIGHT}{CYN}GAME OVER":P
    RINT"{2 DOWN}"S9"SEC. IN TUNNEL"
                                        :rem 19
722 PRINT"{2 DOWN}SCORE:"SC             :rem 218
725 PRINT"{3 DOWN} FIRE BUTTON TO PLAY"
                                        :rem 125
726 PRINT"{DOWN}C TO CHANGE SKILL
    {5 SPACES}{DOWN}S TO STOP"          :rem 217
730 IF-((PEEK(37151)AND32)=0)=1THEN120
                                        :rem 68
735 GETA$:IFA$="C"THEN115               :rem 156
740 IFA$<>"S"THEN730                    :rem 105
750 END                                 :rem 115
760 POKEP+C,T%(J):POKEP,27:PRINTSPC(S)"
    {WHT}{RVS}BONUS":POKEP,28           :rem 154
770 B=B+1000:SC=SC+B:RETURN             :rem 117
780 T=FNR(4):IFT<=2THENS=S+1:IFS>J+10THEN
    S=S-2                               :rem 114
790 IFT>=3THENS=S-1:IFS<2THENS=S+2
                                        :rem 154
800 POKEP+C,T%(J):SYS828:POKEP,27:P=FNP(P
    ):PRINTSPC(S)B$(J1):RETURN          :rem 215
810 POKEP,28:POKES2,TU:FORD=1TODL:NEXT:PO
    KES2,0:RETURN                       :rem 84
815 FORD=1TO1500:NEXT:RETURN            :rem 51
820 DATA-22,-21,1,23,22,21,-1,-23,28,159
                                        :rem 183
830 DATA156,30,3[illegible],158,169,128,141,19,145,
    169,0,133,1,1[illegible]2,169,127,141,34,145,
    162,119                             :rem 141
840 DATA236,32,145,208,4,169,1,133,1,169,
    255,141,34,145,162,110,236,17,145,208
    ,4,169                              :rem 92
850 DATA1,133,2,96,"{BLU}[[[[[[[[","{GRN}
    [[[[[[[","{YEL}[[[[[[","{PUR}[[[[[","
    {RED}[[[[","{BLU}[[[{2 SPACES}[[["
                                        :rem 194
860 DATA"{BLU}[ [[[ [[","{GRN}[[[{OFF}
    {2 SPACES}[[","{GRN}[{OFF}{2 SPACES}[
    [[[","{YEL}[[[{OFF}{2 SPACES}[","
    {YEL}[{OFF}{2 SPACES}[[["           :rem 35
870 DATA"{PUR}[[[{OFF} [","{PUR}[{OFF} [[
    [","{RED}[[[[" "{RED}[{OFF} [[",6,5,7
    ,4,2                                :rem 172
```

Program 3: Canyon Runner For The 64

Version by Kevin Mykytyn, Editorial Programmer

Refer to the MLX article before typing this program in.

```
49152 :076,181,195,169,019,141,013
49158 :017,208,169,127,141,013,169
49164 :220,169,032,141,020,003,085
49170 :169,192,141,021,003,169,201
49176 :129,141,013,220,141,026,182
49182 :208,096,169,001,141,025,158
49188 :208,173,018,208,201,255,075
49194 :208,042,169,212,141,018,064
49200 :208,173,242,002,208,008,121
49206 :169,007,141,242,002,032,135
49212 :160,193,173,017,208,041,084
49218 :120,013,242,002,141,017,089
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49224 :208,206,242,002,173,013,148
49230 :220,041,001,208,021,076,133
49236 :188,254,169,255,141,018,085
49242 :208,173,017,208,041,120,089
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49272 :018,212,173,249,007,201,212
49278 :243,208,021,169,240,141,124
49284 :249,007,174,167,003,208,172
49290 :003,141,250,007,169,129,069
49296 :141,018,212,076,161,192,176
49302 :238,249,007,174,167,003,220
49308 :208,003,238,250,007,173,011
49314 :000,220,172,176,002,174,138
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49356 :074,074,024,105,214,141,068
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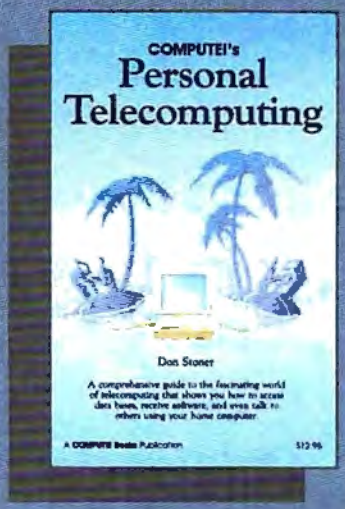

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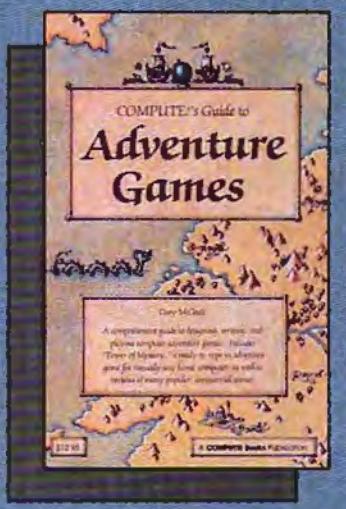

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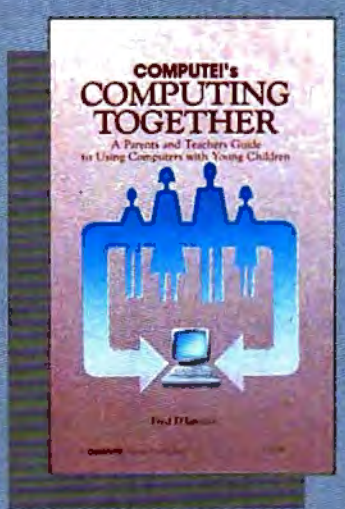

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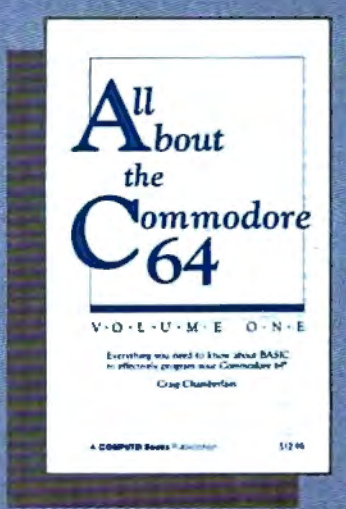

All About the Commodore 64: Volume 1

Craig Chamberlain

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Program 4: Atari Canyon Runner

Version by Kevin Mykytyn, Editorial Programmer

Refer to the MLX article before typing this program in.

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8204:212,133,204,133,206,056,188
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Apple Version Notes

Kevin Martin, Editorial Programmer

The object of the two-player Apple version of "Canyon Runner" is to navigate through a twisting canyon while trying to shoot down an opponent. But beware, your opponent will also be shooting at you.

The program is written in two parts and requires game paddles and a disk drive. Program 5 is all machine language and must be entered with the built-in monitor (see your Apple manual if you are unsure of how this is done). After Program 5 is entered, BSAVE it with the filename CANYON.ML using a starting address of $6000 and length of $923. Once you have saved Program 5, enter the loader program (Program 6) and save it. To play the game, load and run Program 6, which will load in and check the machine language from Program 5, then start the game.

When the program is run, you will be presented with a screen containing many options. Each player can choose his own level of difficulty. Player 1 increases or decreases his difficulty level by pressing X or Z, respectively, while player 2 uses the left and right arrow keys to accomplish this. If you wish to play alone, press S for the solo option.

There are two types of shots. If you press A at the start of the game you will be playing with altitude bombs which explode at the altitude at which they are fired.

The second type of bomb, the detonation bomb (chosen at the start of the game by pressing D), will change its altitude as you change the altitude of your plane, so you can continue to adjust your altitude to the altitude of your opponent after the shot is fired.

The overall width of the canyon can be adjusted by pressing the numbers from 1 to 3. The higher the number picked, the narrower the canyon.

Once the options have been chosen, you can start the game by pressing both paddle buttons simultaneously. The planes are moved from left to right using the paddle. Altitude is changed using the keyboard. Player 1 can increase or decrease his altitude with the A and Z keys. Player 2 can make his plane climb using the semicolon and descend using the period. An altitude reading for each player is displayed at the bottom of the screen.

At any time during the game, you may fire a bomb at your opponent by pressing the paddle fire button. A countdown reading will appear at the bottom of the screen showing the time until impact.

```
8210:233,008,133,225,133,227,209
8216:133,229,230,227,230,229,022
8222:230,229,141,244,002,169,021
8228:000,133,224,133,226,133,117
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8246:002,133,212,173,049,002,113
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8258:145,212,160,006,169,038,028
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8270:247,169,006,145,212,200,033
8276:192,029,208,249,169,007,170
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8318:169,005,133,085,160,009,175
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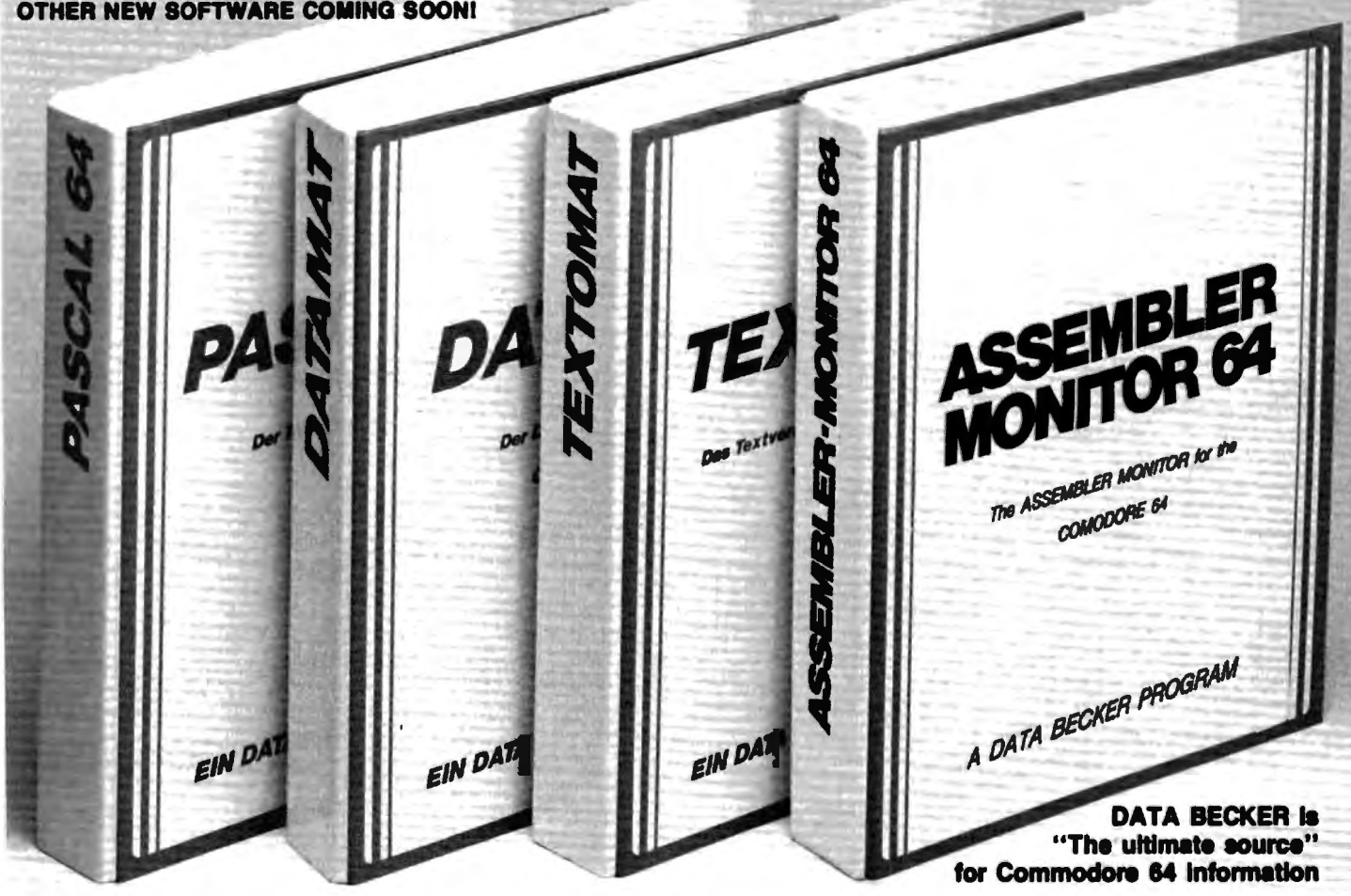

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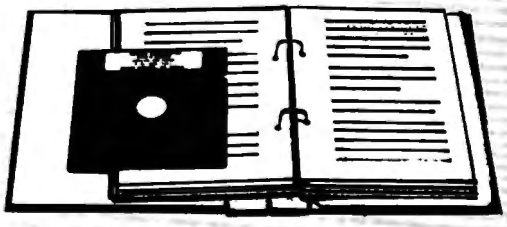

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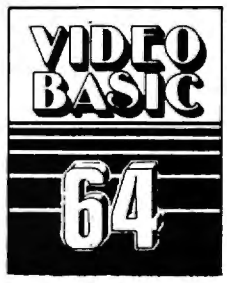

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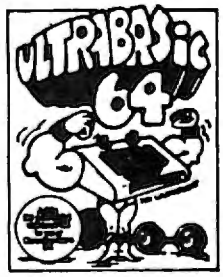

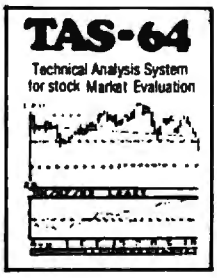

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Program 5: Canyon Runner, Apple ML

Version by Kevin Martin, Editorial Programmer

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6010- A9 A0 A0 85 A3 C9 C8 E5
6018- D0 CC C1 D9 C5 D2 A0 B1
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6080- A0 A0 A0 C3 CF D5 CE D4
6088- A0 C4 CF D7 CE 00 A0 A0
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60A0- AD D0 D2 C5 D3 D3 A0 D2
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60F8- A0 A0 A0 A0 C7 C1 CD C5
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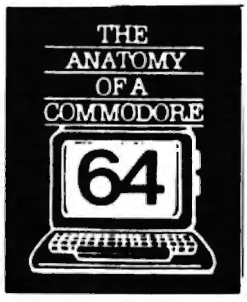

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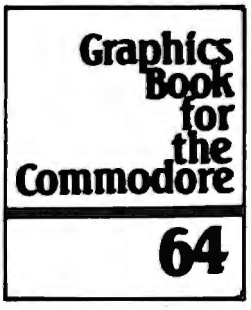

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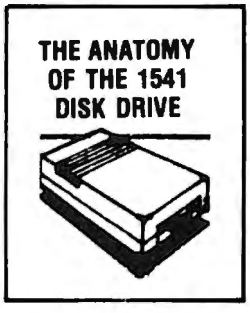

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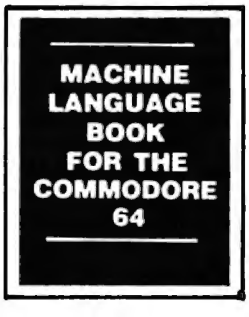

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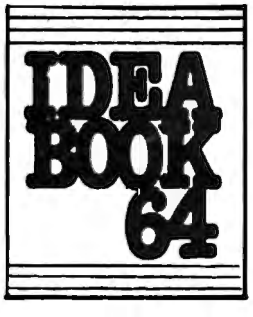

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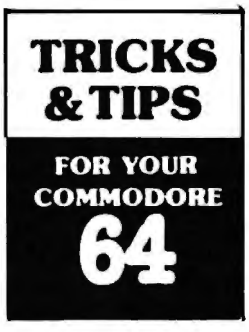

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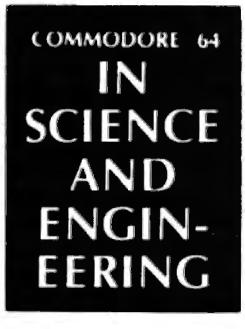

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6170- 61 20 E2 F3 AD F7 F6 20
6178- F4 F3 A9 14 85 22 20 58
6180- FC A9 01 8D 3F 03 A9 04
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65A8- A4 1B A9 00 20 5D F6 A2
65B0- 00 88 D0 FD E8 E0 0A D0
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65C8- 60 20 D8 65 4C 38 61 20
65D0- D8 65 20 FF 65 4C 35 61
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6908- 3A 3E 22 26 2A 2E 32 36
6910- 3A 3E 23 27 2B 2F 33 37
6918- 3B 3F 23 27 2B 2F 33 37
6920- 3B 3F 20 00
```

Program 6: Canyon Runner, Apple Loader

Version by Kevin Martin, Editorial Programmer

```
10  PRINT  CHR$ (4);"BLOAD CANYON.ML
    "
90 CK = 0
100  FOR I = 28672 TO 28761: READ A:
    CK = CK + A: POKE I,A: NEXT
104  IF CK <  > 4288 THEN  PRINT "ER
    ROR IN DATA": END
105 CK = 0
110  FOR I = 24576 TO 26915:CK = CK +
     PEEK (I): NEXT
120  IF CK <  > 265976 THEN  PRINT "
    ERROR IN MACHINE LANGUAGE"
130  CALL 24576
200  DATA  2,0,6,0,36,0,36,45
210  DATA  45,37,36,36,60,44,45,45
220  DATA  53,55,54,54,46,45,45,54
230  DATA  63,63,63,54,54,63,36,36
240  DATA  63,63,39,0,12,12,12,12
250  DATA  12,12,12,12,12,12,12,12
260  DATA  12,12,150,146,58,63,63,25
    5
270  DATA  63,63,63,4,64,24,64,24
280  DATA  21,21,21,21,21,21,149,201

290  DATA  14,14,14,14,14,14,223,219

300  DATA  35,36,36,36,32,36,36,36
310  DATA  0,255,0,0,255,255,0,0
```

Horse Racing

Robert Onufer

Watch your favorite pony win (or lose) in this detailed, effective simulation of race-track betting. Versions included for the TI-99/4A with Extended BASIC, the Commodore 64, VIC-20, Apple II+/IIc/IIe, and IBM PC/PCjr.

"Horse Racing" is a multiplayer game in which you must wager on horses. Up to nine players may play the game, and each starts the game with $500. There are five races. The player with the greatest amount of money after the fifth race is the winner. To make the simulation more accurate, the program recalculates the odds at the beginning of each race. That means that the favorite will always pay lower odds. And you will always know these new odds because they are posted just before the race begins.

Some of the most exciting horse races occur when the track conditions vary. The reason for this is that long shots often have a better chance of winning on slippery tracks because the track could cause some of the better horses to fall or not get a good footing for speed. Horse Racing varies the track conditions from race to race and gives a slight advantage to one horse for each particular track condition. This advantage is taken into account when the initial odds are calculated, making a horse the favorite very often, but not always. In the TI version of Horse Racing, you can change the advantage by changing the value of AD(T) in line 1030. (For other versions, see "Programmer's Notes.")

Track Graphics

After the final odds are displayed, the track is drawn using custom characters. These are drawn on the screen transparently and then lit up all at once in either line 710 or line 720, depending on track conditions. Using the powerful graphics capabilities of TI Extended BASIC, the horses are magnified sprites drawn on a 16 × 16 grid. The animation effect is created by alternating each horse through two different patterns, making the horses appear to move. Speed is randomly updated in lines 750 through 790.

When the program determines that a horse has crossed the finish line, the position of each horse is checked. The victory is given to the horse furthest across the finish line. The track is then erased, payoffs are made or monies deducted, and a summary appears on the screen. After the last race, you may choose to play again by pressing the 1 key or to exit the game by pressing the 2 key.

Program 1: TI Horse Racing

Extended BASIC required.

```
100 DIM NOTE(26),DUR(26)
110 FOR I=1 TO 26 :: READ NOTE(I
    ),DUR(I):: NEXT I
120 DATA 294,30,392,30,494,30,587
    ,45,587,15,587,30,494,45,494,
    15,494,30
130 DATA 392,30,494,30,392,30,294
    ,90,294,30,392,30,494,30,587,
    45,587,15,587,30
140 DATA 494,45,494,15,494,30,294
    ,30,294,30,294,30,392,90
150 IMAGE HORSE ## : ### TO 1
160 A$="000001710F0F0F18204080000
    000000000589C3FF8E0C078442211
    0000000000"
170 B$="000001711170F0F0E040201000
    000000000589C3FF8F8F030101070
    0000000000"
180 C$="00000000000C0BFBF3F1019010
    000000000000463171FDE3E1C3C54D
    2300000000"
```

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```
190 CALL CHAR(128,A$)
200 CALL CHAR(132,B$)
210 CALL CHAR(136,C$)
220 CALL CLEAR :: CALL SCREEN(3)
    : DISPLAY AT(12,9):"HORSE RAC
    ING"
230 GOSUB 990 :: FOR DELAY=1 TO 3
    00 :: NEXT DELAY
240 CALL CLEAR :: CALL SCREEN(5):
    : K=0
250 FOR I=0 TO 14 :: CALL COLOR(I
    ,16,1):: NEXT I
260 DISPLAY AT(8,4):"NUMBER OF PL
    AYERS ?"
270 ACCEPT AT(8,25)SIZE(1)VALIDAT
    E(DIGIT)BEEP:N :: IF (N=0)THE
    N CALL HCHAR(8,28,32,2):: GOT
    O 270
280 FOR I=1 TO N :: CASH(I)=500 :
    : NEXT I
290 DISPLAY AT(10,1):"EACH PLAYER
     STARTS WITH $500"
300 DISPLAY AT(14,2):"HORSES ARE
    NUMBERED FROM"
310 DISPLAY AT(16,8):"BOTTOM TO T
    OP"
320 FOR D=1 TO 600 :: NEXT D
330 K=K+1
340 IF (K>5)+(FL=1)THEN FL=0 :: G
    OTO 1460
350 FOR I=1 TO 5 :: AD(I),AM(I)=0
    :: NEXT I
360 GOSUB 1000 !TRACK COND.
370 GOSUB 1080 !DETERMINE ODDS
380 GOSUB 1150 !PLACE BETS
390 CALL CLEAR
400 GOSUB 560 !DRAW TRACK
410 DISPLAY AT(4,9):"HANOVER DOWN
    S"
420 PAT=128 :: PAT2=132 :: PAT3=1
```

Programmer's Notes For VIC, 64, IBM, and Apple Versions

Patrick Parrish, Programming Supervisor

The VIC-20, Commodore 64, IBM, and Apple versions of "Horse Racing" are designed to capture the excitement of going to the races. As many as nine players can play the game by betting on one of five horses (six horses in the IBM version). Five hundred dollars is awarded to each player to start the game.

Winning odds are based on the wagers made before a race. When betting, bear in mind that each horse favors a different track condition. The advantage gained by a horse running under optimum conditions is determined by the variable AD(T) located in lines 50, 550, 730, and 380 in the VIC, 64, IBM, and Apple versions, respectively. If you want to add to the advantage given to a particular horse under specific track conditions, increase the value assigned to this variable.

The VIC version of Horse Racing runs on the unexpanded VIC with a few bytes to spare. The 64 version uses multicolor sprites to define the horse and riders. A short ML routine to move the sprites is loaded in from the DATA statements beginning at line 1350. The IBM version requires BASICA and a color/graphics adapter for the PC, or a PCjr with Cartridge BASIC. The race track is depicted on graphics screen 1 with the horse and riders drawn from DATA stored in lines 290–500.

The Apple version of Horse Racing runs on all Apple IIs with DOS 3.3 or ProDOS. Since the program uses the secondary text page (at 2048, where the BASIC program normally resides), a series of POKEs is required to relocate the BASIC program. These POKEs are done by Program 5, which serves as our loader program. It locates Program 6 (which must be saved as "HORSERACE") at location 24576 by POKEing 104 and 103 (the high- and low-byte pointers to the start of the BASIC program) with 96 and 0, respectively (256*96+0=24576).

Program 6 defines the horses as high-resolution shapes with shape table DATA stored from line 790 on. The movement of the horses is animated by use of a high-resolution page-flipping routine in lines 190–210. This routine lets you view the horses on one high-resolution screen while drawing them further along the track on a second high-resolution screen. After the shapes have been placed on the second screen, this screen is viewed and drawing is done on the first screen. This sequence continues until the race is won.

A series of POKEs enables us to page flip in Program 6. By alternately accessing locations −16300 and −16299, either high-resolution screen 1 or 2 is displayed. POKEing location 230 with 32 or 64 causes the shapes to be drawn on high-resolution screen 1 or 2, respectively.

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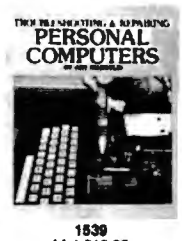
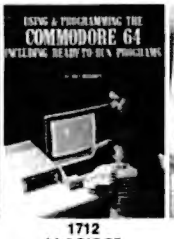


1539
List $19.95

1748
List $16.95

1389
List $15.95

1533
List $17.95



1712
List $13.95

1633
List $19.95

1195
List $13.95

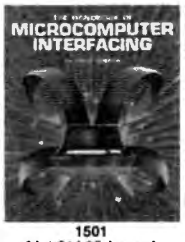
1640
List $21.95

1748
List $17.95

1754
List $12.95

1709
List $16.95

1453
List $16.95



1501
List $14.95 (paper)

1428
List $17.95

1724
List $19.95

1427
List $21.95

1394
List $15.95

1707
List $18.95

1607
List $21.95

1398
List $16.95

1840
List $16.95

1295
List $16.95

1743
List $16.95

1722
List $16.95

1506
List $13.95

1637
List $26.95

1710
List $19.95

1160
List $14.95

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1160 1195 1295 1389 1394 1398 1427 1428 1453
1501 1506 1533 1539 1607 1633 1637 1640 1707 1709
1710 1712 1722 1724 1743 1746 1748 1754 1840

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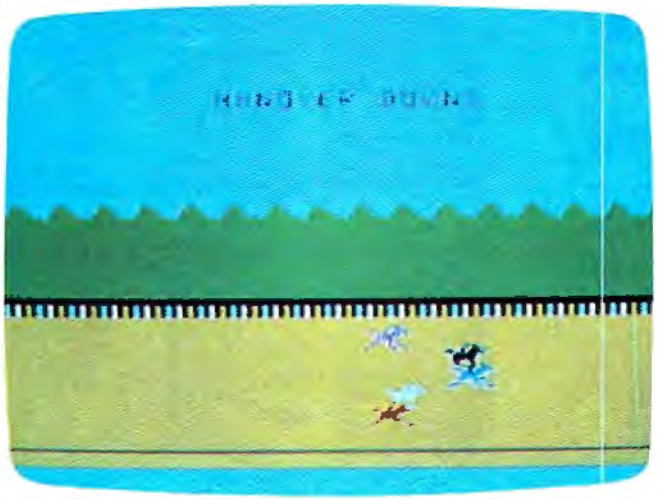


"Horse Racing" for the TI home computer.

```
     36 :: X=4 :: CALL SCREEN(8)
430  CALL MAGNIFY(3)
440  CALL SPRITE(#1,128,7,156,5,#2
     ,128,16,148,5,#3,128,5,140,5,
     #4,128,2,132,5,#5,128,14,124,
     5)
450  GOSUB 990 !OPENING SONG
460  CALL MOTION(#1,0,SP1,#2,0,SP2
     ,#3,0,SP3,#4,0,SP4,#5,0,SP5)
470  CALL POSITION(#1,Y1,X1,#2,Y2,
     X2,#3,Y3,X3,#4,Y4,X4,#5,Y5,X5
     )
480  IF X2>230 OR X1>230 THEN 810
490  IF X4>230 OR X3>230 THEN 810
500  IF X5>230 THEN 810
510  PAT=PAT+X :: PAT2=PAT2-X :: X
     =-X
520  CALL PATTERN(#1,PAT,#2,PAT2,#
     3,PAT,#4,PAT2,#5,PAT)
530  FOR DELAY=1 TO 8 :: NEXT DELA
     Y
540  GOSUB 740 !UPDATE MOTION
550  GOTO 460
560  CALL CHAR(97,"FF")!DRAW RACE
     TRACK
570  CALL CHAR(96,"FFFFFF666666666
     6")
580  CALL CHAR(120,"FFFFFFFFFFFFFF
     FF")
590  FOR I=9 TO 12 :: CALL COLOR(I
     ,1,1):: NEXT I
600  CALL CHAR(104,"80800080800080
     80")
610  CALL CHAR(112,"0101030307CFEF
     FF")
620  CALL CHAR(114,"C0F0F8FCFCFFFF
     FF")
630  CALL CHAR(113,"FFFFFFFFFFFFFF
     FF")
640  CALL HCHAR(15,1,96,32)
650  FOR I=16 TO 22 :: CALL HCHAR(
     I,1,120,32):: NEXT I
660  CALL HCHAR(23,1,97,32)
670  CALL VCHAR(16,31,104,7)
680  FOR I=11 TO 14 :: CALL HCHAR(
     I,1,113,32):: NEXT I
690  FOR I=1 TO 31 STEP 2 :: CALL
     HCHAR(10,I,112):: NEXT I
700  FOR I=2 TO 32 STEP 2 :: CALL
     HCHAR(10,I,114):: NEXT I
710  IF T<5 THEN CALL COLOR(9,2,12
     ,10,16,12,11,13,1,12,12,1)
720  IF T=5 THEN CALL COLOR(9,2,4,
     10,16,4,11,13,1,12,4,1)
730  RETURN
740  RANDOMIZE !SPEED OF HORSES
750  SP1=INT(5*RND+AD(1))
760  SP2=INT(5*RND+AD(2))
770  SP3=INT(5*RND+AD(3))
780  SP4=INT(5*RND+AD(4))
790  SP5=INT(5*RND+AD(5))
800  RETURN
810  ATEM=MAX(MAX(X1,X2),MAX(X3,X4
     ))
820  A=MAX(ATEM,X5)
830  IF A=X1 THEN WIN=1 :: GOTO 87
     0
840  IF A=X2 THEN WIN=2 :: GOTO 87
     0
850  IF A=X5 THEN WIN=5 :: GOTO 87
     0
860  IF A=X3 THEN WIN=3 ELSE WIN=4
870  FOR I=1 TO 5
880  IF I=WIN THEN 900
890  CALL DELSPRITE(#I)
900  NEXT I
910  CALL MAGNIFY(4)
920  CALL MOTION(#WIN,0,0):: CALL
     LOCATE(#WIN,150,124):: CALL P
     ATTERN(#WIN,PAT3):: FOR DELAY
     =1 TO 100 :: NEXT DELAY
930  DISPLAY AT(4,7):"THE WINNER I
     S #";WIN
940  CALL SOUND(1000,392,5)
950  CALL SOUND(1000,332,5)
960  CALL SOUND(1000,262,5)
970  GOSUB 1340 !PAYOFF
980  GOTO 330
990  FOR I=1 TO 26 :: CALL SOUND(D
     UR(I)*3.5,NOTE(I),5):: CALL S
     OUND(30,40000,5):: NEXT I ::
     RETURN
1000 RANDOMIZE !TRACK COND
1010 T=INT(5*RND)+1
1020 TR$(1)="FAST" :: TR$(2)="GOO
     D" :: TR$(3)="SLOW" :: TR$(4
     )="MUDDY" :: TR$(5)="TURF"
1030 AD(T)=.4 :: AM(T)=500
1040 CALL CLEAR :: CALL SCREEN(8)
1050 FOR I=0 TO 8 :: CALL COLOR(I
     ,2,1):: NEXT I
1060 DISPLAY AT(8,12):"RACE";K
1070 DISPLAY AT(12,3):"TRACK COND
     ITION:{3 SPACES}";TR$(T):: F
     OR DELAY=1 TO 300 :: NEXT DE
     LAY :: RETURN
1080 RANDOMIZE !INITIAL ODDS
1090 MT=0
1100 FOR I=1 TO 5 :: M(I)=INT(100
     0*RND)+0.1+AM(I):: MT=MT+M(I
     ):: NEXT I
```

```
1110 FOR I=1 TO 5 :: OD(I)=INT(MT
     /M(I))
1120 IF OD(I)>20 THEN OD(I)=20
1130 NEXT I
1140 RETURN
1150 CALL CLEAR :: CALL SCREEN(7)
     !PLACE BETS
1160 DISPLAY AT(1-(N<5),9):"CURRE
     NT ODDS"
1170 FOR I=1 TO 5 :: DISPLAY AT(1
     +I-(N<5)*2,3):USING 150:I,OD
     (I):: NEXT I
1180 FOR I=2 TO 2*N STEP 2
1190 IF CASH(I/2)<1 THEN AMT(I/2)
     =0 :: GOTO 1270
1200 DISPLAY AT(5+I+(9-N)/2,3):"P
     LAYER";I/2;"BETS - HORSE?"
1210 ACCEPT AT(5+I+(9-N)/2,26)VAL
     IDATE(DIGIT)BEEP SIZE(1):H(I
     /2)
1220 IF H(I/2)>5 THEN CALL HCHAR(
     5+I+(9-N)/2,29,32,3):: GOTO
     1210
1230 DISPLAY AT(6+I+(9-N)/2,3):"A
     MOUNT?" :: ACCEPT AT(6+I+(9-
     N)/2,24)SIZE(3)VALIDATE(DIGI
     T)BEEP:AMT(I/2)
1240 IF AMT(I/2)>CASH(I/2)THEN 12
     30
1250 M(H(I/2))=M(H(I/2))+AMT(I/2)
1260 MT=MT+AMT(I/2)
1270 NEXT I
1280 CALL CLEAR :: CALL SCREEN(14
     )
1290 DISPLAY AT(5,11):"NEW ODDS"
1300 FOR I=1 TO 5 :: OD(I)=INT(MT
     /M(I))
1310 IF OD(I)>20 THEN OD(I)=20
1320 DISPLAY AT(7+I*2,4):USING 15
     0:I,OD(I):: NEXT I
1330 FOR DELAY=1 TO 1000 :: NEXT
     DELAY :: RETURN
1340 FOR I=1 TO N
1350 IF H(I)=WIN THEN CASH(I)=CAS
     H(I)+INT(AMT(I)*INT(MT/M(WIN
     )))
1360 IF H(I)<>WIN THEN CASH(I)=CA
     SH(I)-AMT(I)
1370 NEXT I
1380 CALL DELSPRITE(ALL):: CALL C
     LEAR
1390 DISPLAY AT(3,12):"SUMMARY"
1400 P$="RACES" :: IF K=1 THEN P$
     ="RACE"
1410 DISPLAY AT(5,9):"AFTER";K;P$
1420 FOR I=1 TO N :: DISPLAY AT(8
     +I,3):USING 1510:I,CASH(I):
      NEXT I
1430 FOR DELAY=1 TO 1500 :: NEXT
     DELAY
1440 FL=1 :: FOR I=1 TO N :: IF C
     ASH(I)>0 THEN I=N :: FL=0
1450 NEXT I :: RETURN
1460 CALL DELSPRITE(ALL):: CALL C
     LEAR :: CALL SCREEN(16)
1470 DISPLAY AT(12,10):"GAME OVER
     " :: DISPLAY AT(21,3):"PRESS
      1 TO PLAY AGAIN" :: DISPLAY
      AT(23,4):"PRESS 2 TO END GA
     ME"
1480 CALL KEY(0,KEY,S)
1490 IF KEY=49 THEN 240
1500 IF KEY<>50 THEN 1480
1510 IMAGE PLAYER ##:   $$$$$$$
1520 CALL CLEAR :: END
```

Program 2: 64 Horse Racing

Refer to the "Automatic Proofreader" article before typing this program in.

Translation by Jeff Hamdani, Editorial Programmer

```
10 POKE53280,6:DIMHF(28),LF(28),DR(28)
                                    :rem 71
20 PRINT"{CLR}{9 DOWN}"TAB(14)"{YEL}{RVS}
   HORSE RACING{OFF}{WHT}"          :rem 172
30 PRINT"{9 DOWN}{WHT}"TAB(5)"LOADING DAT
   A.......PLEASE WAIT":V=53248     :rem 143
40 FORI=12288TO12414:READA:POKEI,A:NEXT:P
   OKEV+28,31                       :rem 136
50 POKEV+37,0:POKEV+38,9:FORI=1TO5:POKE20
   39+I,192:POKEV+38+I,6-I:NEXT     :rem 210
60 FORI=0TO8STEP2:READA:POKEV+I+1,A:NEXT:
   FORI=1TO5:READCR(I):NEXT          :rem 6
70 FORI=1TO26:READHF(I),LF(I),DR(I):NEXT:
   I=0:CT=0                         :rem 233
80 IFPEEK(49523)=212ANDPEEK(49524)=96THEN
   120                               :rem 5
90 I=I+1:READA:CT=CT+A:IFA=256THEN110
                                    :rem 225
100 POKE49151+I,A:GOTO90            :rem 129
110 IFCT<>45269THENPRINT"{CLR}ERROR IN RE
    ADING DATA IN.":END             :rem 218
120 PRINT"{CLR}":S=54272:FORL=STOS+24:POK
    EL,0:NEXT                       :rem 211
130 POKES+24,15:POKES+5,18:POKES+6,245
                                    :rem 206
140 POKE53280,15:POKE53281,15:PRINT"
    {10 DOWN}{BLU}"TAB(14)"HORSE RACING":
    GOSUB1060                       :rem 177
150 PRINT"{3 DOWN}"TAB(7)"NUMBER OF PLAYE
    RS (1-9)? ";:HR=0               :rem 94
160 GETZ$:N=VAL(Z$):IF(N<1ORN>9)THEN160
                                    :rem 109
170 PRINTZ$:FORI=1TO200:NEXT:FORI=1TON:CH
    (I)=500:NEXT:PRINT"{CLR}{7 DOWN}"
                                    :rem 177
180 PRINTTAB(6)"EACH PLAYER STARTS WITH $
    500."                           :rem 170
190 PRINTTAB(3)"{DOWN}WHEN A PLAYER LOSES
     ALL OF HIS/HER"                :rem 253
200 PRINTTAB(10)"{DOWN}MONEY, THE GAME EN
    DS."                             :rem 4
210 PRINT"{2 DOWN}HORSES ARE NUMBERED FRO
    M BOTTOM TO TOP."               :rem 81
220 FORI=1TO4000:NEXT               :rem 18
230 HR=HR+1                         :rem 98
240 FORI=1TON:AD(I)=0:AM(I)=0:NEXT:rem 51
250 GOSUB530:REM TRACK CONDITION    :rem 233
260 GOSUB590:REM CALCULATE ODDS     :rem 140
270 GOSUB630:REM PLACE BETS          :rem 99
280 GOSUB400:REM DRAW TRACK         :rem 111
290 POKES+5,17:POKES+6,24:POKES+2,4:POKES
    +3,5:POKEV+(2*T-2),24+AD(T):SYS49152
                                    :rem 35
300 FORI=0TO8STEP2:A=PEEK(V+I):IFA=65THEN
    WN=(I+2)/2                      :rem 140
```

Horse-racing action in the Commodore 64 version of "Horse Racing."

```
310 NEXT:POKEV+21,2↑(WN-1):POKEV+16,0:POK
    EV+(2*WN-2),0                     :rem 212
320 POKE53280,(PEEK(1664-80*(WN-1)+S))AND
    15:J=192                          :rem 177
330 FORI=1TO15:PRINT"{HOME}{5 DOWN}"TAB(8
    )"THE WINNER IS HORSE #";WN:GOSUB380
                                      :rem 125
340 IF(I/2)=INT(I/2)THENJ=193         :rem 151
350 POKEV+(2*WN-2),15+(I+8):POKE2039+WN,J
    :FORK=1TO150:NEXT                 :rem 188
360 PRINT"{HOME}{5 DOWN}"TAB(8)"
    {23 SPACES}":FORK=1TO150:NEXT:J=192:N
    EXT                               :rem 216
370 POKEV+21,0:GOTO880                :rem 28
380 POKES+1,(RND(0)*40)+40:POKES,200:POKE
    S+4,17:POKES+4,16:RETURN          :rem 105
390 REM DRAW TRACKS                   :rem 118
400 POKE53280,6:POKE53281,13:SP=160
                                      :rem 212
410 A$="{RVS}{40 SPACES}{OFF}"        :rem 31
420 PRINT"{CLR}{6 DOWN}{WHT}[R]C[R]C[R]C
    [R]C[R]C[R]C[R]C[R]C[R]C[R]C[R]C[R]C
    [R]C[R]C[R]C[R]C[R]C[R]C[R]C[R]C";
                                      :rem 196
430 PRINT"{WHT}B B B B B B B B B B B B B
    {SPACE}B B B B B B B";            :rem 208
440 PRINT"{HOME}{7 DOWN}":FORI=1TO5:FORJ=
    1TO2:PRINTCHR$(CR(I))A$;:NEXTJ,I
                                      :rem 113
450 PRINT"{HOME}{19 DOWN}{WHT}"MID$(A$,1,
    LEN(A$)-2)                        :rem 246
460 FORI=1TO4:FORJ=4TO34STEP10:PRINTTAB(J
    )"{WHT}{RVS} {OFF}{9 SPACES}";:NEXTJ:
    NEXTI                             :rem 120
470 POKE1823,SP:POKE1823+S,1:FORI=1988TO2
    018STEP10:POKEI,SP:POKEI+S,1:NEXT
                                      :rem 140
480 PRINT"{HOME}{BLU}{DOWN}"TAB(9)"[M]
    [20 T][G]"                        :rem 93
490 PRINTTAB(9)"[M]{3 SPACES}HANOVER
    {2 SPACES}DOWNS{3 SPACES}[G]":rem 185
500 PRINTTAB(9)"[M][20 @][G]"         :rem 227
510 FORI=0TO8STEP2:POKEV+I,24:NEXT:POKEV+
    21,31:RETURN                      :rem 177
520 REM DETERMINE TRACK CONDITION :rem 52
530 T=INT(5*RND(0))+1                 :rem 133
540 TR$(1)="FAST":TR$(2)="GOOD":TR$(3)="S
    LOW":TR$(4)="MUDDY":TR$(5)="TURF"
                                      :rem 236
550 AD(T)=3:AM(T)=500                 :rem 115
560 PRINT"{CLR}{8 DOWN}"TAB(17)"RACE";HR:
    A$="TRACK CONDITION: ":TB=LEN(A$+TR$(
    T))                               :rem 253
570 PRINT"{4 DOWN}"TAB(INT(TB/2)-1);A$+TR
    $(T):FORD=1TO1000:NEXT:RETURN:rem 110
580 REM DETERMINE ODDS                :rem 72
590 MT=0:FORI=1TO5:M(I)=INT(1000*RND(0))+
    .1+AM(I):MT=MT+M(I):NEXT          :rem 103
600 FORI=1TO5:OD(I)=INT(MT/M(I)):IFOD(I)>
    20THENOD(I)=20                    :rem 52
610 NEXT:RETURN                       :rem 240
620 REM PLACE BETS                    :rem 15
630 PRINT"{CLR}{DOWN}"TAB(15)"{RVS}CURREN
    T ODDS{OFF}{DOWN}"                :rem 226
640 PRINTTAB(11)"{DOWN}HORSE #"SPC(7)"ODD
    S{DOWN}"                          :rem 151
650 FORI=1TO5:PRINTTAB(13)I;TAB(23);OD(I)
    ;"TO 1":NEXT:PRINT"{2 DOWN}":RW=13
                                      :rem 90
660 FORI=2TO2*NSTEP2:CN=35:IFCH(I/2)<=0TH
    ENA1(I/2)=0:GOTO790               :rem 122
670 PRINT"PLAYER";I/2;"BETS    HORSE? ";
                                      :rem 245
680 GETZ$:M=VAL(Z$):IFM<1ORM>5THEN680
                                      :rem 35
690 PRINTZ$;:H(I/2)=M:PRINTSPC(3)"AMOUNT
    {SPACE}$ ":A$=""                  :rem 121
700 GETZ$:IF Z$=""THEN700             :rem 131
710 IFASC(Z$)=13THEN770               :rem 59
720 IFASC(Z$)=20THEN760               :rem 57
730 IFASC(Z$)<48ORASC(Z$)>57THEN700
                                      :rem 46
740 IFCN=39THEN700                    :rem 42
750 A$=A$+Z$:POKE214,RW:PRINT:POKE211,CN:
    PRINTZ$:CN=CN+1:GOTO700           :rem 230
760 POKE214,RW:PRINT:POKE211,35:PRINT"
    {4 SPACES}";:CN=35:A$="":GOTO700
                                      :rem 112
770 IFVAL(A$)=0ORVAL(A$)>CH(I/2)THEN760
                                      :rem 253
780 A1(I/2)=VAL(A$):M(H(I/2))=M(H(I/2))+A
    1(I/2):MT=MT+A1(I/2):RW=RW+1   :rem 41
790 NEXT                              :rem 223
800 PRINT"{CLR}{5 DOWN}"TAB(17)"{RVS}NEW
    {SPACE}ODDS{OFF}{2 DOWN}"         :rem 255
810 PRINTTAB(11)"HORSE #"SPC(7)"ODDS
    {DOWN}"                           :rem 133
820 FORI=1TO5:OD(I)=INT(MT/M(I)):IFOD(I)>
    20THENOD(I)=20                    :rem 56
830 PRINTTAB(13);I;TAB(23);OD(I)"TO 1":NE
    XT                                :rem 249
840 PRINT"{2 DOWN}"TAB(12)"PRESS {RVS}B
    {OFF} TO BEGIN"                   :rem 217
850 GETZ$:IFZ$<>"B"THEN850            :rem 14
860 RETURN                            :rem 126
870 REM DETERMINE WINNER(S)           :rem 151
880 FORI=1TON                         :rem 47
890 IFH(I)=WNTHENCH(I)=CH(I)+INT(A1(I)*IN
    T(MT/M(WN))):GOTO910              :rem 163
900 CH(I)=CH(I)-A1(I)                 :rem 89
910 NEXT                              :rem 217
920 POKE53280,15:POKE53281,15:PRINT"{CLR}
    "TAB(17)"{RVS}SUMMARY{OFF}"       :rem 160
930 P$="RACES":IFHR=1THENP$="RACE":rem 15
940 PRINT"{2 DOWN}"TAB(14)"AFTER";HR;P$
                                      :rem 87
950 PRINT"{3 DOWN}"TAB(5)"PLAYER #"TAB(29
    )"AMOUNT"                         :rem 222
960 PRINTTAB(5)"[8 T]"TAB(29)"[6 T]{DOWN}
    "                                 :rem 159
```

```
970 FL=1:FORI=1TON:IFCH(I)>0THENI=N:FL=0
                                    :rem 1
980 NEXTI:FORI=1TON                :rem 242
990 PRINTTAB(8);I;TAB(29);"$";CH(I):NEXTI
                                   :rem 166
1000 IFFL=1ORHR=5THEN1020          :rem 239
1010 FORX=1TO3000:NEXT:GOTO230      :rem 86
1020 PRINTTAB(15);"{2 DOWN}GAME OVER":PRI
     NT"{6 RIGHT}{DOWN}DO YOU WISH TO PLA
     Y AGAIN ?"                    :rem 226
1030 GETZ$:IFZ$<>"Y"ANDZ$<>"N"THEN1030
                                   :rem 208
1040 IFZ$="Y"THENPOKE53281,6:RUN   :rem 158
1050 END                           :rem 157
1060 FORI=1TO26:POKES+1,HF(I):POKES,LF(I)
     :POKES+4,33:FOR T= 1TO 40:NEXT:rem 0
1070 POKES+4,32:FORJ=1TODR(I)*3.7:NEXT:NE
     XT:RETURN                     :rem 180
1080 DATA0,0,0,0,0,0,0,0           :rem 151
1090 DATA0,0,32,0,0,40,0,0          :rem 1
1100 DATA32,0,0,168,16,0,170,124   :rem 58
1110 DATA0,161,173,0,167,247,0,175
                                   :rem 172
1120 DATA195,63,251,192,127,251,192,127
                                   :rem 182
1130 DATA251,192,127,202,192,79,3,240
                                    :rem 74
1140 DATA15,0,240,15,0,204,51,0     :rem 2
1150 DATA51,204,0,51,204,0,0,0     :rem 205
1160 DATA0,0,0,0,0,0,0,0           :rem 150
1170 DATA0,0,32,0,0,40,16,0         :rem 55
1180 DATA32,124,0,169,253,0,170,135
                                   :rem 223
1190 DATA0,161,227,0,163,192,0,175
                                   :rem 175
1200 DATA192,63,235,192,127,251,192,127
                                   :rem 180
1210 DATA251,192,127,251,240,124,250,240
                                   :rem 210
1220 DATA124,0,48,60,3,240,15,12    :rem 62
1230 DATA192,12,195,192,3,195,0     :rem 36
1240 DATA173,156,141,126,110       :rem 137
1250 DATA 151,159,150,5,152:REM CR(I)
                                   :rem 120
1260 DATA 18,209,30,25,30,30,31,165,30
                                    :rem 58
1270 DATA 37,162,45,37,162,15,37,162,30
                                   :rem 127
1280 DATA 31,165,45,31,165,15,31,165,30
                                   :rem 119
1290 DATA 25,30,30,31,165,30,25,30,30
                                    :rem 3
1300 DATA 18,209,100               :rem 203
1310 DATA 18,209,30,25,30,30,31,165,30
                                    :rem 54
1320 DATA 37,162,45,37,162,15,37,162,30
                                   :rem 123
1330 DATA 31,165,45,31,165,15,31,165,30
                                   :rem 115
1340 DATA 18,209,30,18,209,30,18,209,30,2
     5,30,110                       :rem 87
1350 DATA 169,150,141,15,212,169:REM ML C
     ODE                           :rem 248
1360 DATA 129,141,18,212,32,40     :rem 185
1370 DATA 192,238,0,208,238,2      :rem 147
1380 DATA 208,238,4,208,238,6      :rem 154
1390 DATA 208,238,8,208,32,237     :rem 205
1400 DATA 192,32,40,193,32,84      :rem 142
1410 DATA 193,76,10,192,173,16     :rem 197
1420 DATA 208,41,1,240,10,172      :rem 126
1430 DATA 0,208,192,65,208,23      :rem 142
1440 DATA 76,81,193,172,0,208      :rem 150
1450 DATA 192,255,208,13,173,16    :rem 248
1460 DATA 208,9,1,141,16,208        :rem 92
1470 DATA 169,0,141,0,208,173      :rem 141
1480 DATA 16,208,41,2,240,10        :rem 82
1490 DATA 172,2,208,192,65,208     :rem 203
1500 DATA 23,76,81,193,172,2        :rem 96
1510 DATA 208,192,255,208,13,173    :rem 40
1520 DATA 16,208,9,2,141,16         :rem 39
1530 DATA 208,169,0,141,2,208      :rem 139
1540 DATA 173,16,208,41,4,240      :rem 139
1550 DATA 10,172,4,208,192,65      :rem 145
1560 DATA 208,23,76,81,193,172     :rem 206
1570 DATA 4,208,192,255,208,13     :rem 199
1580 DATA 173,16,208,9,4,141        :rem 99
1590 DATA 16,208,169,0,141,4        :rem 96
1600 DATA 208,173,16,208,41,8      :rem 144
1610 DATA 240,10,172,6,208,192     :rem 187
1620 DATA 65,208,23,76,81,193      :rem 156
1630 DATA 172,6,208,192,255,208    :rem 252
1640 DATA 13,173,16,208,9,8         :rem 50
1650 DATA 141,16,208,169,0,141     :rem 191
1660 DATA 6,208,173,16,208,41      :rem 148
1670 DATA 16,240,10,172,8,208      :rem 142
1680 DATA 192,65,208,23,76,81      :rem 161
1690 DATA 193,172,8,208,192,255      :rem 7
1700 DATA 208,13,173,16,208,9      :rem 145
1710 DATA 16,141,16,208,169,0      :rem 141
1720 DATA 141,8,208,96,173,27      :rem 155
1730 DATA 212,56,233,5,176,252     :rem 197
1740 DATA 105,6,96,32,226,192      :rem 152
1750 DATA 168,192,1,208,7,32       :rem 101
1760 DATA 40,192,238,0,208,96      :rem 154
1770 DATA 192,2,208,7,32,40         :rem 45
1780 DATA 192,238,2,208,96,192     :rem 214
1790 DATA 3,208,7,32,40,192         :rem 48
1800 DATA 238,4,208,96,192,4       :rem 105
1810 DATA 208,7,32,40,192,238      :rem 147
1820 DATA 6,208,96,192,5,208       :rem 107
1830 DATA 6,32,40,192,238,8         :rem 50
1840 DATA 208,96,162,0,189,248     :rem 213
1850 DATA 7,201,192,208,8,169      :rem 156
1860 DATA 193,157,248,7,76,62      :rem 169
1870 DATA 193,169,192,157,248,7     :rem 17
1880 DATA 32,71,193,232,224,5      :rem 149
1890 DATA 208,228,96,165,162,24      :rem 8
1900 DATA 105,1,197,162,208,252    :rem 244
1910 DATA 96,104,104,96,169,6      :rem 159
1920 DATA 141,1,212,169,10,141     :rem 181
1930 DATA 0,212,169,65,141,4        :rem 93
1940 DATA 212,162,0,160,0,200      :rem 123
1950 DATA 208,253,232,224,50,208    :rem 39
1960 DATA 246,169,64,141,4,212     :rem 203
1970 DATA 96,256                    :rem 35
```

Program 3: VIC Horse Racing

Refer to the "Automatic Proofreader" article before typing this program in.

Translation by Jeff Hamdani, Editorial Programmer

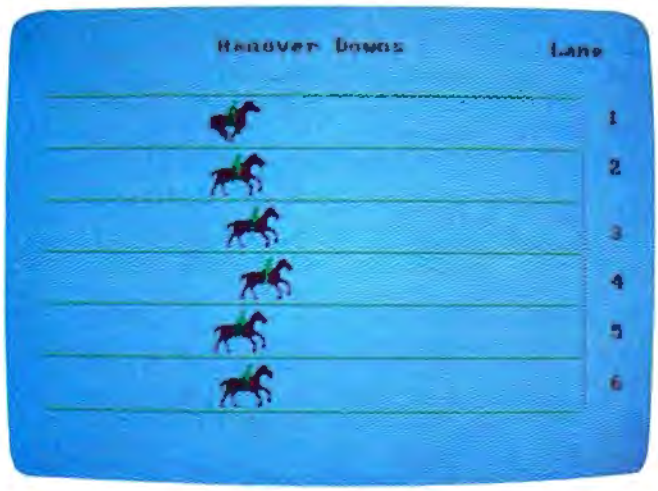
```
2 POKE36879,110:PRINT"{CLR}{9 DOWN}
  {5 RIGHT}{WHT}HORSE RACING"      :rem 50
4 POKE52,28:POKE56,28:CLR:FORI=7168TO7679
  :POKEI,PEEK(I+25600):NEXT        :rem 32
6 FORI=1TO3:READA:FORJ=ATOA+7:READB:POKEJ
  ,B:NEXTJ,I:POKE36869,255         :rem 162
8 V=36878:S=36874:CL=30720         :rem 179
10 INPUT"{CLR}{10 DOWN}{WHT}# OF PLAYERS
   {SPACE}(1-9) ";N:IFN<1ORN>9THEN10
                                   :rem 58
```

```
12 FORI=1TON:CH(I)=500:NEXT:R=0:FORY=9TO1
   7STEP2:PN((Y-7)/2)=7680+22*Y:NEXT
                                        :rem 51
14 FORI=1TO5:AM(I)=0:AD(I)=0:NEXT:POKE368
   79,110:GOSUB48:GOSUB54:GOSUB60:rem 138
16 DEFFNL(I)=PN(I)+X(I):HR=0:WN=0:GOSUB36
                                        :rem 242
18 FORI=1TO5:X(I)=1:POKEFNL(I)+CL,2+I:POK
   EFNL(I),HR:NEXT:HR=33                :rem 129
20 FORI=1TO5:Z=RND(0)/2:POKEFNL(I),32:X(I
   )=X(I)+1+AD(I)+Z:POKEFNL(I)-1-AD(I)-Z,
   32                                   :rem 14
22 POKEFNL(I)+CL,2+I:POKEFNL(I),HR:GOSUB3
   4:NEXT                               :rem 220
24 G=0:FORI=1TO5:IFX(I)>=19THENG=1:rem 78
26 NEXT:IFG=0THENHR=33-HR:GOTO20  :rem 44
28 H=0:FORI=0TO4:IFX(I+1)>HTHENH=X(I+1):W
   N=I+1                                :rem 45
30 NEXT:POKEFNL(WN),32:X(WN)=X(WN)+1:POKE
   FNL(WN)+CL,2+WN:POKEFNL(WN),HR :rem 13
32 PRINT"{HOME}{20 DOWN}{2 SPACES}WINNER
   {SPACE}IS HORSE #";WN:FORD=1TO3000:NEX
   T:GOTO80                             :rem 29
34 POKEV,15:POKES,INT(RND(0)*8)+200:POKEV
   ,0:RETURN                            :rem 91
36 A$="&&&&&&&&&&&&&&&&&&&&&&&&":B$="------
   ----------------":PRINT"{CLR}{7 DOWN}"
                                        :rem 167
38 POKE36879,26                         :rem 63
40 FORI=1TO6:PRINT"{BLK}"B$"{DOWN}";:NEXT
   :PRINT"{WHT}"A$;:PRINTSPC(3)"&"SPC(7)"
   &"SPC(6)"&"                          :rem 223
42 POKE8167,38:POKE8167+CL,1:POKE8175,38:
   POKE8175+CL,1:POKE8182,38:POKE8182+CL,
   1                                    :rem 168
44 PRINT"{HOME}"TAB(3)"{2 DOWN}{BLK}*****
   ************":PRINTTAB(3)"* {RED}HANOV
   ER DOWNS {BLK}*"                     :rem 107
46 PRINTTAB(3)"{BLK}****************
   {BLU}":RETURN                        :rem 41
48 T=INT(5*RND(0))+1:TR$(1)="FAST":TR$(2)
   ="GOOD":TR$(3)="SLOW":TR$(4)="MUDDY"
                                        :rem 154
50 TR$(5)="TURF":AD(T)=.08:AM(T)=500:R=R+
   1:PRINT"{CLR}{8 DOWN}{WHT}"TAB(8)"RACE
   ";R                                  :rem 219
52 PRINT"{2 DOWN}TRACK CONDITION: ";TR$(T
   ):FORI=1TO2000:NEXT:RETURN      :rem 42
54 MT=0:FORI=1TO5:M(I)=INT(1000*RND(0))+.
   1+AM(I):MT=MT+M(I):NEXT              :rem 50
56 FORI=1TO5:OD(I)=INT(MT/M(I)):IFOD(I)>2
   0THENOD(I)=20                         :rem 9
58 NEXT:RETURN                          :rem 198
60 FORI=1TON                            :rem 245
62 IFCH(I)<1THENA1(I)=0:GOTO74     :rem 15
64 PRINT"{CLR}{5 DOWN}"TAB(5)"CURRENT ODD
   S{DOWN}":FORJ=1TO5:PRINTTAB(2)"HORSE"J
   ,OD(J)"TO 1":NEXT                    :rem 238
66 PRINT"{2 DOWN}PLAYER #";I;"BETS-HORSE"
                                        :rem 46
68 INPUTH(I):IFH(I)<1ORH(I)>5THEN68
                                        :rem 139
70 INPUT"{DOWN}AMOUNT$";A1(I):IFA1(I)>CH(
   I)ORINT(A1(I))<>A1(I)ORA1(I)<=0THEN64
                                        :rem 33
72 M(H(I))=M(H(I))+A1(I):MT=MT+A1(I)
                                        :rem 205
74 NEXT:PRINT"{CLR}{6 DOWN}"TAB(7)"NEW OD
   DS{DOWN}"                            :rem 118
76 FORI=1TO5:OD(I)=INT(MT/M(I)):IFOD(I)>2
   0THENOD(I)=20                         :rem 11
78 PRINT"{2 SPACES}HORSE"I,OD(I)"TO 1
   {DOWN}":NEXT:FORDL=1TO3000:NEXT:RETURN
                                        :rem 29
80 FORI=1TON:IFH(I)=WNTHENCH(I)=CH(I)+INT
   (A1(I)*INT(MT/M(WN))):GOTO84     :rem 5
82 CH(I)=CH(I)-A1(I)                    :rem 42
84 NEXT:PRINT"{CLR}{DOWN}{7 RIGHT}SUMMARY
   {2 DOWN}":PRINTTAB(5)"AFTER";R;"RACES
   {DOWN}"                              :rem 218
86 FL=1:FORI=1TON:IFCH(I)>0THENFL=0
                                        :rem 193
88 NEXT:PRINT"{2 SPACES}PLAYERS"SPC(5)"AM
   OUNT":FORI=1TON:PRINTTAB(4)I,SPC(3)"$"
   CH(I):NEXT                           :rem 47
90 IFFL=1ORR=5THEN94                    :rem 249
92 FORK=1TO2500:NEXT:GOTO 14      :rem 198
94 PRINTTAB(6)"{DOWN}GAME OVER":PRINT"
   {2 DOWN}{2 SPACES}PLAY AGAIN (Y/N)?"
                                        :rem 44
96 GETZ$:IFZ$=""OR(Z$<>"Y"ANDZ$<>"N")THEN
   96                                   :rem 23
98 IFZ$="Y"THENRUN                      :rem 124
100 POKE36869,240:END                   :rem 163
102 DATA7168,4,10,11,126,254,106,66,129
                                        :rem 173
104 DATA7432,20,22,45,126,254,202,66,36
                                        :rem 171
106 DATA7472,255,255,255,255,255,255,255,
    255,255                             :rem 141
```

Program 4: IBM PC/PCjr Horse Racing

Translation by Gregg Peele, Assistant Programming Supervisor

```
10 DEFINT O:DEFINT T:CLS:DEF SEG = 0:POK
E 1047,0
20 SCREEN 1,0:COLOR 1,1,0 :KEY OFF
30 CLS:DIM XO (150):WA =0
40 READ X,Y:E=(4+INT((X+7)/8)*Y)/2:DIM O
(E):O(0)=X:O(1)=Y:FOR I=2 TO E:READ O(I)
:NEXT
50 READ X1,Y1:E1=(4+INT((X1+7)/8)*Y1)/2:
DIM O1(E1):O1(0)=X1:O1(1)=Y1:FOR I=2 TO
E1:READ O1(I):NEXT:GOSUB 620
60  IF K>5 THEN 1080
70 CLS:LOCATE 12,10,0:COLOR 1,1,0:PRINT"
PRESS ANY KEY TO START":WE$ = ""
80 WE$= INKEY$ : IF WE$= "" THEN A= RND(
1): GOTO 80:ELSE CLS:WA=0:GOSUB 570
90 GOSUB 670:REM TRACK CONDITIONS
100 GOSUB 760: REM DETERMINE ODDS
110 GOSUB 790:COLOR BACK,-(BACK=2)
120 FOR TI = 1 TO 175 STEP 25:LINE (0,TI
+26)-(286,TI+26),8-BACK: NEXT
130 LINE (288,27)-(288,176),9-BACK,,&HAA
AA:LOCATE 1,12:PRINT "Hanover Downs"
140 LOCATE 1,35:PRINT"Lane":FOR E=1 TO 6
:LOCATE (E*3.2)+2,38:PRINT E:NEXT
150 WHILE WA = 0
160 FOR SLOT = 0 TO 125 STEP 25
170 PUT (XO(SLOT),SLOT+30),0,PSET
180 NEXT: GOSUB 260
190 FOR SLOT =0 TO 125 STEP 25: IF XO(SLO
T)>318 -O(0) THEN WA = 1:WINNER = INT(SL
OT/25)+1
200 XO(SLOT)=XO(SLOT)+ RND(1)*3+AD(SLOT/
25+1)
210 NEXT
220 FOR SLOT = 0 TO 125 STEP 25
```



Six horses racing for victory in the IBM version of "Horse Racing."

```
230 PUT (XO(SLOT),SLOT+30),01,PSET
240 NEXT:GOSUB 260
250 WEND:FOR SLOT = 0 TO 1:NEXT:GOTO 270

260 SOUND 32767,1:RETURN
270 LOCATE 23,14:PRINT "HORSE";WINNER; "
WINS"
280 FOR DELAY = 1 TO 5000:NEXT :GOTO 100
0
290 DATA &H40,&H14,&H0,&H0,&H4001,&H2,&H
0,&H0
300 DATA &H4005,&H802A,&H0,&H0,&H5,&H60A
A,&H0,&H0
310 DATA &H215,&HA8AA,&H0,&H0,&H215,&HAA
AA,&H0,&H0
320 DATA &H5A55,&H2AA0,&H0,&H100,&HAA54,
&H880,&H0,&HAAAA
330 DATA &HAA56,&H80,&H2A00,&HAAAA,&HAA9
6,&H80,&HA200,&HAAAA
340 DATA &HAA96,&H80,&H8200,&HAAAA,&HAA5
A,&HA8,&H8200,&HAAAA
350 DATA &HAA5A,&H80AA,&H200,&HA1AA,&HAA
62,&HA000,&HA00,&H18A
360 DATA &HA00,&H2800,&HA00,&H28,&H200,&
H880,&H2800,&H20
370 DATA &H0,&H8A0,&H2000,&H8,&H0,&H2820
,&HA000,&H8
380 DATA &H0,&H2820,&H8000,&H2,&H0,&HA0,
&HA000,&H8002
390 DATA &H0,&HA0,&H0
400 DATA &H40,&H14,&H0,&H0,&H14,&H28,&H0
,&H0
410 DATA &H214,&HAA,&H0,&H0,&HA50,&H80A9
,&H0,&H100
420 DATA &H2A50,&HA8AA,&H0,&H500,&HAA56,
&HAAAA,&H0,&H500
430 DATA &HAA4A,&H2880,&H0,&H500,&HAA6A,
&H0,&HA00,&HA9AA
440 DATA &HAA6A,&H0,&H2A00,&HAAAA,&HAA5A
,&H0,&H2A00,&HAAAA
450 DATA &HAA5A,&H0,&H8A00,&HA9AA,&HAA6A
,&H0,&H8A00,&HA5AA
460 DATA &HAAAA,&H0,&H8A00,&H85AA,&HA20A
,&H0,&H2200,&H80AA
470 DATA &H880A,&H0,&H0,&HA02A,&H200A,&H
0,&H0,&HA80A
480 DATA &H802A,&H0,&H0,&H8802,&HA0,&H0,
&H0,&HA000
490 DATA &H80,&H0,&H0,&H2800,&H80,&H0,&H
0,&H200
500 DATA &H80,&H0,&H0
510 DATA 293,30,392,30,494,30,587,45,587
,15,587,30
520 DATA 494,45,494,15,494,30
530 DATA 392,30,494,30,392,30,294,90
540 DATA 293,30,392,30,494,30,587,45,587
,15,587,30
550 DATA 494,45,494,15,494,30
560 DATA 294,30,294,30,294,30,392,90,-1,
-1
570 RESTORE 510
580 READ PITCH,DUR:IF PITCH =-1 THEN 610

590 SOUND PITCH,DUR/16:SOUND 32767,1
600 GOTO 580
610 FOR SLOT = 0 TO 125 STEP 25:XO (SLOT
) = 0 :NEXT :RETURN
620 CLS: LOCATE 10,14:PRINT "Horse Racin
g":LOCATE 14,11 :INPUT "NUMBER OF PLAYER
S";NP$:N= VAL(NP$)
630 IF N>9 OR N<1 THEN 620
640 FOR I= 0 TO N
650 CASH(I)= 500
660 NEXT:RETURN
670 IF K=0 THEN LOCATE 10,6:PRINT"EACH P
LAYER STARTS WITH $500."
680 LOCATE 12,8:PRINT"HORSES ARE NUMBERE
D FROM"
690 LOCATE 14,13:PRINT"TOP TO BOTTOM."
700 FOR TI= 1 TO 1000:NEXT:K=K+1
720 T= ABS(RND(1)*5)+1:TR$(1)= "FAST":TR
$(2) = "GOOD": TR$(3) = "SLOW":TR$(4)="M
UDDY": TR$(5) = "TURF":TR$(6) ="SWAMPY":
BACK = 7:IF T= 5 THEN BACK = 2
730 AD(T)=.08:AM(T)=500
740 LOCATE 16,10:PRINT"TRACK CONDITION:
";TR$(T)
750 FOR I=1 TO 10000:NEXT:RETURN
760 MT =0:FOR I = 1 TO 6 : M(I) =INT(100
0*RND(1)+1+AM(I)):MT=MT+M(I):NEXT
770 FOR I =1 TO 6:OD(I)=INT(MT/M(I)):IF
OD(I)>20 THEN OD(I)=20
780 NEXT I:RETURN
790 CLS : LOCATE 9,16:PRINT"CURRENT ODDS
"
800 FOR I = 1 TO 6
810 LOCATE 10+I,12:PRINT "HORSE";I:LOCAT
E 10+I,20:PRINT OD(I);" TO 1":NEXT I
820 FOR I= 2 TO 2*N STEP 2
830 IF  CASH(I/2)<1 THEN AMT(I/2)=0:CASH
(I/2)=0:GOTO 910
840 LOCATE 18,9:PRINT"PLAYER";I/2;:INPUT
 "BETS HORSE";H(I/2)
850 IF H(I/2)<1 OR H(I/2)>6 THEN LOCATE
18,28:PRINT STRING$(6,32):GOTO 840
860 LOCATE 20,12:INPUT "AMOUNT";AMT(I/2)
:IF AMT(I/2)>CASH(I/2) THEN LOCATE 20,12
:PRINT STRING$(20,32):AMT(I/2)=0:GOTO 86
0
870 M(H(I/2))=M(H(I/2))+AMT(I/2)
880 MT=MT+AMT(I/2)
890 LOCATE 18,9:PRINT STRING$(20,32)
900 LOCATE 20,12:PRINT STRING$(20,32)
910 NEXT I
920 CLS
930 LOCATE 9,16:PRINT"NEW ODDS"
940 FOR I= 1 TO 6
950 OD(I)=INT(MT/M(I))
```

```
960 IF OD(I)>20 THEN OD(I)=20
970 LOCATE 10+I,12:PRINT"HORSE";I;:LOCAT
E 10+I,20:PRINT OD(I);" TO 1"
980 NEXT I
990 FOR I= 1 TO 10000:NEXT:CLS:RETURN
1000 FOR I= 1 TO N
1010 IF H(I)= WINNER THEN CASH(I)= CASH(
I)+INT (AMT(I)*INT(MT/M(WINNER)))ELSE CA
SH(I)=CASH(I)-AMT(I):IF CASH(I)<0 THEN C
ASH(I)=0
1020 NEXT I
1030 IF K=1 THEN RD$=""ELSE RD$="S"
1040 CLS:RC$="RACE":LOCATE 9,9:PRINT"SUM
MARY AFTER";K;RC$+RD$
1050 FOR I= 1 TO N:LOCATE 10+I,12:PRINT
"PLAYER";I;"$";CASH(I):NEXT
1060 W=0:FOR I=1 TO N :W=W+CASH(I):NEXT:
IF W=0 THEN 1080
1070 FOR DELAY = 1 TO 10000:NEXT:GOTO 60

1080 FOR DELAY = 1 TO 10000:NEXT:CLS:LOC
ATE 12,15:PRINT"Game Over"
1090 LOCATE 14,9:PRINT"Play again Yes or
 No?":AS$= ""
1100 POKE 1047,1
1110 AS$ = INKEY$:IF LEFT$(AS$,1)<>"Y"AN
D LEFT$(AS$,1)<> "N" THEN 1110
1120 IF LEFT$(AS$,1)= "Y" THEN RUN ELSE
SCREEN 0 :END
```

Program 5: Horse Racing, Apple Loader Program

Translation by Patrick Parrish, Programming Supervisor

```
100  REM  HORSERACE LOADER PROGRAM
105  POKE 104,96: POKE 103,0: PRINT
      CHR$ (4);"RUN HORSERACE"
```

Program 6: Horse Racing, Apple Main Program

```
10   DIM P(25),D(25): HOME : VTAB 11:
      HTAB 9: INVERSE : PRINT "H O R
      S E    R A C I N G": NORMAL : GOSUB
      720: GOSUB 770: GOSUB 780
20   FOR I = 1 TO 5:Y(I) = 19 + 27 *
      (I - 1): NEXT I:OF(1) = 1:OF(4)
       = 1
30 J0 = 0:J1 = 1:J2 = 2:J3 = 3:J5 =
      5:V = 230:V3 =  - 16300:V4 = 32
      :V5 = 64:D3 = 240:D5 = 400
40   HOME : VTAB 9: HTAB 10: PRINT "N
      UMBER OF PLAYERS ":K = 0
50   VTAB 9: HTAB 28: INPUT A$:N =  VAL
      (A$): IF N < 1 OR N > 9 THEN  HTAB
      28: VTAB 9: PRINT "         ": GOTO
      50
60   FOR I = 1 TO N:CASH(I) = 500: NEXT
      I: VTAB 13: HTAB 5: PRINT "EACH
       PLAYER STARTS WITH $500.": VTAB
      15: HTAB 8: PRINT "HORSES ARE N
      UMBERED FROM": VTAB 17: HTAB 13
      : PRINT "TOP TO BOTTOM."
70   FOR J = 2640 TO 3064 STEP 128: FOR
      I = J TO J + 39: POKE I,160: NEXT
      I: NEXT J: FOR I = 1 TO 14: POKE
      2780 + I, ASC ( MID$ ("HANOVER
       DOWNS",I,1)) + 128: NEXT I: FOR
      I = 1 TO 1500: NEXT
80 K = K + 1
90   IF (K > 5) OR (FL = 1) THEN FL =
      0: GOTO 680
100  FOR I = 1 TO 5:AD(I) = 0:AM(I) =
      0: NEXT
110  GOSUB 360: REM  TRACK CONDITION
     S
120  GOSUB 400: REM  DETERMINE ODDS
130  GOSUB 440: REM  PLACE BETS
140  HOME : GOSUB 260: REM  DRAW TRA
     CK
150  POKE 232,J0: POKE 233,12: SCALE=
      J1: ROT= J0: FOR I = J1 TO J5:C
      (I) = I: IF I > J3 THEN C(I) =
      I + J1
160 X(I) = OF(I):XO(J0,I) = X(I):XO(
      J1,I) = X(I): NEXT I
170  FOR I = J1 TO J5: HCOLOR= C(I):
       DRAW J1 AT X(I),Y(I): NEXT I
180  POKE V3,J0: POKE V,V5: GOSUB 77
     0:B = J2
190  FOR Q = J1 TO D5: FOR J = J0 TO
      J1:E =  PEEK (V) = V5: FOR I =
      J1 TO J5:X(I) = X(I) +  INT ( RND
      (J1) * J5 + AD(I)) * J2
200  HCOLOR= J0: DRAW B AT XO(E,I),Y
      (I): HCOLOR= C(I): DRAW B AT X(
      I),Y(I): IF X(I) > D3 + OF(I) THEN
      W = I:I = J5:J = J1:Q = D5
210 XO(E,I) = X(I): NEXT I: POKE V3 +
      E,J0: POKE V,V4 + (V4 * ( PEEK
      (V) = V4)):B = J3 - B: NEXT J: NEXT
      Q
220 B$ = "THE WINNER IS HORSE # " +
       STR$ (W) + ".": IF  PEEK (V) =
      V5 THEN  VTAB 24: HTAB (9): PRINT
      B$;: GOTO 240
230  FOR I = 1 TO 24: POKE I + 3031,
       ASC ( MID$ (B$,I,1)) + 128: NEXT
      I
240  FOR I = 1 TO 2000: NEXT I
250  GOSUB 590: GOTO 70: REM  PAYOFF

260  FOR J = J0 TO J1: POKE V,V4 + J
       * V4: CALL 62450: NEXT J: HGR
     : HGR2
270  FOR J = J0 TO J1: POKE V,V4 + J
       * V4: HCOLOR= J3
280  HPLOT 0,5 TO 279,5: FOR I = 1 TO
      14: HPLOT  - 10 + 20 * I,6 TO  -
      10 + 20 * I,15: NEXT
290  FOR I = 1 TO 14: HPLOT  - 10 +
      20 * I,6 TO  - 15 + 20 * I,11: NEXT
      I
300  HPLOT 0,150 TO 279,150: FOR I =
      1 TO 14: HPLOT  - 10 + 20 * I,1
      51 TO  - 10 + 20 * I,159: NEXT

310  HCOLOR= 5: FOR I = 1 TO 4: HPLOT
      0,15 + I * 27 TO 279,15 + I * 2
      7: NEXT I
320  HCOLOR= 6: HPLOT 260,16 TO 260,
      155
330  POKE  - 16301,J0: IF J = J0 THEN
       VTAB 22: HTAB 14: PRINT "HANOV
      ER  DOWNS"
340  POKE V3 + J,J0: NEXT J
350  POKE V,V4: RETURN
360 T =  INT (5 *  RND (1)) + 1
370 TR$(1) = "FAST":TR$(2) = "GOOD":
      TR$(3) = "SLOW":TR$(4) = "MUDDY
      ":TR$(5) = "TURF"
380 AD(T) = .4:AM(T) = 500
390  HOME : VTAB 10: HTAB 17: PRINT
```

```
     "RACE ";K: VTAB 13: HTAB 8: PRINT
     "TRACK CONDITIONS:  ";TR$(T): FOR
     I = 1 TO 2500: NEXT : RETURN
400 MT = 0: FOR I = 1 TO 5:M(I) =  INT
     (1000 *  RND (1)) + .1 + AM(I):
     MT = MT + M(I): NEXT I
410  FOR I = 1 TO 5:OD(I) =  INT (MT
      / M(I))
420  IF OD(I) > 20 THEN OD(I) = 20
430  NEXT I: RETURN
440  HOME : HTAB 15: VTAB 1 + (N < 5
     ): PRINT "CURRENT ODDS"
450  FOR I = 1 TO 5: HTAB 13: VTAB 1
      + I + (N < 5) * 2: PRINT "HORS
     E ";I;" : ";OD(I);" TO 1": NEXT
     I
460  FOR I = 2 TO 2 * N STEP 2: IF C
     ASH(I / 2) < 1 THEN A1(I / 2) =
     0: GOTO 530
470  HTAB 8: VTAB 5 + I + (9 - N) /
     2: PRINT "PLAYER ";I / 2;" BETS
      - HORSE ";
480  INPUT H(I / 2): IF (H(I / 2) <
     1) OR (H(I / 2) > 5) THEN  VTAB
     5 + I + (9 - N) / 2: HTAB 31: PRINT
     "       ": GOTO 470
490  VTAB 6 + I + (9 - N) / 2: HTAB
     8: PRINT "AMOUNT ";
500  INPUT A1(I / 2): IF A1(I / 2) >
     CASH(I / 2) THEN  VTAB 6 + I +
     (9 - N) / 2: HTAB 16: PRINT "
          ": GOTO 490
510 M(H(I / 2)) = M(H(I / 2)) + A1(I
      / 2)
520 MT = MT + A1(I / 2)
530  NEXT I
540  HOME : VTAB 5: HTAB 17: PRINT "
     NEW ODDS": HTAB 17: PRINT "---
     ----"
550  FOR I = 1 TO 5:OD(I) =  INT (MT
      / M(I))
560  IF OD(I) > 20 THEN OD(I) = 20
570  VTAB 7 + I * 2: HTAB 12: PRINT
     "HORSE ";I;" : ";OD(I);" TO 1":
      NEXT I
580  FOR I = 1 TO 6000: NEXT : RETURN

590  FOR I = 1 TO N: IF H(I) = W THEN
     CASH(I) = CASH(I) +  INT (A1(I)
      *  INT (MT / M(W))): GOTO 610
600 CASH(I) = CASH(I) - A1(I)
610  NEXT I
620  HOME : TEXT : VTAB 5: HTAB 17: PRINT
     "SUMMARY": HTAB 17: PRINT "----
     ---"
630 P$ = "RACES": IF K = 1 THEN P$ =
     "RACE"
640  VTAB 9: HTAB 15: PRINT "AFTER "
     ;K;" ";P$
650  VTAB 12: FOR I = 1 TO N: HTAB 1
     3: PRINT "PLAYER # ";I;": $"CAS
     H(I): NEXT I
660  FOR I = 1 TO 3000: NEXT :FL = 1
     : FOR I = 1 TO N: IF CASH(I) >
     0 THEN I = N:FL = 0
670  NEXT I: RETURN
680  HOME : VTAB 11: HTAB 15: PRINT
     "GAME OVER": VTAB 16: HTAB 10: PRINT
     "PLAY AGAIN (Y/N) ";
690  INPUT A$: IF A$ <  > "Y" AND A$
      <  > "N" THEN 690
700  IF A$ = "Y" THEN 40
710  END
720  FOR LOC = 770 TO 790: READ BYTE
     : POKE LOC,BYTE: NEXT : FOR I =
     1 TO 25: READ P(I),D(I): NEXT I
     : RETURN : REM  ML MUSIC ROUTIN
     E
730  DATA 173,48,192,136,208,5,206,1
     ,3,240,9,202,208,245,174,0,3,76
     ,2,3,96
740  REM  MUSICAL TUNE DATA
750  DATA 128,60,96,60,76,60,64,90,6
     4,30,64,60,76,90,76,30,76,60,96
     ,60,76,60,96,60,128,255,128,60,
     96,60,76,60,64,90,64,30,64,60
760  DATA 76,60,96,60,128,90,128,30,
     128,60,96,255
770  FOR I = 1 TO 25: POKE 768,P(I):
      POKE 769,D(I): CALL 770: NEXT
     I: RETURN
780 CKSUM = 0: FOR I = 3072 TO 3427:
      READ A:CKSUM = CKSUM + A: POKE
     I,A: NEXT : RETURN : REM  CHECK
     SUM CKSUM SHOULD BE 16204
790  DATA  2,0,6,0,181,0,73,73
800  DATA  73,73,73,73,17,27,27,27
810  DATA  27,27,27,27,27,27,83,73
820  DATA  73,73,73,73,73,26,27,27
830  DATA  27,27,27,27,27,27,27,74
840  DATA  73,73,73,105,73,9,26,27
850  DATA  31,27,27,27,27,27,27,27
860  DATA  74,73,73,73,45,13,45,45
870  DATA  26,27,59,31,59,27,27,27
880  DATA  27,27,74,73,73,9,77,45
890  DATA  77,17,27,27,59,63,63,63
900  DATA  63,63,63,83,73,41,45,45
910  DATA  45,45,77,9,26,27,27,63
920  DATA  63,63,63,63,27,27,74,9
930  DATA  45,77,9,45,77,73,26,27
940  DATA  27,63,31,27,27,59,31,27
950  DATA  74,41,77,73,73,41,77,17
960  DATA  27,59,27,27,27,27,27,27
970  DATA  59,83,77,73,73,73,73,105
980  DATA  26,27,27,27,27,27,27,27
990  DATA  27,27,74,73,73,73,73,73
1000  DATA  9,26,27,27,27,27,27,27
1010  DATA  27,27,27,2,0,73,73,73
1020  DATA  73,73,73,17,27,27,27,27
1030  DATA  27,27,27,27,27,83,73,73
1040  DATA  73,73,73,73,26,27,27,27
1050  DATA  31,27,27,27,27,27,74,73
1060  DATA  73,73,73,9,77,26,63,63
1070  DATA  27,63,27,27,27,27,27,74
1080  DATA  73,73,73,77,109,9,26,27
1090  DATA  59,63,59,27,27,27,27,27
1100  DATA  74,73,45,45,45,45,45,77
1110  DATA  17,27,27,63,63,63,63,63
1120  DATA  59,27,83,9,77,45,45,45
1130  DATA  45,77,9,26,27,27,63,63
1140  DATA  27,63,31,27,31,74,73,9
1150  DATA  109,73,77,73,26,27,27,27

1160  DATA  31,27,63,27,27,27,74,73
1170  DATA  73,109,105,73,9,26,27,27

1180  DATA  27,59,59,27,27,27,27,74
1190  DATA  73,73,9,77,73,73,26,27
1200  DATA  27,27,59,59,27,27,27,27
1210  DATA  74,73,73,73,73,73,9,26
1220  DATA  27,27,27,27,27,27,27,27
1230  DATA  27,2,0,0,255,255,0,0
```

Software for children often benefits from large display characters and numbers. Here's a method for creating big numbers on the TI-99/4A, with a simple example program—a number recognition game which uses the larger digits. Includes versions for Commodore VIC and 64, Atari, Apple, IBM PC/PCjr, and the Color Computer.

The Number Game

Lou Tylee

The built-in number characters on the Texas Instruments 99/4A Home Computer are too small to really grab a child's attention. Using the character definition capabilities of the 99/4A, representations of the numbers 0 through 9 can be developed which are three times taller and wider than these built-in digits. And these larger number characters can be used in your own programs.

Magnifying The Numbers

In the May 1983 issue of COMPUTE!, C. Regena wrote a tutorial on the use of TI graphics ("Programming The TI: Graphics"). Regena explains that each character on the display screen is an 8 × 8 grid of 64 dots. When you press a number key on the TI keyboard, that number is displayed using one such character. By employing the CALL CHAR statement in TI BASIC to turn dots on and off within a particular 8 × 8 grid, custom characters can be defined. The larger numbers here each use 9 custom characters in a 3 × 3 array. The figure shows these numbers and corresponding hexadecimal codes for defining characters.

Examining the figure, you may wonder if these numbers could perhaps be defined in a simpler manner. For example, it is possible to represent each number by straight line segments only, such as are used on digital watches. Certainly, this would work, but it may not be advisable for teaching young children, because children learn numbers for the first time in a pattern recognition mode, trying to match similar objects. Hence, the numbers in the figure are designed to mimic (as closely as possible) the TI keyboard depictions of the numbers. For older children, who are used to seeing numbers written in different ways, the digital watch approach to number display would be fine.

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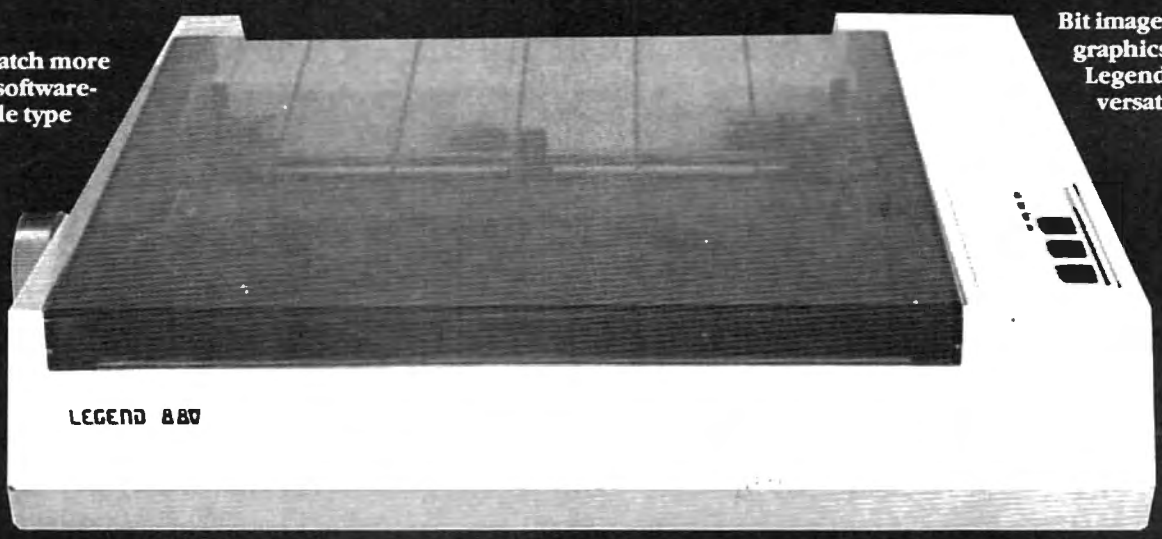

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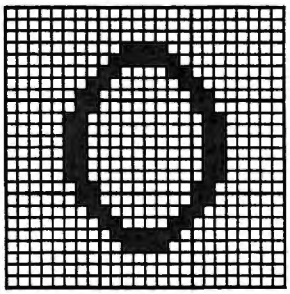
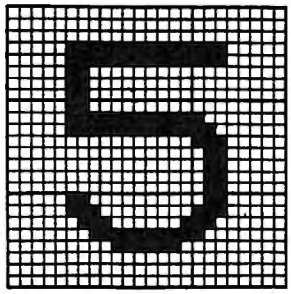
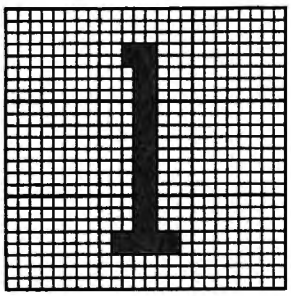


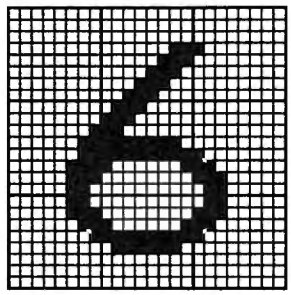
Row	Column	Index	Hex Code
1	1	0	0000000000000103
1	2	1	0000003C7EC38100
1	3	2	00000000000080C0
2	1	3	0306060606060603
2	2	53	0000000000000000
2	3	4	C0606060606060C0
3	1	5	0301000000000000
3	2	6	0081C37E3C000000
3	3	7	C080000000000000



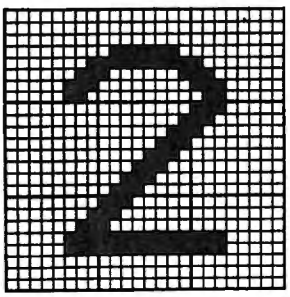
Row	Column	Index	Hex Code
1	1	24	0000000707060606
1	2	35	000000FFFF000000
1	3	25	000000E0E0000000
2	1	26	0607070000000000
2	2	27	00FFFF0000000000
2	3	28	0080C0E060606060
3	1	48	0607030100000000
3	2	43	000081FF7E000000
3	3	44	60E0C08000000000



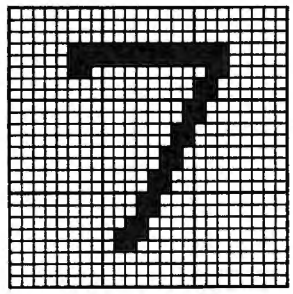
Row	Column	Index	Hex Code
1	1	53	0000000000000000
1	2	8	0000003838181818
1	3	53	0000000000000000
2	1	53	0000000000000000
2	2	9	1818181818181818
2	3	53	0000000000000000
3	1	53	0000000000000000
3	2	10	1818187E7E000000
3	3	53	0000000000000000



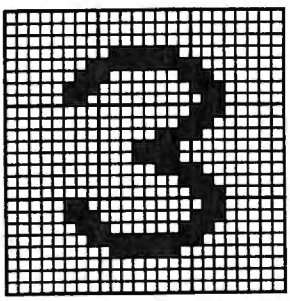
Row	Column	Index	Hex Code
1	1	53	0000000000000000
1	2	29	000000003070E1C38
1	3	30	0000006000000000
2	1	31	0000010303070706
2	2	32	70E0C0FEFF810000
2	3	33	0000000080C0E060
3	1	48	0607030100000000
3	2	43	000081FF7E000000
3	3	44	60E0C08000000000



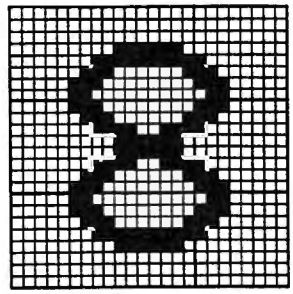
Row	Column	Index	Hex Code
1	1	45	0000000001030706
1	2	46	0000007EFF810000
1	3	47	000000080C0E060
2	1	53	0000000000000000
2	2	11	000103070E1C3870
2	3	12	E0C0800000000000
3	1	13	0001030707000000
3	2	14	E0C080FFFF000000
3	3	15	000000E0E0000000



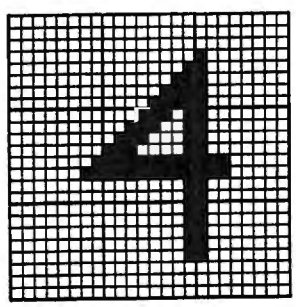
Row	Column	Index	Hex Code
1	1	34	0000000707060000
1	2	35	000000FFFF000000
1	3	36	000000E0E060C0C0
2	1	53	0000000000000000
2	2	37	0101030306060C0C
2	3	38	8080000000000000
3	1	53	0000000000000000
3	2	39	1818307060000000
3	3	53	0000000000000000



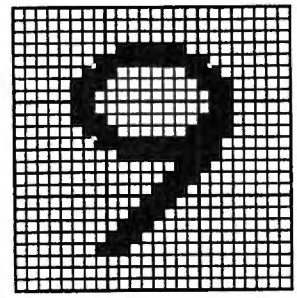
Row	Column	Index	Hex Code
1	1	45	0000000001030706
1	2	46	0000007EFF810000
1	3	47	000000080C0E060
2	1	53	0000000000000000
2	2	16	0001071E1E070100
2	3	42	E0C080000080C0E0
3	1	48	0607030100000000
3	2	43	000081FF7E000000
3	3	44	60E0C08000000000



Row	Column	Index	Hex Code
1	1	45	0000000001030706
1	2	46	0000007EFF810000
1	3	47	000000080C0E060
2	1	40	0703010000010307
2	2	41	0081E77E7EE78100
2	3	42	E0C080000080C0E0
3	1	48	0607030100000000
3	2	43	000081FF7E000000
3	3	44	60E0C08000000000



Row	Column	Index	Hex Code
1	1	53	0000000000000000
1	2	17	000000000103C70F
1	3	18	0000008080806080
2	1	19	0000000001030000
2	2	20	1D3971E1FFFF0101
2	3	21	80808080E0E06080
3	1	53	0000000000000000
3	2	22	0101010101000000
3	3	23	8080808080000000



Row	Column	Index	Hex Code
1	1	45	0000000001030706
1	2	46	0000007EFF810000
1	3	47	000000080C0E060
2	1	48	0607030100000000
2	2	49	000081FF7F03070E
2	3	50	60E0E0C0C0800000
3	1	51	0000000001000000
3	2	52	1C3870E0C0000000
3	3	53	0000000000000000

Using The Magnified Numbers

Now that we have the character definitions, we need to efficiently incorporate them into a program. Ten digits, defined by nine characters each, is a total of 90 characters. Of these 90 characters, however, only 54 are distinct. Lines 150–290 of Program 1 assign each of these distinct characters to an index number in the array CI$. These 54 character indices fill an array N which is used to define the ten large digits. In lines 310–480 of Program 1, I is character N's row and J is character N's column within the 3 × 3 array used to define digit K. For example, character 17 (000000000103070F) defines the first row and second column of the number 4 (see the figure). So we can write N(4,1,2)=17.

Next, we need to relate the two arrays CI$ and N to allow drawing large numbers on the display screen. One way to accomplish this is to load each of the 54 distinct characters into character codes 106 through 159 using CALL CHAR:

```
FOR I=0 TO 53
CALL CHAR(I+106,CI$(I))
NEXT I
```

An alternative which eliminates the need for a CI$ array, is to read the character definitions directly from DATA statements

```
FOR I=0 TO 53
READ C$
CALL CHAR(I+106,C$)
NEXT I
DATA ...
DATA ...
```

where the DATA statements are identical to those used earlier to define CI$. Then, to draw digit K starting at row R and column C on the screen, we use:

```
FOR I=R TO R+2
FOR J=C TO C+2
CALL HCHAR(I,J,106+N(K,I-R+1,J-C+1))
NEXT J
NEXT I
```

This will work fine, yet it has one drawback. It requires the use of 54 custom characters. This does not leave many characters available for other graphics use. We can use another technique that only requires, at most, nine characters for each digit to be displayed on the screen at one time. So, if our application only displays two digits at any one time, just 18 characters must be defined.

Dynamic Character Definition

That technique, used in Program 1, can be called dynamic character definition. That is, character codes are redefined and reused as each number is displayed. Lines 1500–1580 draw digit K starting at row R, column C, and character code CC. This approach requires that the contents of the CI$ array have already been assigned, as shown in lines 150–290. If we are using two digits at most, good choices for starting character codes are CC=126 for one digit and CC=135 for the other. This leaves many codes available for other graphics. As long as we require six or fewer different digits to be displayed, this method of dynamic character definition uses fewer character codes than the previous method.

The large numbers developed here have many applications. Math flash card drills, counting games, and guess-the-number games are just a few. As a sample application, the programs provide a preschool game to teach number recognition. In Program 1, which runs in either TI console BASIC or Extended BASIC, the computer randomly picks a number from 0 to 9 and displays it at the center of the screen. The child is then asked to find that number on the keyboard and press it. A correct response wins a snappy tune and a like number of blocks are drawn. An incorrect answer gets an "uh-oh" and the child is asked to try again. Since this program displays only one number at a time, dynamic character definition (CC=135) is employed for display.

Program 1: TI Number Game

```
100 RANDOMIZE
110 CALL CLEAR
120 CALL SCREEN(8)
130 PRINT TAB(8);"...PLEASE WAIT"
140 REM LOAD CHARACTER CODE ARRAY
150 DIM CI$(53)
160 FOR I=0 TO 53
170 READ CI$(I)
180 NEXT I
190 DATA 000000000000103,000003C7
    EC381,000000000000080C,030606060
    6060603,C0606060606060C
200 DATA 0301,0081C37E3C,C08,000000
    3838181818,1818181818181818
210 DATA 1818187E7E,000103070E1C387
    ,E0C08,0001030707,E0C080FFFF
220 DATA 000000E0E,0001071E1E0701,0
    00000000103070F,0000000808080808
    ,000000000103
230 DATA 1D3971E1FFFF0101,8080808 0E
    0E0808,0101010101,8080808 08,000
    0000707060606
240 DATA 000000E0E,060707,00FFFF,00
    80C0E06060606,0000000307 0E1C38
250 DATA 0000008,0000010303070706,7
    0E0C0FEFF81,000000000 80C0E06,000
    000070706
260 DATA 000000FFFF,000000E0E060C0C
    ,0101030306060C0C,808,181830706
270 DATA 0703010000010307,0081E77E7
    EE781,E0C0800000080C0E,000081FF7
    E,60E0C08
280 DATA 000000000103070 6,0000007EF
    F81,000000000 80C0E06,06070301,00
    0081FF7F03070E
```

```
290 DATA 60E0E0C0C08,0000000001,1C3
    870E0C,
300 REM LOAD CHARACTER INDEX ARRAY
310 DIM N(9,3,3)
320 FOR K=0 TO 9
330 FOR I=1 TO 3
340 FOR J=1 TO 3
350 READ N(K,I,J)
360 NEXT J
370 NEXT I
380 NEXT K
390 DATA 0,1,2,3,53,4,5,6,7
400 DATA 53,8,53,53,9,53,53,10,53
410 DATA 45,46,47,53,11,12,13,14,15
420 DATA 45,46,47,53,16,42,48,43,44
430 DATA 53,17,18,19,20,21,53,22,23
440 DATA 24,35,25,26,27,28,48,43,44
450 DATA 53,29,30,31,32,33,48,43,44
460 DATA 34,35,36,53,37,38,53,39,53
470 DATA 45,46,47,40,41,42,48,43,44
480 DATA 45,46,47,48,49,50,51,52,53
490 REM DEFINE BLOCK CHARACTER
500 CALL CHAR(119,"")
510 CALL COLOR(11,16,16)
520 REM TITLE SCREEN
530 CALL CLEAR
540 CALL SCREEN(12)
550 PRINT TAB(6);"LEARN THE NUMBERS
    ": :
560 GOSUB 1320
570 PRINT "THIS IS A PRE-SCHOOL NUM
    BER"
580 PRINT "RECOGNITION GAME. THE CO
    MPU-"
590 PRINT "TER DISPLAYS A NUMBER AN
    D"
600 PRINT "YOU MUST FIND AND PRESS
    THAT"
610 PRINT "KEY ON YOUR KEYBOARD.":
    :
620 PRINT "IF CORRECT, THAT NUMBER
    OF"
630 PRINT "BLOCKS IS DRAWN AND YOU
    ARE"
640 PRINT "GIVEN ANOTHER NUMBER. IF
     NOT"
650 PRINT "CORRECT, THE COMPUTER WI
    LL"
660 PRINT "ASK YOU FOR ANOTHER ANSW
    ER.": :
670 PRINT "TO STOP THE GAME, PRESS
    THE"
680 PRINT "SPACE BAR WHEN ASKED FOR
     AN"
690 PRINT "ANSWER.": : :
700 PRINT "PRESS ANY KEY TO PLAY."
710 CALL KEY(0,KEY,S)
720 IF S=0 THEN 710
730 CALL SOUND(100,1000,3)
740 REM PLAY GAME
750 CALL CLEAR
760 CALL SCREEN(14)
770 M$="LEARN THE NUMBERS"
780 XM=8
790 YM=3
800 GOSUB 1440
810 RANDOMIZE
820 K=INT(RND*10)
830 IF TM=K THEN 820
840 TM=K
850 CC=135
860 R=8
870 C=15
880 GOSUB 1500
890 M$="PRESS THIS NUMBER .."
900 XM=6
910 YM=13
920 GOSUB 1440
930 REM CHECK ANSWER
940 CALL KEY(0,KEY,S)
950 IF S=0 THEN 940
960 IF ((KEY<48)+(KEY>57))*(KEY<>32
    )THEN 940
970 CALL SOUND(100,1000,3)
980 IF KEY=32 THEN 1000 ELSE 1020
990 REM GAME ENDS
1000 CALL CLEAR
1010 STOP
1020 CALL HCHAR(13,27,KEY)
1030 IF (KEY-48)<>K THEN 1270
1040 REM CORRECT ANSWER
1050 GOSUB 1320
1060 M$=STR$(K)&" BLOCKS:"
1070 IF K<>1 THEN 1090
1080 M$="1 BLOCK:"
1090 XM=6
1100 YM=15
1110 GOSUB 1440
1120 IF K=0 THEN 1220
1130 BC=4
1140 FOR NB=1 TO K
1150 CALL HCHAR(18,BC,119,2)
1160 CALL HCHAR(19,BC,119,2)
1170 CALL SOUND(100,330,3)
1180 FOR D=1 TO 200
1190 NEXT D
1200 BC=BC+3
1210 NEXT NB
1220 FOR D=1 TO 2000
1230 NEXT D
1240 CALL HCHAR(8,15,32,370)
1250 GOTO 810
1260 REM INCORRECT ANSWER
1270 CALL SOUND(100,392,3)
1280 CALL SOUND(100,330,2)
1290 CALL HCHAR(13,27,32)
1300 GOTO 940
1310 REM PLAY TUNE
1320 FOR I=1 TO 2
1330 CALL SOUND(300,349,3,262,3,220
    ,3)
1340 CALL SOUND(150,349,3)
1350 CALL SOUND(150,349,3)
1360 NEXT I
1370 CALL SOUND(300,440,3,349,3,262
    ,3)
1380 CALL SOUND(150,523,3)
1390 CALL SOUND(150,523,3)
1400 CALL SOUND(300,440,3,349,3,262
    ,3)
1410 CALL SOUND(300,349,3,262,3,220
    ,3)
1420 RETURN
1430 REM TEXT PRINT SUBROUTINE
1440 FOR I=1 TO LEN(M$)
1450 C=ASC(SEG$(M$,I,1))
1460 CALL HCHAR(YM,XM+I-1,C)
1470 NEXT I
1480 RETURN
```

```
1490 REM NUMBER DRAWING SUBROUTINE
1500 L=CC
1510 FOR I=R TO R+2
1520 FOR J=C TO C+2
1530 CI=N(K,I-R+1,J-C+1)
1540 CALL CHAR(L,CI$(CI))
1550 CALL HCHAR(I,J,L)
1560 L=L+1
1570 NEXT J
1580 NEXT I
1590 RETURN
```

Program 2: 64 Number Game

Refer to the "Automatic Proofreader" article before typing this program in.

```
10 POKE53281,1:FORI=1TO12:READA:NEXT:GOSU
   B980                                  :rem 57
20 POKE53281,1:CO=2:LL=54272:FORI=LLTOLL+
   24:POKEI,0:NEXTI                      :rem 26
30 POKELL+5,1:POKELL+6,241:POKELL+24,15
                                         :rem 48
40 L8=INT(RND(1)*10)+47                  :rem 232
50 GOSUB 430                             :rem 124
60 GOSUB 140                             :rem 123
70 POKE198,0                             :rem 148
80 GET A$:IFA$=""THEN80                  :rem 243
90 IFA$=" "THENPOKE198,0:SYS198          :rem 21
100 IFASC(A$)<>L8THENGOSUB940:GOTO80
                                         :rem 210
110 GOSUB 330                            :rem 168
120 GOSUB 1100                           :rem 213
130 FORI=1TO3000:NEXT:GOTO40             :rem 232
140 RESTORE:FORI=7TO27STEP5              :rem 20
150 CO=CO+1:IFCO>15THENCO=2              :rem 130
160 PRINT"{HOME}{11 DOWN}"               :rem 54
170 POKE646,CO                           :rem 37
180 POKE249,I:READA:POKE250,A            :rem 224
190 SYS828:PRINT"{UP}":NEXT              :rem 80
200 FORI=10TO25STEP5                     :rem 219
210 CO=CO+1:IFCO>15THENCO=2              :rem 127
220 PRINT"{HOME}{15 DOWN}"               :rem 119
230 POKE646,CO                           :rem 34
240 POKE249,I:READA:POKE250,A            :rem 221
250 SYS828:PRINT"{UP}":NEXT              :rem 77
260 FORI=12TO22STEP5                     :rem 224
270 CO=CO+1:IFCO>15THENCO=2              :rem 133
280 PRINT"{HOME}{19 DOWN}"               :rem 193
290 POKE646,CO                           :rem 40
300 POKE249,I:READA:POKE250,A            :rem 218
310 SYS828:PRINT"{UP}":NEXT:RETURN
                                         :rem 100
320 DATA 16,18,5,19,19,20,8,9,19,11,5,25
                                         :rem 167
330 LL=54272:FORI=LLTOLL+24:POKEI,0:NEXT
                                         :rem 1
340 POKELL+24,15:POKELL+5,36:POKELL+6,132
                                         :rem 155
350 POKE54284,129:POKE54285,132          :rem 201
360 FORI=1TO8:READLB,HB                  :rem 172
370 POKELL,LB:POKELL+1,HB:POKELL+4,33
                                         :rem 32
380 POKE54279,LB:POKE54280,HB:POKE54283,3
    3                                    :rem 178
390 FORK=1TO275:NEXT:POKELL+4,32:POKE5428
    3,32                                 :rem 231
400 FORL=1TO15:NEXT:NEXT                 :rem 48
410 DATA 152,5,152,5,152,5,152,5,12,7,48,
    4,12,7,152,5                         :rem 24
420 RETURN                               :rem 118
430 PRINT"{CLR}";:POKE56334,PEEK(56334)AN
    D254:POKE1,PEEK(1)AND251             :rem 145
440 CO=CO+1:IFCO>15THENCO=2              :rem 132
450 POKE646,CO:L8=L8+1:M=53247+8*L8
                                         :rem 219
460 FORM1=M+1TOM+7:X=PEEK(M1):FORL=1TO7:C
    =146:X=X*2                           :rem 135
470 POKE1,PEEK(1)OR4:POKE56334,PEEK(56334
    )OR1                                 :rem 138
480 POKELL+4,16:Q=INT(RND(1)*40):POKELL+1
    ,Q+(M1-M)*8                          :rem 253
490 IFX>255THENX=X-256:C=18:POKELL+4,17
                                         :rem 91
500 PRINTTAB(16)CHR$(C)CHR$(32);         :rem 56
510 POKE56334,PEEK(56334)AND254:POKE1,PEE
    K(1)AND251:NEXT:PRINT:NEXT           :rem 112
520 POKE1,PEEK(1)OR4:POKE56334,PEEK(56334
    )OR1                                 :rem 134
530 POKELL+4,16:RETURN                   :rem 107
540 POKE646,CO:PRINTTAB(16)CHR$(C);
                                         :rem 76
550 PRINT"{DOWN}{10 SPACES}PLEASE WAIT A
    {SPACE}MOMENT"                       :rem 124
560 T=0:FORJ=688TO703:READK:T=T+K:POKEJ,K
    :NEXT                                :rem 192
570 IFT<>3078THENPRINT"ERROR IN DATA STAT
    EMENTS":STOP                         :rem 142
580 T=0:FORJ=828TO1006:READK:T=T+K:POKEJ,
    K:NEXT                               :rem 235
590 IFT<>20306THENPRINT"ERROR IN DATA STA
    TEMENTS":STOP                        :rem 185
600 POKE249,0:RETURN                     :rem 218
610 DATA32,188,190,226,172,225,191,251
                                         :rem 133
620 DATA187,255,161,236,162,254,252,96
                                         :rem 145
630 DATA 169,208,133,004,173,024         :rem 37
640 DATA 208,41,2,240,4,169              :rem 43
650 DATA 216,133,4,169,0,162             :rem 94
660 DATA 3,6,250,42,202,208              :rem 38
670 DATA 250,24,101,4,133,4              :rem 33
680 DATA 165,250,133,3,173,14            :rem 145
690 DATA 220,41,254,141,14,220           :rem 184
700 DATA 165,1,41,251,133,1              :rem 31
710 DATA 169,0,133,250,169,5             :rem 97
720 DATA 133,2,160,0,177,3               :rem 241
730 DATA 133,5,230,3,177,3               :rem 246
740 DATA 133,6,230,3,198,2               :rem 250
750 DATA 240,28,162,04,169,0             :rem 95
760 DATA 6,6,42,6,6,42                   :rem 55
770 DATA 6,5,42,6,5,42                   :rem 54
780 DATA 164,250,153,48,2,230            :rem 147
790 DATA 250,202,208,232,240,210         :rem 27
800 DATA 165,1,9,4,133,1                 :rem 144
810 DATA 173,14,220,9,1,141              :rem 35
820 DATA 14,220,160,0,166,249            :rem 140
830 DATA 240,8,169,29                    :rem 18
840 DATA 32,210                          :rem 218
850 DATA 255,202,208,250,169,4           :rem 200
860 DATA 133,6,185,48,2,170              :rem 53
870 DATA 189,176,2,133,5,41              :rem 56
880 DATA 64,240,5,169,18,32              :rem 57
890 DATA 210,255,165,5,41,191            :rem 151
900 DATA 32,210,255,169,146,32           :rem 195
910 DATA 210,255,200,198,6,208           :rem 195
920 DATA 221,169,13,32,210,255           :rem 190
930 DATA 192,16,208,196,96               :rem 18
940 POKELL+4,33:POKELL+1,10:POKELL,143
                                         :rem 4
```

```
950 FORI=1TO500:NEXTI                :rem 54
960 POKELL+4,32:FORI=1TO250:NEXTI    :rem 42
970 POKELL+4,8:RETURN                :rem 68
980 PRINT"{CLR}{BLU}{DOWN}{11 SPACES}LEAR
    N THE NUMBERS{2 DOWN}"           :rem 198
990 PRINT"{2 SPACES}THIS IS A PRE-SCHOOL
    {SPACE}NUMBER{11 SPACES}RECOGNITION G
    AME.";                           :rem 241
1000 PRINT" THE COMPUTER DISPLAYS A NUMBE
     R AND";                         :rem 99
1010 PRINT" YOU MUST FIND AND PRESS
     {4 SPACES}THAT KEY ON YOUR KEYBOARD.
     "                               :rem 223
1020 PRINT"{DOWN}{2 SPACES}IF CORRECT, TH
     AT NUMBER OF BLOCKS IS{2 SPACES}DRAW
     N AND YOU ARE";                 :rem 186
1030 PRINT" GIVEN ANOTHER NUMBER. IF NOT
     {SPACE}CORRECT, THE";           :rem 240
1040 PRINT" COMPUTER WILL ASK{3 SPACES}FO
     R ANOTHER ANSWER."              :rem 18
1050 PRINT"{DOWN}{2 SPACES}TO STOP THE GA
     ME, PRESS THE SPACE BAR WHEN ASKED F
     OR AN ANSWER."                  :rem 117
1060 GOSUB330:GOSUB550               :rem 49
1070 PRINT"{3 DOWN}{10 SPACES}HIT ANY KEY
      TO PLAY."                      :rem 137
1080 GET A$:IF A$=""THEN1080         :rem 181
1090 PRINT"{CLR}":RETURN             :rem 72
1100 IFL8=48THENRETURN               :rem 141
1110 FORI=2TO(4*(L8-49))+2STEP4      :rem 240
1120 CO=CO+1:IFCO>15THENCO=2         :rem 176
1130 PRINT"{HOME}{7 DOWN}"           :rem 32
1140 POKE646,CO                      :rem 83
1150 POKE249,I:POKE250,250           :rem 205
1160 SYS828:PRINT"{UP}":NEXT         :rem 126
1170 RETURN                          :rem 169
```

Program 3: VIC Number Game

Refer to the "Automatic Proofreader" article before typing this program in.

```
10 POKE36878,15:S=36875:CO=2:DIMB(10),C(1
   0):CV=36878                       :rem 141
20 GOSUB 320:GOSUB220                :rem 197
30 GOSUB 380:GOSUB 530:PRINT"{CLR}":SYS82
   8                                 :rem 73
40 L8=INT(RND(1)*10)+48              :rem 233
50 IFL8=LOTHEN40                     :rem 227
60 LO=L8                             :rem 194
70 GOSUB 160                         :rem 126
80 POKE198,0                         :rem 149
90 PRINT"{HOME}{12 DOWN}{2 RIGHT}{BLU}PRE
   SS{RIGHT}THIS{RIGHT}NUMBER"       :rem 58
100 GET A$:IFA$=""THEN100            :rem 69
110 IF A$=" "THEN POKE890,0:SYS890:rem 60
120 IFASC(A$)<>L8THENGOSUB590:GOTO100
                                     :rem 254
130 GOSUB 330                        :rem 170
140 GOSUB 630                        :rem 174
150 GOTO 40                          :rem 51
160 PRINT"{CLR}";:M=34816+8*L8:IFL8-48>9T
    HEN65535                         :rem 165
170 FORM1=MTOM+6:X=PEEK(M1):FORL=1TO7:C=3
    2:X=X*2                          :rem 242
180 IFX>255THENX=X-256:C=113:CO=CO+1:IFCO
    >7THENCO=2                       :rem 134
190 POKE646,CO:POKES,128+CO*4        :rem 197
200 PRINTTAB(7)"";CHR$(C);:NEXT:PRINT"":N
    EXT                              :rem 202
210 POKES,0:RETURN                   :rem 139
220 PRINT"{CLR}{2 SPACES}THIS IS A PRE-SC
    HOOLNUMBER RECOGNITION{4 SPACES}GAME.
     THE COMPUTER"                   :rem 139
230 PRINT"DISPLAYS A NUMBER AND"     :rem 172
240 PRINT"YOU MUST FIND AND{5 SPACES}PRES
    S THAT KEY ON YOURKEYBOARD."     :rem 179
250 PRINT"{DOWN}{2 SPACES}IF CORRECT, THA
    T{4 SPACES}NUMBER OF BLOCKS IS
    {3 SPACES}DRAWN AND YOU ARE"     :rem 83
260 PRINT"GIVEN ANOTHER NUMBER. IF NOT CO
    RRECT, THE"                      :rem 137
270 PRINT"COMPUTER WILL ASK FOR ANOTHER A
    NSWER."                          :rem 230
280 PRINT"{DOWN}{2 SPACES}TO STOP THE GAM
    E,{3 SPACES}PRESS THE SPACE BAR
    {3 SPACES}WHEN ASKED FOR AN{5 SPACES}
    ANSWER."                         :rem 73
290 PRINT"{DOWN} HIT ANY KEY TO PLAY."
                                     :rem 58
300 GET A$:IF A$=""THEN300           :rem 73
310 PRINT"{CLR}":RETURN              :rem 18
320 PRINT"{CLR}{4 DOWN} LEARNING THE NUMB
    ERS"                             :rem 138
330 RESTORE                          :rem 186
340 FOR X=1TO8:READ C(X),B(X):POKE CV-2,C
    (X):POKECV-3,B(X):FORD=1TO 350:NEXT
                                     :rem 241
350 POKE CV-2,0:POKE CV-3,0:NEXT     :rem 82
360 RETURN                           :rem 121
370 DATA 195,207,195,207,195,207,195,207,
    207,215,215,225,207,215,195,207
                                     :rem 243
380 PRINT"{2 SPACES}ONE MOMENT PLEASE"
                                     :rem 216
390 I=828                            :rem 196
400 READ A:IF A=256 THEN RETURN      :rem 228
410 POKE I,A:I=I+1:GOTO 400          :rem 230
420 DATA 120,169,3,141,21,3,169      :rem 234
430 DATA 73,141,20,3,88,96,162       :rem 198
440 DATA 1,240,21,206,74,3,169       :rem 186
450 DATA 47,141,3,144,169,255,141    :rem 90
460 DATA 5,144,169,25,141,15,144     :rem 38
470 DATA 76,21,235,173,4,144,208     :rem 41
480 DATA 251,169,32,141,37,145,169
                                     :rem 149
490 DATA 185,141,36,145,238,74,3     :rem 49
500 DATA 169,46,141,3,144,169,240    :rem 89
510 DATA 141,5,144,169,8,141,15      :rem 240
520 DATA 144,76,191,234,0,256        :rem 148
530 POKE56,28:CH=32776               :rem 211
540 FOR X=7184TO7600 STEP 2:          :rem 1
550 POKE X,PEEK(CH):POKE X+1,PEEK(CH)
                                     :rem 152
560 CH=CH+1:NEXTX                    :rem 27
570 POKE36879,25:POKE36869,255:POKE36867,
    47                               :rem 190
580 RETURN                           :rem 125
590 POKES-1,128                      :rem 69
600 FORI=1TO500:NEXTI                :rem 46
610 POKES-1,0                        :rem 211
620 RETURN                           :rem 120
630 IFL8-48=0THENRETURN              :rem 193
640 FORI=1TO(L8-48)*2STEP2           :rem 19
650 POKES,140+I*6                    :rem 178
660 POKE646,CO:CO=CO+1:IFCO>7THENCO=2
                                     :rem 32
670 PRINT"{HOME}{8 DOWN}"TAB(I)"{RVS} "
                                     :rem 208
680 PRINTTAB(I)"{RVS} "              :rem 242
690 FORQ=1TO200:NEXT:POKES,0          :rem 11
700 NEXT                             :rem 214
```

```
710 FORI=1TO500*(L8-48):NEXTI     :rem 200
720 RETURN                        :rem 121
```

Program 4: Atari Number Game

Refer to the "Automatic Proofreader" article before typing this program in.

```
KB 10 W=1.5:POKE 559,0:GOSUB 420:W=1
      .3
IF 20 POKE 752,1:OPEN #1,4,4,"K:":PO
      KE 82,0:GOSUB 290
OH 30 GRAPHICS 3
II 40 ? "{CLEAR}":DL=PEEK(560)+256*P
      EEK(561)+4:POKE DL+21,70:SETCO
      LOR 3,4,8:SETCOLOR 2,0,0:POKE
      752,1
NE 50 FOR I=24 TO 26:POKE DL+I,6:NEX
      T I
LJ 60 R=INT(RND(1)*10)+48
PJ 70 IF R=OLD THEN 60
NG 80 OLD=R
KJ 90 Q=USR(1536,R,1,2,3)
NA 100 PRINT "{3 SPACES}press this k
       ey."
DD 110 GET #1,A
MG 120 IF A=32 THEN GRAPHICS 0:END
KO 130 IF A<>R THEN SOUND 0,93,12,12
       :FOR I=1 TO 250:NEXT I:SOUND
       0,0,0,0:GOTO 110
KL 140 GOSUB 420
KO 150 GOSUB 170
DE 160 GOTO 40
DB 170 IF R=48 THEN RETURN
DP 180 COLOR 2:CO=1:X=1:Y=R-48
CJ 190 FOR I=X TO Y STEP CO
BI 200 PLOT I*4,15:PLOT I*4+1,15
BH 210 PLOT I*4,14:PLOT I*4+1,14
CH 220 SOUND 0,100-I*10,10,12
AN 230 FOR Q=1 TO 50:NEXT Q
CF 240 NEXT I:SOUND 0,0,0,0
GC 250 IF CO=-1 THEN RETURN
JH 260 FOR I=1 TO 600*(R-48):NEXT I
GK 270 CO=-1:COLOR 0:X=R-48:Y=1
GN 280 GOTO 190
FM 290 ? "{CLEAR}":POSITION 11,2:? "
       LEARN THE NUMBER":?
MB 300 ? "  THIS IS A PRE-SCHOOL NUM
       BER RECOGNI-  TION GAME. ";
MJ 310 ? "THE COMPUTER DISPLAYS A
       {6 SPACES}NUMBER AND YOU MUST
        FIND AND PRESS THAT KEY";
ID 320 ? " ON YOUR KEYBOARD."
EI 330 ? :? "  IF CORRECT, THAT NUMB
       ER OF BLOCKS IS"
CG 340 ? "DRAWN, AND YOU ARE GIVEN A
       NOTHER NUMBER.";
DG 350 ? "IF NOT CORRECT, THE COMPUT
       ER WILL ASK{3 SPACES}FOR ANOT
       HER ANSWER."
GC 360 ? :? "  TO STOP THE GAME, PRE
       SS THE SPACE BAR WHEN ASKED F
       OR AN ANSWER."
KC 370 POKE 559,34:IF PEEK(1536)=104
        THEN 400
LB 380 GOSUB 510
LJ 390 ? "{10 SPACES}ONE MOMENT PLEAS
       E."
HM 400 ? :? "{7 SPACES}HIT ANY KEY T
       O CONTINUE."
FA 410 GET #1,A:RETURN
LK 420 RESTORE
BA 430 FOR I=1 TO 8
CI 440 READ A:SOUND 0,A,10,10:SOUND
       1,A+5,10,10:SOUND 2,A-5,10,10
IL 450 FOR J=1 TO 75*W:NEXT J
HI 460 SOUND 0,0,0,0:SOUND 1,0,0,0:S
       OUND 2,0,0,0
IH 470 FOR J=1 TO 15*W:NEXT J
CE 480 NEXT I
HN 490 RETURN
LF 500 DATA 182,182,182,182,144,243,
       144,182
KE 510 ML=1536:FOR I=0 TO 252:READ A
       :POKE ML+I,A:NEXT I:RETURN
HG 520 DATA 104,240,10,201,4,240
OA 530 DATA 11,170,104,104,202,208
AF 540 DATA 251,169,253,76,164,246
BO 550 DATA 104,133,195,104,201,128
JO 560 DATA 144,4,41,127,198,195
JE 570 DATA 170,141,250,6,224,96
JO 580 DATA 176,15,169,64,224,32
JH 590 DATA 144,2,169,224,24,109
FB 600 DATA 250,6,141,250,6,104
LA 610 DATA 104,141,251,6,104,104
CH 620 DATA 141,252,6,14,252,6
LG 630 DATA 104,104,141,253,6,133
NE 640 DATA 186,166,87,169,10,224
CM 650 DATA 3,240,8,169,20,224
CK 660 DATA 5,240,2,169,40,133
AG 670 DATA 207,133,187,165,88,133
MI 680 DATA 203,165,89,133,204,32
DH 690 DATA 228,6,24,173,252,6
KL 700 DATA 101,203,133,203,144,2
OC 710 DATA 230,204,24,165,203,101
BE 720 DATA 212,133,203,165,204,101
LL 730 DATA 213,133,204,173,250,6
NG 740 DATA 133,187,169,8,133,186
JB 750 DATA 32,228,6,165,212,133
LJ 760 DATA 205,173,244,2,101,213
FL 770 DATA 133,206,160,0,162,8
MI 780 DATA 169,0,133,208,133,209
NI 790 DATA 177,205,69,195,72,104
CK 800 DATA 10,72,144,8,24,173
FN 810 DATA 251,6,5,208,133,208
PH 820 DATA 224,1,240,8,6,208
GN 830 DATA 38,209,6,208,38,209
PC 840 DATA 202,208,228,104,152,72
MA 850 DATA 160,0,165,209,145,203
CA 860 DATA 200,165,208,145,203,104
PG 870 DATA 168,24,165,203,101,207
LI 880 DATA 133,203,144,2,230,204
KC 890 DATA 200,192,8,208,183,96
FM 900 DATA 169,0,133,212,162,8
FK 910 DATA 70,186,144,3,24,101
BD 920 DATA 187,106,102,212,202,208
CI 930 DATA 243,133,213,96,0,1
CB 940 DATA 28
```

Program 5: Apple Number Game

```
10  FOR I = 1 TO 8: READ A: NEXT
20  DIM A(10,6): HOME : GOSUB 310
30  GR : COLOR= 1
40  HOME : PRINT  TAB( 13)"PRESS THI
    S KEY"
50 P =  INT ( RND (1) * 10): IF P =
    OLD THEN 50
60 OLD = P
70  GOSUB 450
```

```
 80  POKE  - 16368,0
 90  IF  PEEK ( - 16384) < 128 THEN 90
100  GET A$
110  IF A$ = " " THEN  TEXT : HOME :
      END
120  IF P + 48 <  > ASC (A$) THEN  FOR
     I = 1 TO 75:S =  PEEK ( - 16336
     ): NEXT : GOTO 80
130  GOSUB 540
140  GOTO 50
150  RESTORE
160  FOR I = 1 TO 8
170  READ F: POKE 769,F: POKE 768,5
180  CALL 770: NEXT I: RETURN
190  DATA  133,133,133,133,162,179,1
     62,133
200  FOR I = 0 TO 9: FOR J = 1 TO 6:
      READ B:A(I,J) = B: NEXT J,I: RETURN

210  DATA  60,102,110,118,102,60
220  DATA  24,56,24,24,24,126
230  DATA  60,102,12,24,48,126
240  DATA  126,12,24,12,102,60
250  DATA  12,28,60,108,126,12
260  DATA  126,96,124,6,102,60
270  DATA  60,96,124,102,102,60
280  DATA  126,6,12,24,48,48
290  DATA  60,102,60,102,102,60
300  DATA  60,102,62,6,12,56
310  PRINT : PRINT "            LEARN
      THE NUMBERS": PRINT
320  PRINT : PRINT "  THIS IS A PRE-
     SCHOOL NUMBER RECOGNI-  TION GA
     ME.";
330  PRINT "  THE COMPUTER DISPLAYS
     A     NUMBER, AND YOU MUST FIND
      AND PRESS THAT";
340  PRINT "KEY ON YOUR KEYBOARD."
350  PRINT : PRINT "  IF CORRECT, TH
     AT NUMBER OF BLOCKS IS  DRAWN,
     AND YOU ARE GIVEN ";
360  PRINT "ANOTHER NUMBER.IF NOT CO
     RRECT, THE COMPUTER WILL ASK
     YOU FOR ANOTHER ANSWER."
370  PRINT : PRINT "  TO STOP THE GA
     ME, PRESS THE SPACE BAR WHEN AS
     KED FOR AN ANSWER."
380  PRINT : PRINT  TAB( 11)"ONE MIN
     UTE PLEASE": GOSUB 200: GOSUB 6
     60
390  GOSUB 150
400  PRINT : PRINT : PRINT "
     HIT ANY KEY TO CONTINUE."
410  POKE  - 16368,0
420  IF  PEEK ( - 16384) < 128 THEN
     420
430  GET A$
440  RETURN
450 Q = Q + 1: IF Q > 15 THEN Q = 2
460  FOR I = 1 TO 6
470 X = A(P,I)
480  FOR J = 1 TO 8
490  COLOR= 0:X = X * 2
500  IF X > 255 THEN X = X - 256: COLOR=
     Q: POKE 768,1: POKE 769,X: CALL
     770
510  PLOT 16 + J,4 + I
520  NEXT J,I
530  RETURN
540  IF P = 0 THEN  RETURN
550 Q1 = 1:X = 1:X1 = 1:X2 = P
560  FOR I = X10 TO X2 STEP X
570 Q = Q + 1: IF Q = 16 THEN Q = 2
580  COLOR= Q * Q1
590  VLIN 30,33 AT I * 4 - 2: VLIN 3
     0,33 AT I * 4 - 1: VLIN 30,33 AT
     I * 4
600  POKE 768,5: POKE 769,I * 25: CALL
     770
610  NEXT I
620  IF Q1 = 0 THEN  RETURN
630  FOR I = 1 TO 700 * P: NEXT I
640 Q1 = 0:X =  - 1:X1 = P:X2 = 1
650  GOTO 560
660  FOR I = 770 TO 795: READ M: POKE
     I,M: NEXT I
670  DATA  172,01,03,174,01,03,169,0
     4,32,168,252,173,48,192,232,208
     ,253,136,208,239,206,0,03,208,2
     31,96
680  RETURN
```

Program 6: Color Computer Number Game

```
100 REM TITLE SCREEN
110 CLS 7:PRINT @231,"LEARN THE NUM
    BERS";:Y=2:GOSUB 370:CLS 1
120 PRINT:PRINT " THIS IS A PRE-SCH
    OOL NUMBER":PRINT " RECOGNITION
     GAME. THE COMPUTER":PRINT" DIS
    PLAYS A NUMBER AND YOU MUST"
130 PRINT" FIND AND PRESS THAT KEY
    ON":PRINT" ON YOUR KEYBOARD.":P
    RINT
140 PRINT " IF CORRECT, THAT NUMBER
     OF":PRINT" BLOCKS IS DRAWN AND
     YOU ARE":PRINT" GIVEN ANOTHER
    NUMBER. IF NOT"
150 PRINT " CORRECT, THE COMPUTER W
    ILL ASK":PRINT" YOU FOR ANOTHER
     ANSWER. TO":PRINT" STOP THE GA
    ME, PRESS THE SPACE";"
160 PRINT " BAR WHEN ASKED FOR AN A
    NSWER.":PRINT:PRINT "
    (4 SPACES)PRESS ANY KEY TO PLAY
    .";
170 A$=INKEY$:IFA$=""THEN 170 ELSE
    SOUND 225,1
180 REM PLAY THE GAME
190 CLS 3:PRINT @39,"LEARN THE NUMB
    ERS";
200 K=INT(RND(0)*10):IF K=TM THEN 2
    00 ELSE TM=K:GOSUB 400
210 PRINT @260,"PRESS THIS NUMBER .
    .. ";
220 A$=INKEY$:IF A$="" THEN 220
230 IF ASC(A$)=32 THEN CLS:END
240 IF ASC(A$)<48 OR ASC(A$)>57 THE
    N 220
250 PRINT @282,A$;
260 IF K<>ASC(A$)-48 THEN SOUND 20,
    10:GOTO 220
270 REM CORRECT ANSWER
280 Y=1:GOSUB 370:PRINT @363,STR$(K
    );:B$=" BLOCKS: ":IF K=1 THEN B
    $=" BLOCK: "
290 PRINT B$;:FOR I=1 TO 500:NEXT I
300 IF K=0 THEN 350
310 FOR I=1 TO K
320 V=RND(8):IF V=3 THEN 320
```

```
330 POKE 1439+I*3+1,143+16*(V-1):PO
    KE 1471+I*3+1,143+16*(V-1)
340 POKE 1439+I*3+2,143+16*(V-1):PO
    KE 1471+I*3+2,143+16*(V-1):SOUN
    D 128,3:NEXT I
350 FOR I=1 TO 2000:NEXT I:GOTO 190
360 REM PLAY A TUNE
370 FOR I=1 TO Y:SOUND 133,6
380 SOUND 159,6:SOUND 176,3:SOUND 1
    76,3:SOUND 159,6
390 NEXT I:SOUND 133,6:RETURN
400 X=1167:GOSUB 540:ON K+1 GOSUB 4
    20,440,450,460,470,480,490,500,
    510,520:REM DRAW NUMBERS
410 RETURN
420 POKE X,142:POKE X+1,141:POKE X+
    32,138:POKE X+33,133
430 POKE X+64,140:POKE X+65,140:RET
    URN
440 POKE X,133:POKE X+1,138:POKE X+
    32,133:POKE X+33,138:POKE X+64,
    132:POKE X+65,136:RETURN
450 POKE X,140:POKE X+1,143:POKE X+
    33,140:POKE X+32,143:POKE X+64,
    140:POKE X+65,140:RETURN
460 POKE X,140:POKE X+32,140:POKE X
    +64,140:POKE X+65,140:POKE X+1,
    143:POKE X+33,143:RETURN
470 POKE X,138:POKE X+32,140:POKE X
    +1,130:POKE X+33,142:POKE X+64,
    128:POKE X+65,136:RETURN
480 POKE X,143:POKE X+32,140:POKE X
    +64,140:POKE X+1,140:POKE X+33,
    143:POKE X+65,140:RETURN
490 POKE X,143:POKE X+32,143:POKE X
    +64,140:POKE X+1,140:POKE X+33,
    141:POKE X+65,140:RETURN
500 POKE X,140:POKE X+32,129:POKE X
    +64,132:POKE X+65,128:POKE X+1,
    141:POKE X+33,138:RETURN
510 POKE X,142:POKE X+32,142:POKE X
    +64,140:POKE X+65,140:POKE X+1,
    141:POKE X+33,141:RETURN
520 POKE X,142:POKE X+32,140:POKE X
    +64,140:POKE X+1,141:POKE X+33,
    141:POKE X+65,140:RETURN
530 REM DRAW BLOCK
540 FOR I=110 TO 236 STEP 32:PRINT
    @I,CHR$(128)+CHR$(128)+CHR$(128
    )+CHR$(128);:NEXT I:RETURN
```

Program 7: PC/PCjr Number Game

```
10 KEY OFF:WIDTH 40
20 GOSUB 280
30 CLS:DEF SEG=0:POKE 1047,PEEK(1047) OR
 32
40 COLOR 2
50 B1$=STRING$(3,219):B2$=B1$:B3$=B1$
60 R=INT(RND(1)*10):IF R=OLD THEN 60
70 OLD = R
80 GOSUB 180:COLOR 7
90 LOCATE 12,13:PRINT"Press This Key"
100 POKE 1050,PEEK(1052)
110 C$ = INKEY$:POKE 1050,PEEK(1052):Z =
 RND(1):IF C$ = "" THEN 110
120 IF C$=" " THEN CLS:END
130 IF VAL(C$)<>R THEN SOUND 80,7:GOTO 1
10
140 GOSUB 520
150 GOSUB 400
160 CLS
170 GOTO 60
180 CO=CO+1:IF CO=16 THEN CO=2
190 IF CO=8 THEN CO=9
200 FOR I=1 TO 6
210 X=A(R,I)
220 FOR J= 1 TO 8
230 COLOR 0:X=X*2
240 IF X>255 THEN X=X-256:COLOR CO
250 LOCATE I+3,J+16:PRINT CHR$(219)
260 NEXT J,I
270 RETURN
280 CLS:LOCATE 2,11:PRINT"Learn The Numb
ers"
290 LOCATE 5,2:PRINT"  This is a pre-sch
ool number recogni-";
300 PRINT "tion game. The computer displ
ays a"
310 PRINT "number, and you must find and
 press thatkey on your keyboard."
320 PRINT:PRINT"  If correct, that numbe
r of blocks is  drawn, and you are given
 another number.";
330 PRINT"If not correct, the computer w
ill ask   you for another answer."
340 PRINT:PRINT"  To stop the program, p
ress the space  bar whe asked for an ans
wer."
350 GOSUB 520
360 GOSUB 610
370 PRINT:PRINT"          hit any key to c
ontinue ";
380 V$ = INKEY$:Z=RND(1):IF V$ = "" THEN
 380
390 RETURN
400 IF R=0 THEN RETURN
410 X=1:X1=1:X2=R:H=1
420 FOR I= X1 TO X2 STEP X
430 CO=CO+1:IF CO=16 THEN CO=2
440 IF CO=8 THEN CO=9
450 COLOR CO*H:SOUND I*40+130,3
460 LOCATE 16,I*4-2:PRINT B1$:LOCATE 17,
I*4-2:PRINT B2$:LOCATE 18,I*4-2:PRINT B3$
470 NEXT I
480 IF X= -1 THEN RETURN
490 FOR U=1 TO 500*R:NEXT U
500 X=-1:X1=R:X2=1:H=0
510 GOTO 420
520 RESTORE
530 FOR I= 1 TO 8
540 READ B
550 SOUND B,7
560 SOUND 32767,2
570 NEXT I
580 RETURN
590 DATA 174.61,174.61,174.61,174.61
600 DATA 220,130.81,220,174.61
610 FOR I = 0 TO 9:FOR J = 1 TO 6:READ B
:A(I,J) = B:NEXT J,I:RETURN
620 DATA 60,102,110,118,102,60,24,56,24,
24,24,126
630 DATA 60,102,12,24,48,126,126,12,24,1
2,102,60
640 DATA 12,28,60,108,126,12,126,96,124,
6,102,60
650 DATA 60,96,124,102,102,60,126,6,12,2
4,48,48
660 DATA 60,102,60,102,102,60,60,102,62,
6,12,56
```

Dragonriders Of Pern For Commodore 64 And Atari

Shay Addams

Dragonriders mixes the plot line of Anne McAffrey's science fiction novels into a menu-driven, all-text adventure that incorporates a hi-res action sequence. The scenario unfolds on Pern, a faraway planet threatened by silvery alien life forms (Thread) drifting across space from a nearby red star to destroy everything they touch.

Only the flying dragons bred for centuries in the Weyrs of Pern's volcanic heights can incinerate the Thread before it hits the ground. In addition to a half-dozen Weyrs, the planet's fate is influenced by various Holds, which are guided by Lord Holders and Crafts Masters. Ultimate success hinges on forming alliances with these individuals and groups—so politicking, learning to figure out and manipulate people and events, is more important than hand-eye coordination. The computer moves for the other Weyrs in the solitaire game, and always controls the other Weyrs when more than one person is playing.

Negotiations And Intrigue

Gameplay consists of two phases, negotiation/intrigue and Thread fighting. Most of the time you'll be involved with the former. During this phase, an all-text "event screen" reveals exactly what's happening around Pern at the moment, with details on which Weyrs, Holds, or Craftsmen are currently engaged in negotiation or attempts to form alliances. The day on which these events will be settled is noted, and the current date is posted at the bottom right of the screen. When an event reaches its settlement date, the results are displayed at the bottom of the screen. Weddings (preceded with a flourish of trumpets), baby lizard hatchings, plagues, and other random events that can affect the outcome of the game also appear here.

To jump into the fray, press the fire button (or function key). You will see an "action menu." The menu offers a list of eight options that include description, negotiate, attempt alliance, invite to wedding or hatching, dragonrider or Lord Holder conclave, or duel. Below the menu, information on the status of your Weyr names your three strongest supporters among the Holds and Craftsmen, and other useful information. After choosing an option, you're presented with a list of the various Holds and Craftsmen and prompted to pick one.

Forming Alliances

The description option returns you to the event screen, where a terse paragraph on the individual tells his attitude toward you and drops other hints that will help determine the best way to convince him to form an alliance with your Weyr. If you've decided to negotiate or try to form an alliance, you get to choose up to three Holds or Craftsmen to assist you. (You cannot select to deal with anyone already engaged in a meeting.) Then you must pick from a menu of negotiating attitudes: pleading, conciliatory, amiable, forceful, or threatening.

Now you're returned to the event screen. No other actions are possible while awaiting the results of the meeting, so you're limited to reading the events of the day and plotting new strategies based on these happenings. If Sea Cliff Hold rejects an alliance with Telgar Weyr, for instance, you'll know that, depending on other variables, you should negotiate with Sea Cliff next. To enliven the gameplay, a vividly colored map of Pern occasionally takes over the screen and pinpoints the area where Thread is falling. A prompt asks who will send dragons, and the first player to respond can dispatch as few or as many dragons as he has on hand. It's important to defend the areas allied or bound to you,

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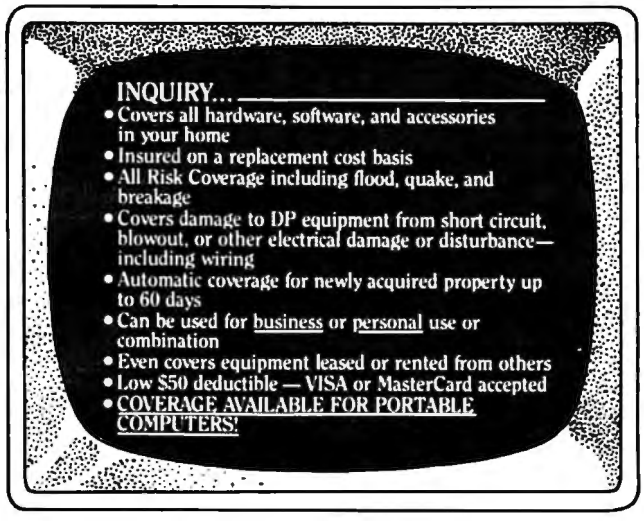

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because other Holds will be more likely to form alliances with you.

A Turn (Pern year) takes two to seven minutes, depending on which of three speed settings is chosen, and you can choose to play games from 1 to 99 Turns long. Following each Turn, a victory status screen awards two points for each Hold and one for each Craft Hall you've allied with. You need 20 points to win.

Hi-Res Panorama

The Thread-fighting sequence is played on a colorful, hi-res panorama of Pern's countryside that's complete with a castle. As wisps of Thread drift slowly toward the surface, you maneuver a flying dragon that burns them up with its fiery breath while avoiding their deadly touch. It's vital to do well in this phase, in order to convince the Holds of your capability to defend them.

In flight, the dragon wraps around to the other side of the screen. Sprites are employed for a 3-D effect—you can point the dragon at the horizon and hit the stick to watch him shrink in size as he flies into the distance and vaporizes Thread that's falling further away. Before starting, you can set the level (0–3) at which Thread falls, and this sense of depth adds an effective new dimension to action games.

The screen flashes red when your dragon dies, and it's replaced by another until your supply of dragons is depleted. After all players have completed this phase, a results screen shows how many dragons were killed and which Holds are Thread-infested. At this point, you can save the game in progress to disk or continue with the next Turn of 240 days. One positive feature of the program is that it is entirely RAM-resident, so you never have to wait for it to access the disk for more data the way most adventures do.

The Agreeable Pern

Pern is unusual in its gameplay and structure, and even more so in its victory requirements—winning depends on getting characters to *agree* with you, not on the number *killed* by you. And if too many Holds get infested, no one wins. Much of the fun emerges from recognizing the traits of various characters, predicting and exploiting how they react to certain actions and persuasions, and ultimately being drawn into the day-to-day life and culture of Pern. If you're tired of shooting up the same retreaded space ships, weary of typing "look under rock," this one-of-a-kind game may offer the offbeat kind of entertainment you're seeking. *Dragonriders of Pern* is also an intriguing forerunner of the next generation of computer games, more than a few of which will also be based on established novels.

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A Natural Voice

Some synthesizers build words out of phonemes, the basic sounds that are inherent to speech, such as consonants and vowels. Since all the components of speech are available to phoneme-based synthesizers, they can speak any word, but they do sound metallic, inhuman, somewhat robotic. No one would mistake it for a natural voice.

Commodore uses a different technique. A limited vocabulary is spoken by a person and recorded on a mainframe computer. The digitized speech is then analyzed, compacted, and reconstructed. Because of the compacting, a minimum amount of memory is used. This enables Commodore to pack a lot of words into a small amount of memory.

Installation

The *Magic Voice* cartridge plugs into the Commodore 64 cartridge port. If you are using a TV, the *Magic Voice* module also has a plug that goes into the audio/video socket on your computer. The SID chip mixes its own sound with the voice, then drives it through the TV speaker. If you use a monitor or stereo for sound, you plug the audio out from the audio/video socket into the *Magic Voice* module. An output from the module is then attached to your monitor or stereo. In theory, this should work fine. But these two wires are usually molded together so it's difficult to plug the audio jack into *Magic Voice* and the video into your monitor. It's impossible if you use the rear connections on a Commodore monitor. The cable isn't long enough. Fortunately, you can buy an RCA phono extension cord to get the extra length.

Magic Voice knows 235 words. The vocabulary covers a wide variety of common words and a list of computer-specific terms such as *cursor* and *disk*. The cartridge automatically adds commands to BASIC without using any of the BASIC memory space. Machine language programmers, however, will have to live without the memory at $C000–$C3FF, which is used by *Magic Voice*.

To program speech, you use the command SAY. SAY "HI" will do just that. The female voice is remarkably pure and natural. In fact, you can actually mistake the voice for that of a real person. You can also use variables, such as SPEAK A$. One limitation of SAY is that you must use a separate statement for each word. You cannot SAY "YOU ARE CORRECT", but must SAY "YOU":SAY "ARE":SAY "CORRECT".

When a voice is playing, the 64 does not wait for it to finish. This lets your program run quickly, since the speech doesn't slow it down. The computer will wait for the word to be finished if you send another word while it is speaking. A system variable called RDY is added to BASIC to let you detect when the box is through talking.

No Chipmunks

You can speed up or slow down the rate of speech, but not dramatically. The RATE command accepts a number from one to ten. Rate #4 is the normal, default setting. Rate #1 speaks 0.65 times slower than normal, and rate #10 is 1.4 times faster. Changing the rate doesn't change the pitch. You won't get a chipmunk sound. The remaining command, VOC, is only used when you've loaded additional words into memory (more on that later).

These new BASIC commands make programming speech easy. You can also refer to words by their number in the dictionary. For example, SAY 157 will utter "YES." This is the most memory-efficient technique, but it makes your program hard to read.

The biggest problem is trying to find the words you need to communicate. Since there are only 235 words, you cannot say everything that comes to mind. The manual includes two vocabulary listings, one of them in alphabetical order to help you quickly find the available words. There are no basic phonemes, so there is no way to construct words not in the vocabulary.

This problem can be alleviated by adding additional speech cartridges that expand the vocabulary. Commodore has promised variations on the voice such as male and child voices. There are also two Commodore games that can use *Magic Voice*—*Gorf* and *Wizard of Wor*. When your ship is destroyed, Gorf laughs, "HA-HA-HA SPACE CADET." Psychological warfare, with the computer challenging and taunting you, adds an extra dimension to game play. Curiously, this voice is computery and hard to understand, following the example set by the arcade versions of the games.

The manual gives an adequate explanation on how to use the module, and has many example BASIC programs that use speech, such as a program that can say any number up to 999,999,999 by stringing together words like "two - million - one - hundred - thousand - four - hundred - thirty-two." There is also good documentation for using *Magic Voice* Kernal routines in machine language programs. There is no documen-

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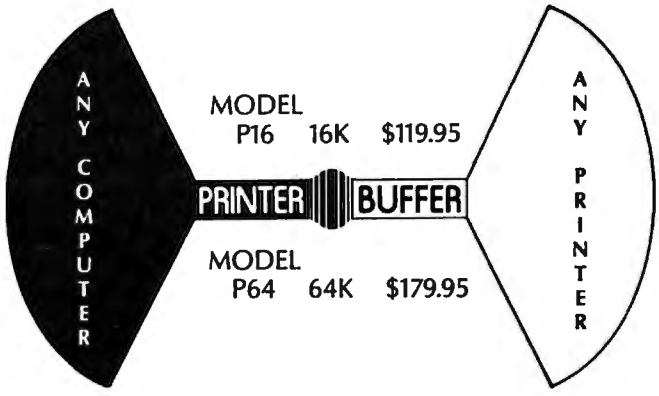

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tation on how you can digitize and create new words. That would require expensive equipment in any case.

Applications

What can you do with *Magic Voice?* Games that speak set up a better computer-human rapport. Talking prompts and instructions allow youngsters who cannot yet read to more easily interact with the computer. This is ideal for educational applications. Word processing programs can use spoken messages when a displayed prompt might be overlooked. And for the handicapped, the *Magic Voice* can read for the blind and talk for the speech-impaired. As you type, each letter can be pronounced, which can also help teach touch typing. Also, Commodore has announced plans to support *Magic Voice* in future software offerings.

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Atari Touch Tablet And Light Pen

Tom R. Halfhill, Staff Editor

One of the most marvelous things about home computers—particularly Atari computers—is their full-color graphics. And one of the most frustrating things about home computers can be the complexity of programming those graphics.

Nearly everybody has been impressed by the dazzling graphics demos on the computer screens at the local computer shop or department store. But when you first bring the computer home, unwrap it, set it up, and plug it in, the screen is forbiddingly blank—all it says is READY.

The computer may be ready, but you aren't. Where do you start? How can you learn to create those wonderful graphics which helped sell you on the computer in the first place?

If you're ambitious, you might start tackling the BASIC programming manual, plus other books and magazines. But it could require hours of study before your first crude graphics even begin to appear on the screen. And by then you'll be yearning for a better way.

There *are* better ways, of course. For instant results, there's nothing like plugging in some sort of input device which lets you draw and paint using skills you've been developing since your first scribbles in kindergarten. Ideally, this input device should feel to your fingers like a traditional pencil, crayon, or paintbrush; its effect on the screen should resemble the effect of these conventional tools on paper; and it should insulate you from the extensive programming.

Some graphics-drawing programs use joysticks or paddle controllers as input devices. These are not traditional drawing implements, but they aren't hard to master—particularly if you've played videogames. Still, it would be nice if the years you spent learning how to manipulate pencils, pens, and paintbrushes could be wedded directly to an input device which *acts* like a pencil, pen, or paintbrush, and which also eliminates the need to program the computer on its own level. Such a device would also make the computer much more accessible to youngsters. They're still struggling to develop basic skills and don't need anything extra to confuse them.

Generally, two solutions have been invented: light pens and touch tablets (also called graphics tablets). Examined objectively, they are technically similar—both translate the position of a stylus into coordinates which the computer understands as a point on the screen. Therefore, both devices bypass a major step in programming.

But in other, more subjective ways, light pens and touch tablets are quite different. Each device has its own "feel," and the ultimate choice must depend on your own preferences. It's analogous to the differences between drawing in chalk or in pen-and-ink. When choosing between a light pen and a touch tablet, your best bet is to try your hand at both before deciding. However, there are a few objective differences which might sway your decision one way or the other. Fortunately, two recent products from Atari, Inc., give Atari users a wider choice between these two types of drawing tools.

Compatible With Almost Any System

The Atari Light Pen package includes a stylus with a touch-sensitive tip that plugs into a joystick port with a 46-inch cord; *AtariGraphics* software on a snap-in ROM cartridge; and a 20-page manual. The package works on any Atari computer, but at least 48K RAM is recommended (and required to save screen images on disk). To save screens on tape, at least 16K RAM is required.

The Atari Touch Tablet package includes a graphics tablet with two fire buttons that plugs into a joystick port with a 48-inch cord; a plastic stylus with a tiny fire button that plugs into the tablet via a 27-inch cord; *AtariArtist* software on a ROM cartridge; a DOS 3.0 diskette; and a 21-page manual.

The package works on any Atari computer with at least 16K RAM.

Getting started with either package is quick and easy. You just plug in the light pen or touch tablet, insert the ROM cartridge, and switch on the computer. If you have a disk drive, you insert a system disk with DOS before booting up. Both packages seem to work equally well with all versions of Atari and OS/A+ DOS.

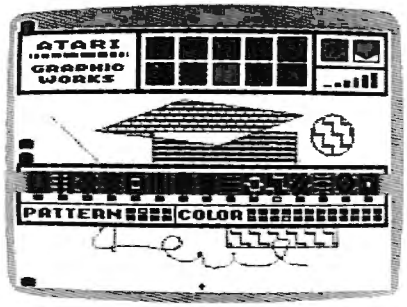
Light pens require calibration, so the first thing the *AtariGraphics* software asks you to do is point the pen at a certain spot on the screen. If nothing happens, it probably means the brightness on your TV or monitor is too low. Remember, a light pen contains a photosensor that actually reads the light emitted by the screen. If there isn't enough light, the computer can't determine where the pen is pointing.

Proper calibration is the Achilles heel of light pens, and the Atari Light Pen is no exception. Response can vary from screen to screen, static electricity can interfere with the readings, and generally you'll have to turn up the brightness until the colors are partially washed out. In fact, some dark colors won't register a reading at all. One solution is to draw with bright colors and then change them into the darker colors you really want after the work is finished. Fortunately, because the Atari is the only home computer besides the IBM PCjr with color indirection, this is very easy to do. After the light pen is calibrated, the main drawing screen appears.

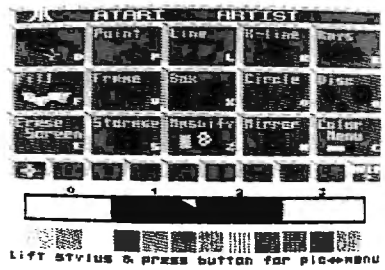
The touch tablet, of course, requires no calibration, so after a title screen, the main menu screen appears.

Two Types Of Menus

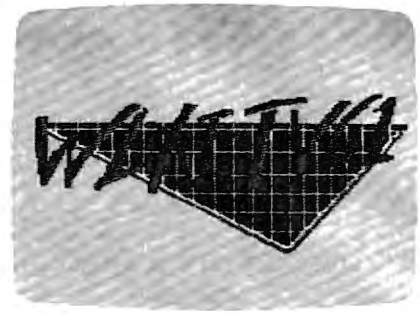
Although the *AtariGraphics* (light pen) and *AtariArtist* (touch tablet) programs share many similarities, they have different



An example of two pull-out menus with the Atari Light Pen's AtariGraphics *software. They slide across your picture when you touch the pen to one of the tiny tabs along the left side of the screen.*



Instead of pull-out menus, the Atari Touch Tablet's AtariArtist *software has this separate menu screen, available by pressing a button.*



This screen picture—a TV station logo—was created by slipping a bumper sticker beneath the touch tablet's plastic surface and tracing the design with the stylus.

kinds of menus. The *AtariGraphics* software was obviously influenced by the philosophy exemplified by the Apple Macintosh. Along the left side of the screen are four tiny white tabs; pressing the light pen to any of them causes a menu to slide over your drawing. The four menus allow you to choose drawing modes, colors, patterns, and storage options. When you point to the tab again, the menu slides back off the screen, leaving your drawing intact. You can even make the tabs themselves disappear by pressing the TAB key on the keyboard.

In contrast to this pull-out menu approach, the *AtariArtist* software has the more conventional alternate menu screen. Pressing either fire button on the touch tablet or the button on the stylus instantly flips between the drawing screen and the menu.

With either program, selecting menu options requires only two steps. All the options are represented on the screen as icons—small self-explanatory pictures. With the light pen, you point to the option icon you want and then softly push the pen against the screen. The pen's pressure-sensitive tip registers your choice. When using the tablet, you move a pointer around the screen by gently touching the tablet's surface with the stylus or your finger. When the pointer indicates the function you want, you press either fire button on the tablet or the button on the stylus. Again, this confirms your choice. (With three buttons to choose from, lefties aren't left out.)

The menu options available in *AtariArtist* and *AtariGraphics* are quite similar. With either system you can draw freehand; automatically draw circles, rectangles, and straight lines connecting any two points; automatically fill any shape with a wide variety of colors and patterns; change your selection of colors and patterns; magnify a picture for fine detail work; draw in two-way or four-way mirror modes, in which each stroke on one part of the screen is mirrored on the opposite part; and, of course, save/load screens using disk or tape.

Color Tradeoffs

But there are important differences between the two programs, too. For instance, the *AtariGraphics* light pen software has three major functions missing from *AtariArtist*: You can enter text on the screen from the keyboard; superimpose a grid of dots over your picture as a guide for drawing straight lines or proportioning; and draw any kind of parallelogram, not just squares and rectangles.

On the other hand, the *AtariArtist* touch tablet software has options that *AtariGraphics* lacks: you can draw discs (solid circles) and boxes (solid rectangles); you can draw "rays" (numerous lines emanating from a single point); and you can vary the brush stroke of the stylus from fine to broad, or even simulate drawing with two or three styli at once.

Of course, there are ways around each program's limitations. You could make discs and boxes with the light pen by drawing a circle or rectangle, then filling it; you could draw parallelograms with the touch tablet by connecting straight lines; and you could produce rays with the light pen by drawing each radiating line separately. It's probably safe to say that any screen which could be created with one system could be duplicated with the other.

Both *AtariGraphics* and *AtariArtist* let you work with a palette of 128 possible colors, of which only four can be displayed on the screen simultaneously. At first this might seem like an odd limitation, since Atari computers are capable of 256 colors. The explanation is that Atari had to compromise to keep the packages compatible with *all* Atari computers, past and present. Ataris manufactured before early 1982 have the CTIA graphics chip instead of the more recent GTIA. The CTIA chip displays only half as

many luminances—eight for each of the 16 colors, instead of the GTIA's 16 luminances.

The limit of four simultaneous colors is another compromise. Some Atari graphics modes can display more than four colors, but at lower resolutions. *AtariArtist* and *AtariGraphics* both employ a graphics mode of 160 by 192 pixels (screen dots), sometimes referred to as GRAPHICS 7-1/2. It can be accessed on Atari XLs in BASIC, but not on previous Ataris without special programming. The Atari's maximum resolution is 320 × 192 pixels (GRAPHICS 8), but that mode offers only two colors. So Atari traded less resolution for more colors.

Interestingly, though, the pointer on the *AtariArtist* color mode steps twice for each luminance level—as if the 16-luminance, 256-color capabilities were built-in, but dormant.

Canvas Vs. Sketchbook

The drawing possibilities offered by the *AtariGraphics* and *AtariArtist* programs are so much alike that a purchase decision will probably be based on the hardware: light pen versus touch tablet (unfortunately, the light pen software won't work with the touch tablet or vice versa). This is where your personal sense of each device's "feel" is all-important.

The idea of a light pen might seem more natural. After all, it's like moving a paintbrush across a canvas or a crayon across paper. It's the way you've always created paintings or drawings.

The touch tablet, in contrast, might seem unnatural. Unlike any traditional art medium, it separates the mechanical action from the artwork. It's sort of like drawing by remote control.

But all is not as it seems. Light pens can be finicky as mentioned above. Also—and don't underestimate this—light pens can strain your arm and eyes, because you have to reach up to the screen and sit very close.

The touch tablet lets you relax at a comfortable distance from the computer, but it also takes some getting used to. The separation of manipulation from creation is analogous to word processing. When writing, you're supposed to look at the screen instead of the keyboard; likewise, when drawing you're supposed to look at the screen instead of the tablet. Most people catch on fairly quickly.

The touch tablet does have several advantages which are more tangible. It's probably more suitable for small children, since it responds better and can be manipulated with fingers instead of a stylus. You can copy small pictures with it by slipping the picture beneath the removable plastic surface and then tracing it with the stylus.

The *AtariArtist* color menu includes a spectacular option that lets you temporarily replace any of the four screen colors with a scrolling 128-color rainbow. Another option calls up a help screen for confused beginners. The magnify option is by far more versatile—you can perform virtually any function available in the normal mode, while the light pen software merely lets you change the colors of pixels. And finally, pictures made with the tablet take up much less room on tape or disk than pictures made with the light pen, thanks to a data-compaction scheme.

Before buying one of these packages, at least give the other a fair test. Either way it's hard to go wrong. Both are high-quality, well-designed products.

Atari Touch Tablet $89.95
Atari Light Pen $99.95
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Questions Beginners Ask

Tom R. Halfhill, Staff Editor

Are you thinking about buying a computer for the first time, but you don't know much about computers? Or maybe you recently purchased a computer and are still a bit baffled. Each month in this column, COMPUTE! *will answer questions often asked by beginners.*

Q I am interested in purchasing a printer to go along with my computer. Several questions come to mind. First of all, what is meant by *parallel* and *serial* as related to printers? Do most new printers have a built-in interface of one type or another? I know the Atari printers do (I own an Atari 800XL), but what about third-party printers? What type of peripheral port does Atari use? The RS-232C or the Centronics standard? Numerous advertisements for printers in your publication claim compatibility with one brand or another. Does that mean the printer can be directly connected without an extra interface device? Most of the ads for printers do not specify the brand of computer that they are compatible with. Is it because the appropriate interface can be purchased separately? I'm sure there are plenty more folks out there who, like me, need answers to these questions.

A Welcome to the world of personal computing, where frequently used terms often have ambiguous meanings and few things are as simple as they should be.

There are indeed plenty of folks out there who would like answers to those questions. Similar questions are asked by practically everybody who starts shopping for a printer for the first time. Let's tackle them one by one.

The terms *serial* and *parallel* refer to the two general types of computer interfaces. They apply to all computer devices, not just printers. (An interface is simply a connection between two parts of a computer system.)

A serial interface transfers information one bit at a time, one after the other. Since it takes eight bits to represent one character, a computer hooked up with a serial interface to a printer must send a stream of eight signals each time a character is to be printed.

A parallel interface, on the other hand, transfers information eight bits at a time, all at once. A computer hooked up with a parallel interface to a printer can send the eight signals simultaneously for every character to be printed. Therefore, when all other things are equal, a parallel interface is much faster than a serial interface.

Here's an analogy: Think of a multiplex movie theater at a shopping mall, one with eight separate screens showing eight different movies. If the ticket booth is staffed by only one person (as they frequently are), everyone has to wait in one very long line, no matter which movie they want to see. The line moves relatively slowly. But if the ticket booth is staffed by eight people, one for each screen, the lines move about eight times faster. That's the difference between serial and parallel.

So, you might conclude that a printer with a parallel interface is preferable to one with a serial interface. But in practice, the printer interface's speed isn't too important for average home users. Under-$1000 printers are generally limited by the speed of their own printing mechanisms, not by the speed at which the interface can transmit data. Instead, your decision should be based on which interface is more readily available for less money.

Nearly all printers come with one type of interface built-in, either parallel or serial. Some have both. Some have neither. So you can order them with the one you want. And some printers have one interface plus the option of adding a

second. If this information is not in the advertisement, you'll have to contact the manufacturer, distributor, or dealer.

There are many different kinds of serial and parallel interfaces, but over the years two have become accepted as de facto standards for personal computer printers. The most common serial interface is called the RS-232C, and the most common parallel interface is called the Centronics standard (named after the manufacturer which made it popular). Probably 90 percent of the printers you see will have one interface or the other, especially printers made by *third-party companies* (independent firms which are not connected with a computer manufacturer).

Many personal computers—including the Atari, Commodore 64, VIC-20, Apple II/IIe, TI-99/4A, and IBM PC—do not include an RS-232C or Centronics interface as standard equipment. This means you either have to buy a printer made to plug directly into the computer, or buy an interface that will connect your computer to an RS-232C or Centronics-standard printer.

Atari computers do have a built-in serial interface, but it's not RS-232C standard. The Atari 600XL and 800XL also have a built-in parallel interface, but it's not Centronics standard. Both interfaces are unique to Atari, and they're made for plugging in Atari-compatible disk drives, cassette recorders, and other peripherals. The serial interface—that large socket on the right-hand side of the computer—works directly with the new line of Atari printers, including the 1025 dot-matrix printer, the 1020 color printer, and the 1027 letter-quality printer. No extra interface is required.

Although the computer manufacturer's own printers are usually the safest bet for full compatibility, you may want to buy a third-party printer for certain features or for a lower price. To hook up an RS-232C or Centronics-standard printer to your Atari, you'll need the Atari 850 Interface Module. It has one Centronics port and four RS-232C ports. Unfortunately, these modules cost about $175, and they're hard to find. Fortunately, equivalent interfaces are available from third-party companies for less money, and at least one third-party Atari-compatible disk drive has such an interface built-in.

Also, Atari planned to introduce something called the 1090XL Expansion System for the 600XL and 800XL. This is a box which plugs into the rear parallel expansion port found only on the 600XL/800XL, adding five expansion slots. The slots would accept more memory and various types of interface cards. However, Atari's recent sale and massive layoffs might affect future plans for such new products.

Anyway, once you add an RS-232C or Centronics interface to your computer, all you need is a compatible printer and a cable. When an advertisement states that a certain printer is "compatible" with your computer, it can mean two things: Either the printer is directly compatible (no extra interface required), or it's compatible with your computer only if you already have the RS-232C or Centronics interface. It's up to you to determine which. Always check before you buy, and make sure the proper cable is available, too. Strange as it may seem, not all RS-232C or Centronics ports take the same plugs. Sometimes the pins are wired differently. Specify the exact configuration of your system so the dealer can steer you to the printer, interface, and cable which will match together correctly.

Of course, everything we've discussed so far is limited to *hardware* compatibility. If you're planning to use the printer with a certain program—such as a word processor—you should also think about *software* compatibility. Certain programs can't take advantage of all the special features built into certain printers, and vice versa. But that's a topic for another column. For more information on matching printers and word processors, see "Questions Beginners Ask," COMPUTE!, March 1984. ©

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Robert Alonso, Assistant Editor

Logical Dreams

"If" is one of the most useful words in our vocabulary; it allows us to test situations and make appropriate decisions based on the test. Likewise, the BASIC command IF is one of the most useful words in the computer's vocabulary, and for the same reasons. Computer programs always rely on logical decisions to produce a result. Everything from data processing applications to arcade-style games relies on IF-THEN testing. The format is pretty simple: *if* something is true, *then* do something in response. For example, IF *joystick is pushed up*, THEN *move spaceship up.*

Using The Right IF

The IF-THEN statement can often be replaced with the statement IF-GOTO. Before mixing the statements or replacing one with the other in your programs, you must first understand the nature of each. IF-THEN is the most convenient and safest to use of the two. The reason for this is that almost any instruction placed after the THEN will be executed without any problems. You can place a line number after the THEN and the program will go to that line number, or you can place an expression such as A=A+1 and the program will execute it. The IF-THEN statement can thus be a very powerful and useful part of your programs. IF-GOTO is not as versatile as IF-THEN because it can only execute line numbers after the GOTO. If you tried placing an expression such as the previously mentioned A=A+1, the computer would flag it as an error.

IBM's Double GOTO

The Apple, Atari, and Commodore computers all flagged Program 1 as having an error in the line containing the IF-GOTO. The only two computers tested that did not flag it as an error were the IBM PC and PCjr. The IBM computers allowed the expression A=A+1 after an IF-GOTO and also allowed the following line:

```
20 IF A=1 GOTO GOTO 40
```

The double GOTO was allowed only if a line 40 had been entered and only after the IF statement. A program with a line number followed by double GOTOs and a target line number resulted in an error. This kind of rule bending is atypical of IBM. Just for reference you should know that the second edition (May 1982) of the BASIC manual by IBM and Microsoft states: "If the expression is true (not zero), the THEN or GOTO clause is executed. THEN may be followed by either a line number for branching or one or more statements to be executed. GOTO is always followed by a line number."

Although IBM may let you get away with an expression after an IF-GOTO, you should try to avoid such a construction within your programs. It is not standard and can produce errors and plenty of confusion. It is probably better to use only the IF-THEN statement because it allows either an expression or a line number and works the same on all the tested computers.

Sometimes an IF-THEN construction alone is not enough. In some situations, a structure called IF-THEN-ELSE can be useful. This structure is quite similar, but allows you to specify two THEN outcomes (one that's triggered by the IF and one that's triggered by an implied "IF NOT"). In other words, if the condition following the IF is true, whatever follows the THEN is carried out. If it is false, whatever follows the ELSE is carried out.

The Missing ELSE

However, this IF-THEN-ELSE construction is almost never used in programs published in magazines and books. The reason for this is not

that there is something better, but that many home computers (Apple, Atari, and Commodore) do not have an ELSE command as part of their BASIC. IBM is one of the few that do allow IF-THEN-ELSE. The TI *Extended BASIC* cartridge also allows it.

There is a way to mimic IF-THEN-ELSE. Let's say that you want to test if a variable is equal to 100 and you want the THEN to end the program if it is. Otherwise, you want an ELSE to add 1 to the variable and let the program continue. Program 2 is an example of a routine that will do just that, without the ELSE command.

Imitating IF-THEN-ELSE

The IF-THEN-ELSE construction is in lines 30 and 40. The reason this works is that if the IF-THEN in line 30 is false, program execution "falls through" to line 40. The line following an IF-THEN can thus be used for the ELSE. There are some extra precautions that you should take. If the IF-THEN in line 30 had an expression (like A=A+1) instead of the END instruction, the program would execute the expression and then go to the next line and execute the line which you are using as an ELSE. This must be avoided or your program will not work properly. Program 3 is an example of how to properly mimic an IF-THEN-ELSE.

Take a look at the differences between Programs 2 and 3. The GOTO 50 in line 30 of Program 3 prevents the program from going on to line 40 when the IF condition is true. You should always include a GOTO with a target line number at the end of your IF-THEN if you are going to create the IF-THEN-ELSE construction. It is the only way to insure that the ELSE condition will not be executed haphazardly.

Program 1: IF-GOTO Error Demo

```
10 A=1
20 IF A=1 GOTO A=A+1
30 PRINT A
```

Program 2: IF-THEN-ELSE Construction

```
10 A=0: B=0: REM INITIALIZE
20 B=B+A: REM EXPRESSION
30 IF A=100 THEN END: REM IF THEN
40 A=A+1: GOTO 20: REM ELSE
```

Program 3: Better IF-THEN-ELSE

```
10 A=0: B=0: REM INITIALIZE
20 B=B+A: REM EXPRESSION
30 IF A=100 THEN PRINT B: GOTO 50: REM IF THEN
40 A=A+1: GOTO 20: REM ELSE
50 END
```

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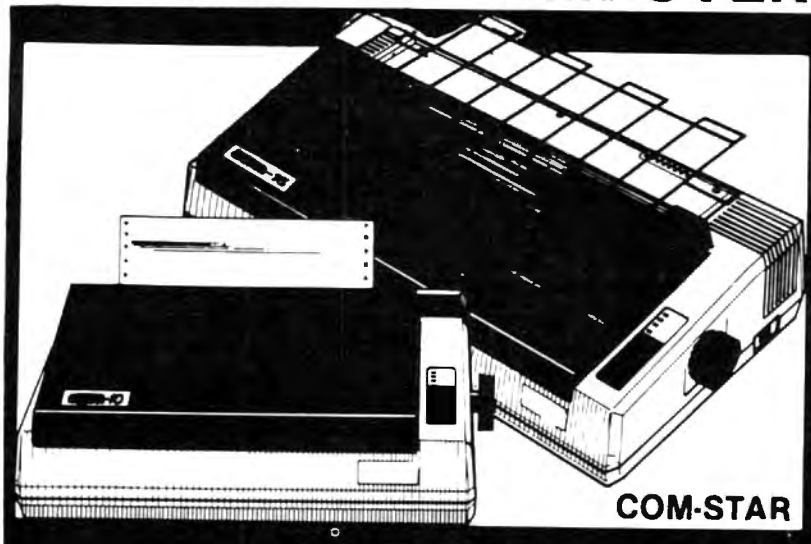

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Has all the features of the 10" COM-STAR PLUS+ PRINTER plus 15½" carriage and more powerful electronics components to handle large ledger business forms! (Better than Epson FX 100) List $599 **SALE $379.00.**

Superior Quality 140-160 CPS 10" COM-STAR PLUS+ IBM Pers/Bus Printer $389.00

Has all the features of the 10" COM-STAR PLUS+ PRINTER! It is especially designed for all IBM personal computers! 140-160 CPS HIGH SPEED PRINTING 100% duty cycle, 2K buffer, diverse character fonts, special symbols and true decenders, vertical and horizontal tabs.
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The **Super Com-Star+ High Speed Business Printer** 160-180 CPS has a 10" carriage with all the Com-Star+ features built in! The 15½" **High Speed Business Printer** is especially designed with more powerful electronics to handle larger ledger business forms! Exclusive bottom feed! (Centronics parallel interface) **One year immediate replacement warranty** 15½" printer is also compatable with IBM Personal/Business Computers! 15½" Printer List $699.00 **SALE $399.00**

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This is the worlds finest daisy wheel printer **Fantastic Letter Quality**, up to 20 CPS bidirectional, will handle 14.4" forms width! Has a 256 character print buffer, special print enhancements, built in tractor-feed (Centronics Parallel and RS232C Interface) List $699 **SALE $399.**

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COM-STAR PLUS+ Print Example: ABCDEFGHIJKLMNOPQRSTUVWXYZ ABCDEFGHIJKLMNOPQRSTUVWXYZ 1234567890

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④	12" HI RESOLUTION 80 COLUMN GREEN OR AMBER MONITOR	249.00
•	BOX OF 10 LORAN LIFETIME GUARANTEED DISKS	49.95
•	1100 SHEETS FANFOLD PAPER	19.95
•	ALL CABLES NEEDED FOR INTERFACING	102.05
	TOTAL LIST PRICE	**$ 3717.95**

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Printer replacement options (replace the 4023 with the following at these sale prices)

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★ Comstar Hi-Speed 160 CPS 15½" Serial-Business Printer	$779.00	**$ 499.00**
★ Telecommunications Deluxe Modern Package	$ 199.00	**$ 139.00**

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			Inventory	149.95	**99.00**
Professional Data Base	149.95	**99.00**	General Ledger	149.95	**99.00**
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Commodore - 64

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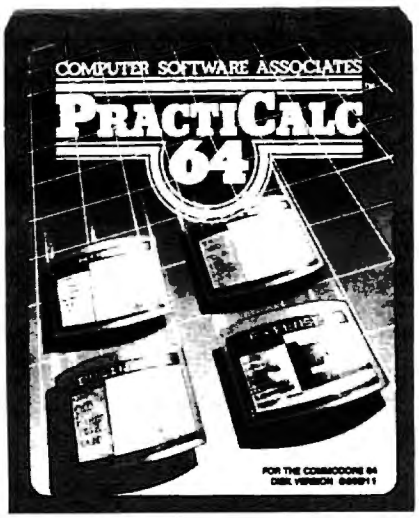

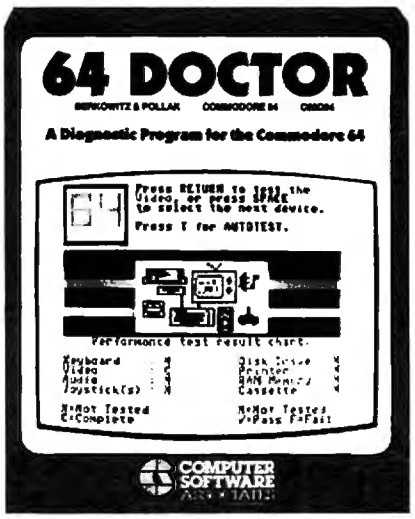

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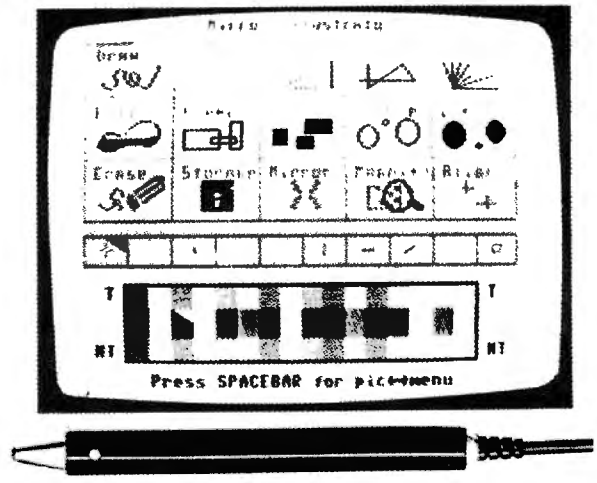

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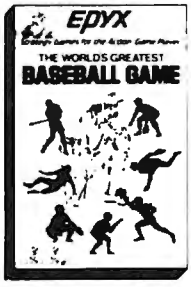

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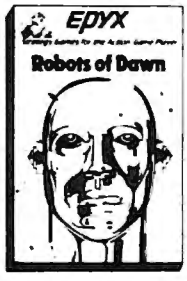

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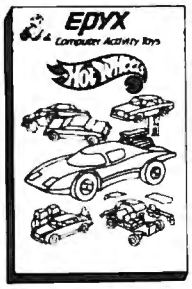

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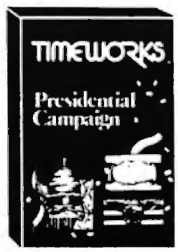

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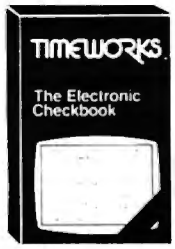

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Learn Basic Programming from the ground up. This first step takes you through the actual design of Lunar Lander, using moving graphics.

Shows in detail how basic programming works and what should go into a good game. List $24.95. **Sale $19.95.**

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Programming Kits

Manuals are written in plain, easy to follow English. The 8 step approach to program design is fully explained and can easily be applied to your future programming adventures.

Programming Kit II

Intermediate game design and Sprite Builder. Design Slot Machine and study intermediate programming including arrays, subroutines, sound, special function keys, and random function. Plus Sprites are covered in detail and a Sprite Editor is included. List $24.95. **Sale $19.95.**

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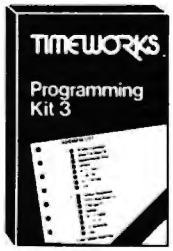

Intermediate Data Base design. Instead of games you may want to go the business route. Use this program to develop a Data Base Manager to allow quick storage and retrieval of any information. Learn disk/tape storage, sorting, menus, plus multi dimensioned arrays, plus a whole lot more. List $24.95. **Sale $19.95.**

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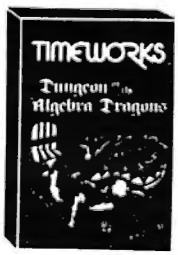

At last a good educational game. You must wander through 3-D mazes until you encounter dragons, then you must answer the algebra problems they give you. A right answer gets you a free ride, a wrong answer gets you eaten. Fantastic educational value. (Tape or Disk.) List $29.95. **Sale $24.95.**

Spellbound

The screen is sprinkled with the letters from one of 20 words of your choice along with a few extra random ones. Use your Joystick to sting the letters in the right order but don't sting the wrong ones or cross your path or you explode. Fantastic educational value. Fun for all ages. List $24.95. **Sale $17.95.**

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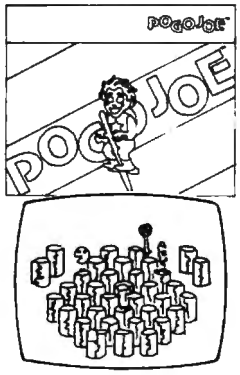

Better than Qbert. Guide Pogo Joe across 32 screens of cylinders. As many as 8 nasties at a time are out to kill you. Fantastic graphics and sound. List $29.95. **Sale $19.95**. Coupon $16.95.

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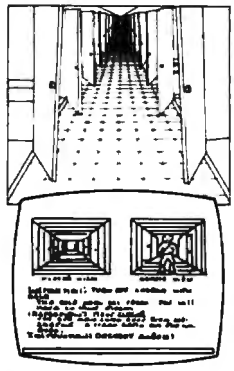
• GAME OF THE YEAR!

Asylum



One of the best graphic adventures we've seen. Get yourself out of the Asylum past guards and secret doors. Stunning, 3D graphics will make you feel like an inmate. List $34.95. **Sale $24.95**. Coupon $22.00.

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A good sword, little magic, and lots of cunning takes you against Evil Wyverns, Saber Toothed Tigers, and the Undead. If you reach the bottom of the dungeon your halfway home. Great and 3D graphics. List $34.95. **Sale $24.95.** Coupon $22.00.

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Wylde

Be a Hobbit! Make your way through the magic mountains to the treasure of the mountain king. Fight Trolls, Orks and other nasties along the way. Fantastic realism. List $34.95. **Sale $24.95**. Coupon $22.00.

(Disk)

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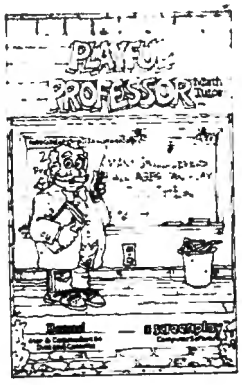

Make your way to the treasure by correctly answering math problems. If you guess wrong and the professor shows you how step by step. Addition, subtraction, multiplication, and division basics are all covered. Fantastic educational value. List $34.95. **Sale $24.95**. Coupon $22.00.

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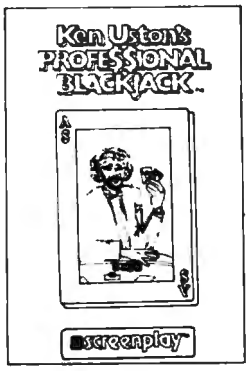
Ken Uston's Professional Blackjack



The ultimate Blackjack tutor made famous by Ken Uston, $5,000,000 winner. All different casino Blackjacks are discussed as well as a free $29.95 value Blackjack Book are yours. Fantastic tutor. List $79.95. **Sale $49.95.**

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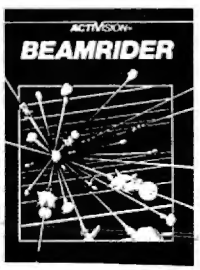
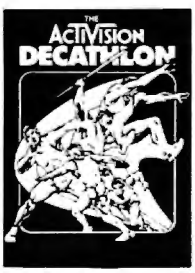
Pitfall II - Lost Caverns — The feats of Pitfall Harry continue with the full advantages of the Commodore-64. The caverns are 27 levels deep and you must make Harry swim through rivers, float through the air on balloons, even freefall with perfect timing. Fantastic sound, graphics, and action. (Very Highly Recommended) List $39.95. **Sale $27.95**. (Disk)

Beamrider — (Better than Tempest) Move and fire along the grid as aliens attempt to destroy you. Super fast joystick action is the only thing that will keep you alive to make it to the next grid (99 grids) where more challenges await you. Super Action and Graphics. List $39.95. **Sale $27.95**. (Disk)





Decathalon — Finally an Olympic Event for two players at the same time (or play against the computer) Run, Hurl, Vault, Jump and more (10 events in all). Fantastic graphics and sound will keep you playing this one for days on end. Great Competition. List $39.95. **Sale $27.95**. (Disk)

Toy Bizarre — The toy factory has gone crazy. Toys spring to life and try to destroy you and the factory. Jump from level to level and close the valves, and capture the toys before the toys do you and the factory in. Fantastic Graphics and Sound. List $39.95. **Sale $27.95**. (Disk)

H.E.R.O. — Descend through the caverns with your dynamite and laser helmet; clear the tunnels to rescue the trapped miners; watchout for molten lava, animals, insects, etc. If you hit the lights they go out and you're in the dark. Fantastic Graphics and Sound combine with a superb theme to make this a best game for the year. List $39.95. **Sale $27.95**. (Disk)

Zenji — Find your way through the paths. Easy? The paths constantly change as the squares slide around. Use your senses to decide which way is out. If your senses fail, you are trapped and dead! Fantastic action. List $39.95. **Sale $27.95**. (Disk)

Zone Ranger — Better than Asteroids and Omega Race. You must pilot your starship first through asteroid alien territory and dock at your base, then you must make your way through the mazes past hostile aliens. Constantly 4-way scrolling screens make this a must for all game players. Fantastic Graphics and Action. List $39.95. **Sale $27.95**. (Disk)

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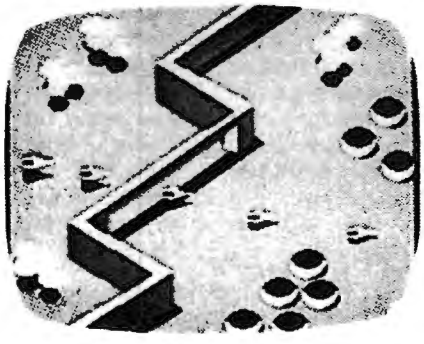
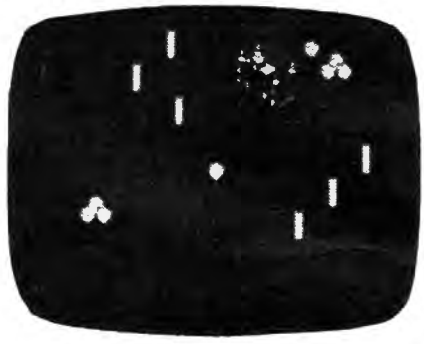
Best Multi Level Graphics Games in the U.S.A.

RAID OVER MOSCOW

Raid over Moscow — The ultimate in multi screen computer graphics has arrived. (over six screens) The Soviets have launched an attack. First you must locate and destroy the ICBM missiles from your Stealth Bomber, then you must lead your squadron through the Soviet terrain to the Kremlin itself. Destroy the defenses, then destroy the defense center and finally the attack operations themselves. Fly planes, launch grenades, shoot bazookas. Super Fantastic Graphics, Sound, Animation. **(The best multi-level game we've seen!!!)** List $39.95. **Sale $29.95.** (Disk.) *Coupon $26.95.*

BEACH HEAD

Beach Head — Multi Screen computer graphics at its finest. First you must maneuver your fleet through the mine laden channel while torpedoes are fired at you from all sides. Next you must engage the enemy planes with your anti-aircraft guns (best scenario graphics anywhere). Then you must sink the enemy fleet before they sink you. Next you maneuver to the beach head where your tanks must get through an obstacle course and finally fight the ultimate battle at Headquarters. All scenes in stunning 3-D graphics. (Will be the best graphics of 1984, definitely).

List $39.95. **Sale $24.95.**
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Neutral Zone — Reach the outer edges of the galaxy. You must protect your spaceship from attacking enemy space ships while defending yourself from enemy missiles. Fantastic 360 degree 3-D High Resolution Graphics. Rated No. 1 for graphics in 1983. List $34.95. **Sale $24.95.**(Tape or disk).

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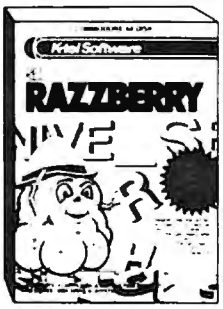
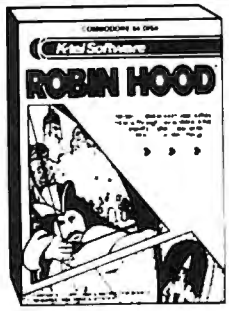


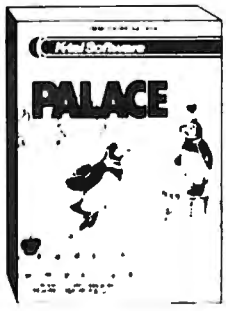
Red Razzberry — Fantastic educational game that teaches spelling and good sentence structure. First you must pick the missing letter for the word (correct spelling) then you must pick the two missing letters for the word. Finally you must pick the correct word for the grammatically correct sentence. Great for students and adults. List $24.99. **Sale $16.95.** (Disk).

Plantin Pal — Finally a full analysis and advisor for all your gardening needs. Plantin Pal asks you what you want to plant (gives suggestions, too!). Then tells you where to plant them! (garden layout) How to take care of them! Plus what to do when something goes wrong! (Insects, pests, and plant diseases) Fantastic for all your gardening needs. List $29.99. **Sale $19.99** (Disk).

Speed Reading Coach — Teaches vocabulary, comprehension, and speed to help you read better. Eye training and vocabulary come first, then the screen flashes word by word or sentence by sentence through paragraphs and asks you questions when you're done. Fantastic Reading Aid. List $29.99. **Sale $19.99** (Disk).



Robin Hood — You as Robin must fight your way through Sherwood Forest, Nottingham Castle, past the Duke, rescue Maid Marion, and finally steal the gold. Fantastic graphics with 5 different screens of challenges. List $19.99. **Sale $14.99.** (Disk)



Ice Palace — You as the Penguin must make your way through the automated Ice Block Factory on your way to your true love. 3 screens worth of melting ice blocks, deadly snowballs, and Freddies Fire Demons try to stop you. Plus you must eat the fruit to keep your strength up and build an ice ladder before your love can be yours again. Fantastic graphics and action. List $24.95. **Sale $19.95.** (Disk)

Sir Lancelot — Fight your way through the castle, kill the dragons, and save the maiden. But this is just the beginning! 8 more quests with 8 more challenging screens await your rise to be knighted king of the realm. Fantastic graphics and sound. List $19.95. **Sale $14.95.**(Disk)

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Now you can control the Starship Enterprise as you fight Klingons before they destroy your bases. Full 3-D view as well as overhead radar lets you know what's going on around you. Use your joystick to control warp drive, impulse power, photon torpedoes and phasers. But watch your shields, photon supply and warp power. Fantastic graphics and sound make this a must for everyone. List $39.95. **Sale $29.95** (cartridge).

Congo Bongo

• Official arcade version • 3-D graphics
• Two screen displays • One or two players.

The famous arcade game featuring the coconut throwing gorilla, monkeys, hippos, sharks and rhinos now comes to the Commodore 64. Superb reproduction of the arcade machine challenges you to destroy the gorillas lair. List $39.95. **Sale $29.95** (cartridge).

ZAXXON

• Official arcade version • Stunning 3-D scrolling graphics • Multiple screen displays.

Now the famous invasion of robot Zaxxon's lair can be done in your own home. Invade the fortress, get past the fighters then through Zaxxon's home and finally destroy Zaxxon himself. Just like the arcade game. This one's fantastic. List $39.95. **Sale $29.95** (cartridge).

BUCK ROGERS
PLANET OF ZOOM

• Official arcade version • 3-D color graphics
• Four Galactic screen displays.

Just like the arcade version. Steer your ship through deadly electron posts as you fight off enemy space saucers and hoppers. Finally you meet the enemy source ship. If you get through all this you start again only this time the enemies have more powers and surprises. Fantastic graphics and sound. List $39.95. **Sale $29.95** (cartridge).

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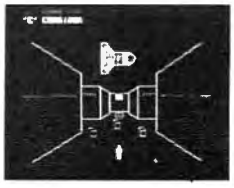
CYBERWORLD List $49.95 **Sale $34.95**



This five-screen arcade adventure packs the computer with intense graphics and sound! You are a special Cyberleague agent in a universe full of hostile aliens and vicious robots. Joystick and keyboard transport you through 3-D rooms, space barriers, fleets of invaders, and warship-ridden quadrants of space. Over 100 sprites, 8 new character sets, and dozens of mind-boggling sound effects make up this multi-layered adventure. Animation, action, and strategy all combined into a game so extensive that two disk sides are jammed with game programs and data! Reach the ultimate rank of admiral and you may carve a niche in the permanent high-score list. A full-size book quality manual with full-color covers is included to guide you through your most exciting game experience.

NEW

NEW

Perplexian Challenger

List $34.95 **Sale $24.95**

The incredibly responsive three-axis joystick control of a space fighter is in your hands. Split screen graphics provide a continuous display of your ship's instrumentation, as well as a three-dimensional, animated view of space.

You, as a pilot, must utilize lightning fast reflexes to destroy invading ships, and avoid their return fire. Simultaneously, you must maneuver your ship to capture space debris that remains from the explosions.

Outstanding graphics features include smooth 3-D rotations, split screens, and the most incredible high-resolution hyperspace sequence ever produced.

Programmed entirely in machine language, this action-strategy game is guaranteed to blow you away.

All the professional features you expect are included: automatic self-demo, high score retention, pause, and provisions for 1 to 4 players. Add to this, features you don't expect like easy-loading, and music during the load. Perplexian Challenger is a game that brings the arcade experience to your home.

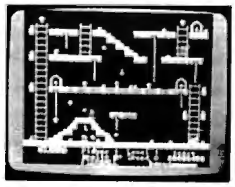
Wizard

List $49.95 **Sale $34.95**

Jump from ropes to ladders, dodge plummeting boulders and duck under deadly arrows in your quest for sparkling diamonds, gleaming bars of gold, and glistening pearls. With joystick in hand you must explore forty dazzling screens, each a new and exciting adventure. Take the key to unlock the doorway to your next spine-tingling level. Each key restores your magical powers, allowing you to cast over ten different spells. With these magic spells you have the power to overcome vicious creatures, terrifying traps, and perilous plunges.

Your Wizard is realistically animated in every possible direction. Dozens of movements are possible — jump over burning fires, shimmy up or down ropes and ladders, even slip down treacherous sliding staircases! Magic portals move your Wizard through midair and protect you from a myriad of fully-animated fiendish monsters. Catch an elevator to the top of the screen and dart through sliding gates in your quest for magic and treasure.

Wizard's fascinating variety of screens are sure to please and entertain, and of course you can build an unlimited number of your own levels using the construction set provided with your game.



Gothmog's Lair

List $44.95 **Sale $34.95**

Real-time adventure excitement at its best. Solve countless puzzles and slay over a dozen monsters by using the huge vocabulary of over 200 words. Two challenging difficulty levels await you with over 80 areas, each fully described in Old English script.

Menacing monsters, knaving villains, tattered code books and treacherous terrain are just a few of the situations you must overcome in your quest for the thirteen priceless treasures. More than seventy objects are invaluable to you in your search for glory and wealth!

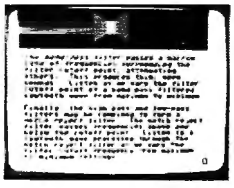
A full-size, thoroughly illustrated manual is included. Featuring color front and back, book quality, and a fold-out map, this "extra" further extends the professionalism of this game. The following are quotes from unsolicited testimonials sent to us by adventurers in Gothmog's Lair...

"I have extremely enjoyed Gothmog's Lair, and plan to buy more adventure games..."

Scott Tulman, Memphis, TN

"Gothmog's Lair is the best adventure I've ever played..."

Dennis Manochio, Jr., Saratoga, CA



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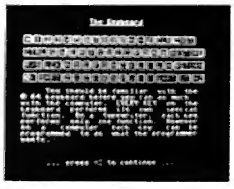

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All About The Status Register

Part 1

Louis F. Sander

The status registers have always been a mystery to the beginning machine language programmer. This article will help clear up the mystery.

All but the simplest machine language programs make use of the 6502's seven processor status flags, and any ML programmer worth his salt masters their functions and uses. Like almost everything in ML programming, the flags operate in a straightforward and unambiguous way, but they are full of mystery for the beginner.

If you've started ML programming, but are confused by that NV-BDIZC business, this article will help you understand it. It includes a fully explained ML demo program, identically executable on a Commodore 64/PET/CBM, Apple, or Atari computer.

These explanations will assume that you have some ML knowledge and at least a beginning grasp of hexadecimal arithmetic.

Let's start by defining a *register*, which is a circuit inside a processor. Registers have the characteristics of memory locations, in that data can be written to them or read from them. But they often don't have addresses as such, since they are used internally by the microprocessor itself. The accumulator is the most familiar register, but there are many others in your computer.

The 6502 has an internal 8-bit register, variously called the flags register, processor status register, or P register, the bits of which are set or cleared by the results of various operations. In this context, *set* means equal to 1, and *cleared* means equal to 0. At times the bits are set and cleared, or *conditioned*, automatically by the 6502 chip itself; other times they are conditioned by specific program instructions. Any book on 6502 programming will show you each instruction's effect on the status bits.

Bit Branches

Programs can check these bits and use the results of the check for whatever purpose the programmer has in mind, often to decide on a branch. The bits are sometimes called flags, and indeed, they work like the little red flags on rural mailboxes—the postal patron can raise the flag to let the mailman know there's outgoing mail, and the mailman can lower it to signal he's emptied the box. Here are the names and purposes of the eight bits in the status register, moving from left (high-order bit) to right (low-order bit):

N (bit 7)—Negative flag. (Some books call it S, for sign.) The N flag matches the high bit of the result of whatever operation the processor has just completed. If you load $FF (1111 1111) into the Y-register, for example, since the high bit of the Y-register is set, the N flag will be set, too. ML programmers make good use of the N flag. (By the way, even though this is the eighth bit, we call it bit 7, because computers start numbering things at 0.) In a computer technique called twos complement arithmetic, the high-order bit of a number is set to 1 if the number is negative, and cleared to 0 if it's positive, and that's where the N flag gets its name.

V (bit 6)—Overflow flag. This flag is important in twos complement arithmetic, but elsewhere it is rarely used. In the interest of simplicity, we'll say no more about it.

Bit 5 has no name, and is always set to 1. Since nothing can change it, it is of no use to the programmer.

B (bit 4)—Break flag, set whenever a BRK instruction is executed, clear at all other times. Rarely used by beginners.

D (bit 3)—Decimal flag. When D is set by the programmer, the 6502 does its arithmetic in BCD, binary coded decimal, which is yet another exotic type of computer math. Fortunately for nonexperts, it's seldom used, and the beginner's only concern with the D flag is to be sure it is

not set unintentionally, because when it *is*, program behavior can be bizarre.

I (bit 2)—Interrupt mask. When this bit is set, the computer will not honor interrupts, such as those used for keyboard scanning in many computers. It is widely used, but so different from the other flags that we'll say no more about it.

Z (bit 1)—Zero flag. This one's used a great deal, and basically the computer sets it when the result of any operation is zero. Load the X-register with $00, and you set the zero flag. Subtract $32 from $32, and you do the same. Many 6502 instructions affect the Z flag, and there's always a "zero or not-zero" aspect to it, but it's not always obvious to the novice when a zero condition exists. This is probably the most important of the flags, and if you master it, mastery of the others will be easy.

C (bit 0)—Carry flag. Carry is set whenever the accumulator rolls over from $FF to $00 (just like the odometer on a car, rolling over from all nines to all zeros). It's also set by various rotation and comparison instructions. The carry flag is about as important as the Z flag, and a little more mysterious, at least to me, but its operation is really rather simple.

Next month we'll go through some practical examples to demonstrate exactly how everything works.

Unicopy

Single Disk Copying For The Commodore 64

Jim Butterfield, Associate Editor

Copying programs and sequential files can sometimes be difficult. There are backup programs, of course; but they require that you copy the whole disk, and sometimes you just want to copy one or two programs. LOAD and SAVE work for simple BASIC programs, but not for anything complex. Well-equipped users have two disk drives and can use utilities that will transfer from one to the other.

Dual disk units (notably the Commodore 4040) don't quite do the job for Commodore 64 owners. There's a slight format difference between 4040 and 1541 that makes it undesirable to write on a disk formatted on the other unit. Thus, a 4040-copied disk is not well-suited for the 1541 if you wish to write further material to the disk.

"Unicopy" will help to solve these problems. It will take your choice of programs or sequential files from the disk and hold them in memory. When you're finished, or when memory is full, you can then write the files to a new disk or to cassette tape.

Buffering Files

As you scan the input disk, you'll be offered programs and sequential files for copying. You may tap the Y or N key to signal: yes, you want to copy this file; or no, you don't want this one. More on this in a moment.

Before presenting you with the filename, Unicopy looks at the size of the file and the amount of memory space that is left. If the file is too big to fit, the program won't offer it to you; instead, it will signal MORE and quit scanning the directory. That way, you know that there is more on the disk, but it can't be fitted in this time. Unicopy could catch the missing files on a subsequent run. The program will not skip by the big ones to look at smaller files later in the directory, since it might be important to you to keep a group of files in the same order as they were shown on the previous disk.

There's one exception to the big files rule. If the file won't fit into the whole memory buffer area, there's no way to copy it with this program. Unicopy will skip such jumbo files.

How big is the buffer area? It depends on how your Commodore 64 is configured. If it's a "clean" system with no other resident programs, Unicopy will throw out BASIC (temporarily) and use all the memory it can get—about 48K, or the equivalent of 192 disk blocks. On the other hand, a program in residence—monitor, DOS wedge, interface package, or whatever—must not be disturbed; in this case, UNICOPY will become conservative and restrict itself to less than 36K or 144 disk blocks. The exact amount of space will depend on the other program's location and size.

You'll be asked "Any resident programs?" at the start of Unicopy; buffer size will be set accordingly.

One more thing: If you plan to direct the output to cassette tape, Unicopy must insure that no more than 28K or 112 blocks are used. Tape routines forbid writing a program from above address 32766; so Unicopy will trim accordingly. By the way, this solves a subtle problem with cassette tape: Normally, you can never save memory above hex $7FFE; but Unicopy will move the program down and save it successfully from where it is held in lower memory.

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Initial Tasks And First Questions

If you're copying to another disk, be sure that the destination disk is formatted before running Unicopy. The disk may already be formatted if you're just adding some new files; but if not, remember to NEW it, since Unicopy won't do the job for you. You may copy files to more than one disk; format them all as necessary.

We've already mentioned ANY RESIDENT PROGRAMS?; answer Y or N.

OUTPUT TO TAPE OR DISK? calls for touching the T or D key.

If you select tape, you'll be asked WRITE END-OF-TAPE MARK? If you respond with N, you'll copy the programs to tape and that's all. If you answer Y, you'll copy the programs to tape and then write a special block called a "tape mark." Here's what the tape mark does: At some later time, if you're searching through this tape for a particular file, the tape mark will stop the search.

Thus, if you don't find the file you want on tape, you won't go running through the whole tape, most of which is blank. An unsuccessful search will terminate early, thanks to the tape mark.

DISK INPUT PATTERN? allows you to use pattern matching. You're prompted with the asterisk; if you want to see everything, just press RETURN. But there are many other combinations. AR* will present only programs that begin with AR, such as: AR, ARCHER, ARM, or ARRRRGH. R?D? will present you with such names as REDS, RIDE, or R2D2, but not RIDDLE. *=P will offer programs only. And PLUTO will offer you only a file called PLUTO.

When you are presented with names from the directory, you may tap Y or N to accept or reject the files for copying. If you know that you want to take or reject a sequence of files, you may hold down the appropriate key. The RETURN key acts to "lock in" the previous key, so that pressing Y, RETURN will accept everything and N, RETURN will reject everything.

The Output

Eventually the questionnaire will stop, and the computer will advise READING FILES. The programs or sequential files will be brought into the buffer area. The programs won't be in their usual place in memory, but that doesn't matter; we just want to copy them, not to run them.

After the files are loaded, the computer will say READY TO WRITE FILES; PRESS ANY KEY. Don't press a key—yet.

If you're writing to cassette tape, place the tape in the drive. If you have time and think it's necessary, fast forward and rewind the tape to even up the tension. Finally, press PLAY and RECORD and touch any key on the keyboard. The tape will start to write: The screen will go blank, of course.

If you're writing to another disk, take the source disk out of the drive and insert the destination disk. (You did make sure that the destination disk was preformatted, didn't you?) Now touch any key on the keyboard. As the files write to the disk, you'll see their names displayed.

If any errors are encountered during input or output, you'll be told about them.

When the copying job is done, you'll be asked ANOTHER OUTPUT? If you want to write to another tape or disk, put it into the drive and press Y for "yes." Otherwise, press N and the job is done.

The Generator

The listing given here is a generator program that will write Unicopy for you. The DATA statements will be checked carefully for accuracy before Unicopy is created for you; you'll be told of any errors.

Type in the program. Take special care with lines 200 to 320; and don't miss the semicolon at the end of line 300. When the program is complete, place a disk into your disk drive (Unicopy will be written onto it) and type RUN.

It will take the generator over a minute to check the accuracy of your DATA statements. If there are any errors, you'll be told about them (the line number will be given) and Unicopy will not be written.

If there are no errors in the DATA statements, Unicopy will be written to disk ready to be loaded and used.

Other Types Of Files

Unicopy does not attempt to copy USR or REL type files, nor does it try to copy "direct" data. This type of job should be done by the programs which use these types of files.

Unicopy

```
1 DATA 1,8,11,8,100,0,158,50,48,54,51,0,-
  45                                :rem 35
2 DATA 0,0,53,0,160,255,140,34,15,169,89,
  141,-5                            :rem 242
3 DATA 33,15,169,0,141,37,15,141,39,15,16
  9,13,-39                          :rem 100
4 DATA 32,210,255,200,185,186,13,208,247,
  165,55,141,-50                    :rem 138
5 DATA 43,15,165,56,141,44,15,32,207,255,
  201,78,-44                        :rem 200
6 DATA 208,13,169,0,141,43,15,169,208,141
  ,44,15,-35                        :rem 196
7 DATA 141,39,15,32,115,13,201,68,240,15,
  162,0,-13                         :rem 128
8 DATA 142,39,15,169,127,205,44,15,176,3,
  141,44,-55                        :rem 208
```

```
9 DATA 15,169,122,133,141,169,15,133,142,
  24,173,44,-44                          :rem 93
10 DATA 15,229,142,141,35,15,169,15,162,8
   ,160,111,-23                          :rem 28
11 DATA 32,186,255,169,0,162,49,160,15,32
   ,189,255,-34                          :rem 54
12 DATA 32,192,255,160,255,169,13,32,210,
   255,200,185,-13                       :rem 182
13 DATA 51,14,208,247,160,0,185,75,14,153
   ,49,15,-35                            :rem 199
14 DATA 200,192,3,208,245,32,207,255,201,
   13,240,6,-49                          :rem 28
15 DATA 153,49,15,200,208,243,140,30,15,1
   60,255,169,-41                        :rem 132
16 DATA 13,32,210,255,200,185,232,14,208,
   247,169,1,-11                         :rem 76
17 DATA 162,8,160,96,32,186,255,173,30,15
   ,162,49,-50                           :rem 5
18 DATA 160,15,32,189,255,32,192,255,169,
   13,32,210,-29                         :rem 100
19 DATA 255,162,1,32,198,255,32,228,255,3
   2,228,255,-47                         :rem 111
20 DATA 32,228,255,141,31,15,32,228,255,1
   3,31,15,-9                            :rem 186
21 DATA 240,122,169,0,141,32,15,141,41,15
   ,32,228,-36                           :rem 225
22 DATA 255,141,38,15,32,228,255,240,3,23
   8,41,15,-34                           :rem 243
23 DATA 173,38,15,240,17,56,173,35,15,237
   ,38,15,-4                             :rem 155
24 DATA 176,3,238,41,15,32,210,9,240,198,
   32,228,-29                            :rem 203
25 DATA 255,170,208,250,173,32,15,201,83,
   240,16,201,-4                         :rem 75
26 DATA 80,208,181,173,41,15,240,7,173,37
   ,15,240,-17                           :rem 247
27 DATA 171,208,36,140,36,15,160,2,185,50
   ,15,32,-26                            :rem 191
28 DATA 210,255,200,204,36,15,144,244,169
   ,13,32,210,-27                        :rem 127
29 DATA 255,32,204,255,32,63,10,162,1,32,
   198,255,-25                           :rem 248
30 DATA 76,227,8,160,255,169,32,32,210,25
   5,200,185,-44                         :rem 94
31 DATA 15,15,208,247,32,204,255,169,1,32
   ,195,255,-54                          :rem 47
32 DATA 160,255,169,13,174,37,15,208,11,3
   2,210,255,-4                          :rem 35
33 DATA 200,185,78,14,208,247,240,69,32,2
   10,255,200,-56                        :rem 142
34 DATA 185,95,14,208,247,32,234,10,32,86
   ,13,173,-64                           :rem 1
35 DATA 39,15,240,4,169,54,133,1,32,176,1
   1,32,-64                              :rem 96
36 DATA 204,255,173,39,15,240,4,169,55,13
   3,1,160,-45                           :rem 251
37 DATA 255,169,13,32,210,255,200,185,213
   ,14,208,247,-53                       :rem 191
38 DATA 32,228,255,170,208,250,32,228,255
   ,201,89,240,-1                        :rem 144
39 DATA 203,201,78,208,245,169,15,32,195,
   255,96,160,-9                         :rem 116
40 DATA 20,169,160,153,51,15,136,208,250,
   32,228,255,-54                        :rem 138
41 DATA 170,240,55,201,34,208,246,160,2,3
   2,228,255,-43                         :rem 81
42 DATA 201,34,240,9,153,50,15,200,170,20
   8,242,240,-19                         :rem 70
43 DATA 33,32,228,255,170,240,27,201,32,2
   08,246,32,-2                          :rem 29
44 DATA 228,255,170,240,17,201,32,240,246
   ,141,32,15,-62                        :rem 128
45 DATA 153,51,15,169,44,153,50,15,200,20
   0,96,56,-42                           :rem 245
46 DATA 173,35,15,237,38,15,141,35,15,238
   ,37,15,-3                             :rem 155
47 DATA 160,17,185,52,15,145,141,136,16,2
   48,24,165,-12                         :rem 96
48 DATA 141,105,22,133,141,165,142,105,0,
   133,142,96,-40                        :rem 122
49 DATA 160,0,162,0,202,208,253,136,208,2
   48,165,203,-35                        :rem 135
50 DATA 45,34,15,141,31,15,32,228,255,201
   ,89,240,-27                           :rem 242
51 DATA 17,201,78,240,13,201,13,240,15,17
   3,31,15,-19                           :rem 227
52 DATA 201,64,240,226,208,11,141,33,15,1
   69,255,44,-26                         :rem 85
53 DATA 169,0,141,34,15,173,33,15,201,78,
   240,5,-42                             :rem 140
54 DATA 32,26,10,144,3,32,192,10,96,162,1
   5,32,-9                               :rem 40
55 DATA 198,255,160,0,32,228,255,153,72,1
   5,200,201,-47                         :rem 91
56 DATA 13,240,8,192,49,176,4,165,144,240
   ,237,32,-55                           :rem 5
57 DATA 204,255,169,13,153,72,15,173,72,1
   5,201,49,-37                          :rem 53
58 DATA 144,18,238,42,15,160,0,185,72,15,
   201,13,-32                            :rem 191
59 DATA 240,6,32,210,255,200,208,243,96,1
   69,145,32,-38                         :rem 99
60 DATA 210,255,169,32,162,25,32,210,255,
   202,208,250,-3                        :rem 125
61 DATA 169,145,32,210,255,169,13,76,210,
   255,230,141,-1                        :rem 136
62 DATA 208,2,230,142,165,141,205,43,15,1
   65,142,237,-54                        :rem 133
63 DATA 44,15,96,169,122,133,139,169,15,1
   33,140,165,-26                        :rem 156
64 DATA 141,141,45,15,165,142,141,46,15,1
   60,18,140,-50                         :rem 79
65 DATA 36,15,136,177,139,153,52,15,201,1
   60,208,3,-9                           :rem 253
66 DATA 140,36,15,136,16,241,238,36,15,23
   8,36,15,-29                           :rem 2
67 DATA 160,18,165,141,145,139,200,165,14
   2,145,139,160,-1                      :rem 241
68 DATA 0,140,42,15,185,50,15,32,210,255,
   200,204,-49                           :rem 232
69 DATA 36,15,144,244,169,32,32,210,255,1
   69,2,162,-62                          :rem 52
70 DATA 8,160,98,32,186,255,173,36,15,162
   ,50,160,-36                           :rem 6
71 DATA 15,32,189,255,32,192,255,32,132,1
   0,176,37,-63                          :rem 50
72 DATA 162,2,32,198,255,32,228,255,160,0
   ,145,141,-51                          :rem 40
73 DATA 32,217,10,176,20,166,144,240,240,
   32,132,10,-33                         :rem 69
74 DATA 176,11,160,20,165,141,145,139,200
   ,165,142,208,-31                      :rem 231
75 DATA 4,160,21,169,0,145,139,24,165,139
   ,105,22,-21                           :rem 244
76 DATA 133,139,165,140,105,0,133,140,32,
   204,255,169,-52                       :rem 185
77 DATA 2,32,195,255,169,13,32,210,255,17
   3,42,15,-53                           :rem 254
```

```
78 DATA 208,3,32,192,10,165,139,205,45,15
   ,165,140,-58                          :rem 50
79 DATA 237,46,15,176,3,76,252,10,96,169,
   122,133,-25                           :rem 13
80 DATA 139,169,15,133,140,173,40,15,201,
   68,208,23,-15                         :rem 89
81 DATA 162,15,32,201,255,169,73,32,210,2
   55,169,48,-17                         :rem 101
82 DATA 32,210,255,169,13,32,210,255,32,2
   04,255,160,-38                        :rem 134
83 DATA 18,140,36,15,136,177,139,153,52,1
   5,201,160,-28                         :rem 95
84 DATA 208,3,140,36,15,136,16,241,172,36
   ,15,136,-7                            :rem 198
85 DATA 185,52,15,141,32,15,172,36,15,169
   ,44,153,-9                            :rem 211
86 DATA 52,15,200,169,87,153,52,15,200,20
   0,200,140,-22                         :rem 72
87 DATA 36,15,160,18,177,139,133,141,200,
   177,139,133,-40                       :rem 199
88 DATA 142,200,177,139,141,43,15,200,177
   ,139,240,65,-27                       :rem 199
89 DATA 141,44,15,160,0,173,40,15,201,68,
   240,21,-12                            :rem 181
90 DATA 185,52,15,153,50,15,200,204,36,15
   ,144,244,-14                          :rem 30
91 DATA 56,173,36,15,233,6,141,36,15,160,
   0,140,-41                             :rem 138
92 DATA 42,15,185,50,15,32,210,255,200,20
   4,36,15,-38                           :rem 237
93 DATA 144,244,169,32,32,210,255,173,40,
   15,201,68,-3                          :rem 40
94 DATA 240,6,32,208,12,76,154,12,169,2,1
   62,8,-20                              :rem 97
95 DATA 160,98,32,186,255,173,36,15,162,5
   0,160,15,-54                          :rem 59
96 DATA 32,189,255,32,192,255,32,132,10,1
   76,23,162,-23                         :rem 99
97 DATA 2,32,201,255,160,0,177,141,32,210
   ,255,32,-33                           :rem 232
98 DATA 217,10,144,246,32,204,255,32,132,
   10,169,2,-4                           :rem 241
99 DATA 32,195,255,169,13,32,210,255,173,
   42,15,208,-27                         :rem 107
100 DATA 3,32,192,10,24,165,139,105,22,13
    3,139,165,-58                        :rem 83
101 DATA 140,105,0,133,140,165,139,205,45
    ,15,165,140,-62                      :rem 168
102 DATA 237,46,15,176,3,76,214,11,173,40
    ,15,201,-22                          :rem 233
103 DATA 84,208,5,169,5,32,106,247,96,169
    ,2,162,-17                           :rem 214
104 DATA 1,160,1,32,186,255,173,36,15,162
    ,50,160,-10                          :rem 229
105 DATA 15,32,189,255,173,32,15,201,83,2
    08,29,32,-52                         :rem 43
106 DATA 192,255,162,2,32,201,255,160,0,1
    77,141,32,-38                        :rem 81
107 DATA 210,255,32,217,10,144,246,32,204
    ,255,169,2,-60                       :rem 130
108 DATA 32,195,255,96,32,56,248,160,1,17
    7,141,153,-41                        :rem 104
109 DATA 193,0,136,16,248,32,217,10,32,21
    7,10,56,-13                          :rem 236
110 DATA 173,43,15,229,141,141,47,15,173,
    44,15,229,-14                        :rem 86
111 DATA 142,141,48,15,24,165,193,109,47,
    15,133,174,-18                       :rem 143
112 DATA 165,194,109,48,15,133,175,169,1,
    170,32,106,-38                       :rem 149
113 DATA 247,165,141,133,193,165,142,133,
    194,173,43,15,-28                    :rem 41
114 DATA 133,174,173,44,15,133,175,32,103
    ,248,96,160,-27                      :rem 195
115 DATA 255,169,13,32,210,255,200,185,11
    2,14,208,247,-10                     :rem 227
116 DATA 32,228,255,168,208,250,32,228,25
    5,168,240,250,-55                    :rem 47
117 DATA 32,192,10,96,160,255,169,13,32,2
    10,255,200,-12                       :rem 129
118 DATA 185,159,14,208,247,32,228,255,16
    8,208,250,32,-9                      :rem 213
119 DATA 228,255,201,84,240,4,201,68,208,
    245,32,210,-50                       :rem 134
120 DATA 255,141,40,15,201,68,240,30,160,
    255,169,13,-8                        :rem 79
121 DATA 32,210,255,200,185,186,14,208,24
    7,32,228,255,-30                     :rem 234
122 DATA 201,89,240,7,201,78,208,245,238,
    40,15,32,-63                         :rem 41
123 DATA 210,255,96,147,13,13,85,78,73,67
    ,79,80,-6                            :rem 176
124 DATA 89,32,32,86,49,46,49,32,32,74,73
    ,77,-26                              :rem 80
125 DATA 32,66,85,84,84,69,82,70,73,69,76
    ,68,-14                              :rem 94
126 DATA 13,13,70,79,82,77,65,84,32,79,85
    ,84,-62                              :rem 84
127 DATA 80,85,84,32,68,73,83,75,83,32,73
    ,78,-58                              :rem 92
128 DATA 32,65,68,86,65,78,67,69,13,13,65
    ,78,-54                              :rem 95
129 DATA 89,32,82,69,83,73,68,69,78,84,32
    ,80,-33                              :rem 98
130 DATA 82,79,71,82,65,77,83,32,46,46,46
    ,46,-30                              :rem 75
131 DATA 13,40,87,69,68,71,69,44,32,77,79
    ,78,-15                              :rem 87
132 DATA 73,84,79,82,44,32,76,73,78,75,41
    ,63,-7                               :rem 33
133 DATA 32,78,157,0,13,68,73,83,75,32,73
    ,78,-56                              :rem 75
134 DATA 80,85,84,32,80,65,84,84,69,82,78
    ,63,-47                              :rem 92
135 DATA 32,42,157,0,36,48,58,13,42,42,32
    ,78,-48                              :rem 58
136 DATA 79,32,70,73,76,69,83,32,42,42,13
    ,0,-52                               :rem 10
137 DATA 32,82,69,65,68,73,78,71,32,70,73
    ,76,-3                               :rem 32
138 DATA 69,83,58,13,0,42,42,32,82,69,65,
    68,-60                               :rem 23
139 DATA 89,32,84,79,32,87,82,73,84,69,32
    ,70,-51                              :rem 91
140 DATA 73,76,69,83,32,42,42,13,32,32,32
    ,32,-39                              :rem 50
141 DATA 32,80,82,69,83,83,32,65,78,89,32
    ,75,-2                               :rem 28
142 DATA 69,89,13,0,79,85,84,80,85,84,32,
    84,-47                               :rem 40
143 DATA 79,32,84,65,80,69,32,79,82,32,68
    ,73,-41                              :rem 83
144 DATA 83,75,63,32,42,157,0,87,82,73,84
    ,69,-58                              :rem 83
145 DATA 32,69,78,68,45,79,70,45,84,65,80
    ,69,-34                              :rem 96
```

```
146 DATA 32,77,65,82,75,63,32,42,157,0,32
    ,65,-3                          :rem 10
147 DATA 78,79,84,72,69,82,32,79,85,84,80
    ,85,-49                         :rem 112
148 DATA 84,63,32,13,0,72,79,76,68,32,68,
    79,-37                          :rem 35
149 DATA 87,78,32,39,89,39,32,79,82,32,39
    ,78,-4                          :rem 52
150 DATA 39,32,84,79,32,83,69,76,69,67,84
    ,32,-7                          :rem 42
151 DATA 70,73,76,69,83,13,13,0,32,32,32,
    32,-17                          :rem 250
152 DATA 32,46,46,46,32,77,79,82,69,13,0,
    -31                             :rem 122
200 DATA{2 SPACES}153                :rem 69
210 M=63:T=63                       :rem 186
220 READ X:L=PEEK(M):H=L=200:IF H THEN L=
    X                               :rem 137
230 V=R<>L:S=(T<>63 AND V)          :rem 187
240 IF V THEN T=L:IF NOT S THEN R=R+1:S=R
    <>L                             :rem 226
250 T=(T*3+X)AND 63                 :rem 233
260 IF S THEN PRINT "ERROR LINE";R:E=-1
                                    :rem 211
270 R=L:IF NOT H GOTO 220            :rem 67
280 IF E THEN STOP                  :rem 227
290 X=-1:RESTORE:OPEN 1,8,3,"0:UNICOPY64,
    P,W"                            :rem 182
300 IF X>=0 THEN PRINT#1,CHR$(X);  :rem 70
310 READ X:L=PEEK(M):IF L<200 GOTO 300
                                    :rem 61
320 CLOSE 1                        :rem 60
```

INSIGHT: Atari

Bill Wilkinson

Let me start my fourth year by discussing the biggest event in Atari history since the introduction of the 800 Home Computer. But first a moment's reflection on my years with COMPUTE!.

Sometime about three years ago, I was reading COMPUTE!'s "The Readers' Feedback" column when I noticed a couple of questions about Atari computers which the editorial staff hadn't answered. And I also noticed a question which a reader had answered incorrectly.

I reacted. I phoned COMPUTE! and, for reasons best known to himself alone, a nice gentleman by the name of Richard Mansfield listened to my ranting and raving. I started to write for COMPUTE!.

Since then, I have written many columns and have covered a wide range of topics. But now I feel that it's time to change the style of this column. When I started, I intended to answer two or three questions a month and perhaps add a tidbit of my own. Lately, though, I've paid less attention to what you, my readers, want and have shown you some exotic but (perhaps for many of you) uninteresting programs, etc.

I am going to try to revive the chitchat style of this column. It will be more fun for me to write like that again and, I hope, more fun for you to read.

Whither Atari?

As I write this, only a few days have passed since the bombshell exploded: Jack Tramiel bought Atari! I don't see how I could avoid commenting on this—even if I wanted to.

By the time you read this, some of the things I will speculate on here will have been reduced to the role of mere facts or—equally likely—humorous fiction. Nevertheless, I would like to try to play the crystal ball game. Bear with me, please, as I make some predictions:

Nobody pays a quarter of a *billion* dollars (even 1991 dollars) for a name alone. If Mr. Tramiel doesn't produce and sell some (many?) of Atari's current and/or soon-to-be-current products, he will have bought nothing at all (since the massive layoffs make it obvious that he has little use for the expertise of the people who *were* Atari).

What products will survive? Probably the 800XL. It's a good machine and can probably be cost-reduced to be truly competitive with the Commodore 64. It could well have an effective price/performance ratio for well into the next two years.

I'm not so sure about the peripherals. The disk drive, or a version of it, certainly. Printers, of course. The cassette recorder? It's a piece of junk, and everyone knows it. The much ballyhooed add-on box, with MSDOS, 80-column screen, 128K bytes, and an ice cream freezer? Maybe. But don't be surprised to see it licensed to a third-party, low-volume manufacturer. It's too difficult for a lean and mean company to support such a complex product.

A Fabulous Game Machine

What about the game machine side of Atari? Some have suggested that Mr. Tramiel will drop it like a hot potato. Baloney, I say. Why did he buy it then? Was he fooled by Warner and the ex-Atari management? I have heard Jack Tramiel called many things, but "stupid" is not one of them.

I have seen *and* played with the 7800 "ProSystem." It is a truly fabulous game machine (and it's even a fair computer, with 95 percent plus compatible Atari BASIC). Making it 100 percent compatible with the 2600 was a stroke of genius. When I buy one (and I will), I can keep

my collection of 20-odd 2600 cartridges. Though I suspect—having seen *Xevious* and *BallBlazer* and *Rescue on Fractulus* and *Robotron* and . . .—that they will be little used. Tens of millions, like the 2600? Maybe not. A few million? Definitely yes.

Now what about the supposedly all-important, superadvanced, already developed computer that Tramiel and associates are bringing to the game? Well, first of all, I don't know how far along that machine is. Designed? Almost certainly. Prototypes available? A good probability. Debugged and with software ready? Possible, but I seriously doubt it.

Personally, I expect to see an early prototype shown in January 1985, with "selling" models shown in June, both probably at the Consumer Electronics Shows.

An Atari Mac?

And what will this miracle machine, the savior of Atari as a "name" in the industry, look like? Ah, now there you've got me. I am skeptical about reports that it will be a "business" machine: Why buy a game company's name for such a scheme? But an integrated "noncomputer" such as the Macintosh? Sure! Maybe even "a computer for the rest of us" (Apple's Macintosh slogan) that is *affordable* by the rest of us.

Well, how did I score? Or is it still too soon to tell? I am more than a little interested in knowing the outcome.

Answered Letters

Several people, led by Lloyd Keller of Palmetto, Florida, wrote me about something I tossed in, offhand, in my June column. While discussing the Atari *Translator Disk*, I had said, "Of course, you don't turn the power off to boot anymore."

And why not? Because, on an 800XL or 1200XL, the *Translator Disk* software loads into the RAM which is shared with OS (the hidden, bank-selected RAM). It then switches out the ROM completely, leaving you with an Operating System in RAM which is much, much more compatible with the old Atari 800's OS. Many programs which will not work in XL machines suddenly work just fine.

However, since your OS is now in RAM, you certainly can't turn off the power in order to boot another disk (for example, a protected game). Similarly, some cartridges insist on the old OS before they will run. You can't turn off the power to plug them in and still retain the OS in RAM.

Thus, before running, the *Translator Disk* software allows you to change cartridges or diskettes and then tell it you are ready to do a pseudoboot. That's all there is to it.

Mr. Keller, however, pointed out that his manuals tell him not once but many times to never change a cartridge with the power on. Well, sometimes manuals tend toward the cautious side.

Point 1: Nobody sticks a cartridge out in plain sight and then designs the electronics so that a three-year-old's sticky fingers can zap the whole machine by removing it. Point 2: The OS in the XL machines has a complex cartridge-presence checker built in. It checks to see if a cartridge has been inserted or removed every time the OS is called or every 1/60 second.

The action of this checker varies between the 600XL/800XL and the 1200XL. On the former, it causes the machine to "hang" until you hit reset, at which point it does a power-on sequence. The 1200XL simply keeps trying to do a power-on sequence, over and over again, and could lock up as a result.

So my point remains: Someone could and should produce an inexpensive cartridge which would act like the *Translator Disk*, thus giving cassette-only owners access to a wider range of software.

The Loop That Shouldn't Work

Shame on all you loyal Atari readers. It took a couple of Commodore 64 owners to bring one of my mistakes to light. A. J. Bryant of Winnipeg, Canada, and David MacKenzie of Bethesda, Maryland, tried the FOR-NEXT nesting test that I presented in my March 1984 column on their 64 machines.

Lo and behold, the program works (it is supposed to fail). And Mr. MacKenzie even asked me if Microsoft knew something we didn't. Well. I couldn't take a challenge like that lying down, so I powered up our 64 (yes, we really do have one) and tried it myself. Hmm.

Then I tried it on my trusty 800XL. It worked there also! My face is red. Between the time I developed the test and the time I submitted it for publication by COMPUTE!, I tried to pretty it up. There is a variation on Murphy's law which is appropriate here: "If it ain't broke, don't fix it."

So Program 1 is the original FOR-NEXT test. It fails on all Atari computers. It fails on Commodore 64s *and* Applesoft. The normal mode of failure is to issue a NEXT WITHOUT FOR error at line 280.

At first, I was surprised when Apple Integer BASIC passed this test. But I soon discovered why: Integer BASIC doesn't treat nested FOR loops properly at all. Program 2 is another, simpler test I devised to smoke out BASICs which have this kind of problem, so let's take a quick look at it.

Line 10 and 20 simply set up a pair of nested loops. But then line 30 starts an outer loop over again (or at least an intelligent BASIC interpreter will think so, since we are reusing I as a loop variable). Thus, line 50 should cause an error, because starting the outer loop over should erase the information about the inner (FOR J) loop. Indeed, on all the BASICs I mentioned except Apple Integer BASIC, it does. With Integer BASIC, though, the error does not occur until line 60. Tch-tch.

If there are any BASICs which pass both these tests, I would like to hear of them. Thanks.

More Letters Next Month

I've already started wading through a pile of letters; and, although I obviously can't promise a response to every one, maybe I'll try to answer *your* question or comment next month. See you then.

Program 1: Original FOR-NEXT Test

```
100 REM IT IS NORMAL FOR THIS PRO
    GRAM TO STOP
101 REM WITH AN ERROR ON LINE 280
110 PRINT "I","J","I*J"
120   FOR I=1 TO 9
130     FOR J=1 TO 9
140     PROD=I*J
150     IF PROD > 14 THEN 200
160     IF PROD > 10 THEN 190
170     PRINT I,J,PROD
180     NEXT J
190   NEXT I
200 PRINT "J","I","J*I"
210   FOR J=1 TO 9
220     FOR I=1 TO 9
230     PROD = J*I
240     IF PROD > 14 THEN 300
250     IF PROD > 10 THEN 280
260     PRINT J,I,PROD
270     NEXT I
280   NEXT J
290 STOP
300 STOP
```

Program 2: FOR-NEXT Test 2

```
10 FOR I=1 TO 3
20   FOR J=1 TO 3
30 FOR I=10 TO 12
40   PRINT I,J
50   NEXT J
60 NEXT I
```

MACHINE LANGUAGE

Jim Butterfield, Associate Editor

Same Game, Different Players

It's sometimes hard to recognize a simple, obvious fact: Machine language runs in the same machine as the other languages, such as BASIC. Thus, if you want to figure out how to do something in machine language, you need only figure out how it's done in BASIC.

Programmers often have a blind spot. They feel that once they abandon BASIC they must relearn all about their machine from the beginning. But it's the same machine, and most things work essentially the same way.

I sometimes have questions from programmers that almost baffle me, since I have trouble recognizing this blind spot. For example: "How do I set the background color to white on the 64?" Just POKE 53281,1. "No, I mean in machine language." Yes; just put value 1 into address 53281, whatever that works out to be in hexadecimal. "But that's BASIC—I want machine language." That's neither BASIC nor machine language—that's how the 64 sets color. I get the feeling that some programmers somehow see a barrier that isn't there.

Special characters seem to be a major obstacle. Users often view Commodore's "programmed cursor" as something special to BASIC. It's not; it's part of the operating system. Providing that the normal output path at subroutine $FFD2 is used, all the control characters work as they would in BASIC. Want to clear the screen? Do a LDA #$93:JSR $FFD2. Want to print the next characters in black? Code LDA #$90:JSR $FFD2 and then go ahead and print. Want to home the cursor, print in reverse font, switch to text mode, or whatever? Use the same special characters as for BASIC.

Tables of these special characters have been printed on numerous occasions, and I could include one here, but I'd rather give you a special procedure to let the computer tell you the character to use. For most keyboard-generated characters, this will work splendidly.

In BASIC, choose the programmable key you want and type the following partial line:

```
PRINT ASC("
```

Don't press RETURN yet. Now, touch the key you're interested in; use SHIFT or CTRL if appropriate. The key's graphic representation will appear in reverse video directly behind the quotation mark. Complete the line by pressing the quotes again and closing the parentheses, giving:

```
PRINT ASC(" ... ")
```

Now press RETURN. You'll be given the value of that key. Use the hexadecimal equivalent in your machine language program: It will do the same thing.

Using this technique, you'll discover that the code to turn all printed output to blue is decimal 31, hex $1F; to home the cursor, decimal 19, hex $13, and so on. A couple of codes that you can't discover this way include Return (you should know this one) as decimal 13, hex $0D; Delete (rarely needed) as decimal 20, hex $14; Set text mode as decimal 14, hex $0E; and Set graphics mode as decimal 142, hex $8E.

The above character-finding technique also works on the function keys of the VIC-20 and Commodore 64. You won't usually want to print these, of course, but it's often useful to detect these keys after reading the keyboard with subroutine GETIN at $FFE4. The function keys can give you very user-friendly programs.

Output Control

The same sort of question crops up for outputting to devices. Users ask, "How do I make my

printer do certain lines in text mode?" When questioned as to how they do it in BASIC, the reply is something like, "Easy: I just prefix each new line with a cursor-down character." Fine. The same character exists in machine language (decimal 17, hex $11). Send it at the right time and the printer will do the appropriate thing.

It seems odd having to explain that peripheral devices don't even know what languages are sending data to it; when the right characters are delivered, the appropriate thing happens. But many users have a mental block. Somehow, machine language is suspected of making all the mechanical parts work in a different manner. 'Tain't so. It's the same machine and the same system.

Disk systems are especially tricky in some users' minds. Although it seems natural to them to open a data channel for writing using a name such as 0:DFILE,S,W in BASIC, they come unglued when it's time to do the same job in machine language. They have the name DFILE but somehow can't cope with the idea of tacking on a ,S,W behind it before opening the file.

The same mental gap occurs when it's time to scratch a file. In BASIC, users know that all they have to do is to open the command channel (secondary address 15), and then send "S0:FILENAME" to this command channel in order to scratch the file. It works the same way in machine language, of course.

Yet it sometimes seems that all we need to do is pick up a book on machine language and all the knowledge we have learned about the machine fades away into the distance.

Character Confusion

Sometimes, the confusion is understandable because of the way BASIC sends values. If BASIC outputs a value K (with a statement such as PRINT# ... K) it breaks the value into separate digits. In other words, if K is 13, BASIC will send a space, a numeric 1 character, and a numeric 3 character. A machine language programmer with a value of 13 to send might just load it into the A register and send it. But that's not a value—that's just a carriage return character. We must convert the value to decimal, and then the characters to ASCII, before sending.

On the other hand, if BASIC sends a character with CHR$(..), such as is done with the M-R and M-W commands, machine language can send the value directly.

So how would we initiate a block read in machine language? First, examine how it would be done in BASIC. To do a direct block read, we must open the command channel and open a data channel. Let's assume that we have done this using OPEN 15,8,15 and OPEN 1,8,2,"#". When this has been done, we finally give the command for the block read with:

```
PRINT#15,"U1:2,0,";25,14
```

This would read drive 0, track 25, sector 14. The value of 2, by the way, is the secondary address of the data file. Command U1, by the way, is preferable to its equivalent B-R for doing a block read.

In machine language, we would open the print path with LDX #15 and JSR $FFC9. We would then send the U, followed by 1, then the colon, the two, the comma, the zero, and the second comma.

Now comes the part where we need to be careful—not tricky, just careful. The track number, in this case 25, must be broken into two digits, the two and the five. That's not hard: Such a simple division could be accomplished by repeatedly comparing the value to 10, subtracting if necessary, and counting how many times we subtract. Two subtractions leave five: We send space, ASCII two, ASCII five. Now we do the same thing with the sector value and we're done. To keep precisely to the BASIC syntax, we'd also send a Return before disconnecting from the print path.

Yes, it does work like BASIC. Yes, I'd work out a logic flow in BASIC before diving directly into machine language. But ultimately, I'd feel quite secure: If it works in BASIC, it must also work in machine language.

Once you get a wholesome feeling for your machine, the language you use becomes less significant. After all, a language—any language—is just a tool to help you get the job done. C

C. Regena

Algebra Tutorial

Part 1

We have examined educational software in previous columns and discussed how to construct drill programs. Now let's create a tutorial program. There have been a lot of requests for an educational program for algebra so here is the first part of a tutorial program on multiplying binomials.

"Algebra Tutorial," assumes the student has some knowledge of algebra and understands terms usually introduced before binomial multiplication. This program only covers multiplication of one binomial (numeric expression of two terms) by another binomial—such as (x + 5) times (x + 4). Additional related units could include multiplying polynomials, dividing polynomials by binomials, and factoring trinomials.

The program uses PRINT statements to avoid DATA statements with lots of numbers. If you prefer to prevent scrolling, you can use the graphics method of CALL HCHAR and CALL VCHAR to print problems on the screen.

Redefining Characters

Lines 160 and 170 redefine two characters for use in printing the problems. Character 94 is ordinarily the caret or exponentiation symbol, but is redefined here as a 2, which will be used as the superscript for a number squared. To type the program in, use SHIFT 6 to get the ^ symbol in lines such as line 400.

The underline is also redefined. Character 95 is ordinarily the underline, but several underlines together yield a dotted line, and we want a solid line. Lines 230 and 270 are examples of the underline in the listing. To type the underline, press the FCTN key and the U. As you type the listing, you will see the regular symbols, but when you run the program, you will see the redefined characters.

When learning algebra, it is important to understand that you can work with letters using the same rules and methods that are used with regular numbers. Lines 190–300 print a screen showing a comparison of binomial multiplication in algebra with a numeric multiplication problem. Lines 310–460 show the general form of the multiplication problem and its answer.

Generating A Random Problem

Lines 470–950 present a problem for the student to try. A and B are two random numbers chosen for the second terms of the binomials. This problem is the simple case using X plus a number from 1 to 3. The computer goes through the problem step by step, and the student presses a number where prompted. Correct numbers must be entered to continue.

CALL KEY is used rather than INPUT, so the student just needs to press a key for the answer. If you use INPUT, there is a greater chance for user error or for the program to crash. Avoid INPUT in tutorials so the student can use the program as easily as possible.

The tutorial adds new information a little at a time. Lines 960–1110 present a screen showing numeric coefficients for the first term. Lines 1120–1180 (and the subroutine starting at line 1960) give the student a problem of this type. Lines 1190–1300 present a screen of information about using positive and negative numbers.

```
110 CALL CLEAR
120 PRINT "  BINOMIAL MULTIPLICATIO
    N"
130 PRINT ::"THIS PROGRAM DISCUSSES
    "
140 PRINT :"MULTIPLICATION OF BINOM
    IALS"
150 PRINT :"SUCH AS (X+5) TIMES (X+
    3).":::::
160 CALL CHAR(94,"0000304808102078")
170 CALL CHAR(95,"00000000000FF")
180 GOSUB 1530
190 CALL SCREEN(8)
200 PRINT "COMPARE":"  ALGEBRA TO":
    "  REGULAR MULTIPLICATION:"
210 PRINT ::"{3 SPACES}12";TAB(21);
    "X + 2"
220 PRINT :"{3 SPACES}23";TAB(21);"
    X + 3"
230 PRINT "   ___";TAB(20);"______"
240 PRINT :"{3 SPACES}36";TAB(20);"
    3X + 6"
250 PRINT TAB(16);"^"
260 PRINT "  24";TAB(15);"X  + 2X"
270 PRINT "  ___";TAB(15);"________
    ___"
280 PRINT TAB(16);"^"
290 PRINT "  276";TAB(15);"X  + 5X
    + 6"::::
300 GOSUB 1530
310 CALL SCREEN(4)
320 PRINT "IN GENERAL,"
330 PRINT :TAB(15);"X  +  A"
340 PRINT :TAB(15);"X  +  B"
350 PRINT TAB(12);"__________"
360 PRINT :TAB(14);"BX  + AB"
370 PRINT TAB(7);"^"
380 PRINT TAB(6);"X  +{4 SPACES}AX"
390 PRINT TAB(6);"_______________"
400 PRINT TAB(7);"^"
410 PRINT TAB(6);"X  + (A+B)X + AB"
420 PRINT :::"THE FIRST TERM IS X*X
    "
430 PRINT "THE LAST TERM IS A*B"
440 PRINT "THE MIDDLE TERM COMBINES
    "
450 PRINT "A AND B MULTIPLIED BY X"
460 GOSUB 1530
470 CALL CLEAR
480 CALL SCREEN(8)
490 PRINT "NOW YOU MULTIPLY:"
500 RANDOMIZE
510 A=INT(3*RND)+1
520 B=INT(3*RND)+1
530 F=0
540 PRINT :TAB(22);"X +";A
550 PRINT :TAB(22);"X +";B
560 PRINT TAB(21);"______"
570 PRINT :B;"TIMES TOP";TAB(21);"?
    X +"
580 C=23
590 GOSUB 1620
600 IF K=48+B THEN 630
610 GOSUB 1580
620 GOTO 590
630 C=28
640 GOSUB 1620
650 IF K=48+A*B THEN 680
660 GOSUB 1580
670 GOTO 640
680 PRINT TAB(17);"^"
690 PRINT " X TIMES TOP";TAB(16);"X
      +  X"
700 C=23
710 GOSUB 1620
720 IF K=48+A THEN 750
730 GOSUB 1580
740 GOTO 710
750 PRINT TAB(16);"__________"
760 PRINT TAB(17);"^"
770 PRINT " ADD";TAB(16);"X  +  X +"
780 GOSUB 1620
790 IF K=A+B+48 THEN 820
800 GOSUB 1580
810 GOTO 780
820 C=28
830 GOSUB 1620
840 IF K=A*B+48 THEN 870
850 GOSUB 1580
860 GOTO 830
870 GOSUB 1690
880 IF F=0 THEN 910
890 GOSUB 1530
900 GOTO 470
910 PRINT :::"CHOOSE:  1 ANOTHER PR
    OBLEM"
920 PRINT TAB(10);"2 CONTINUE PROGR
    AM"
930 CALL KEY(0,K,S)
940 IF K=49 THEN 470
950 IF K<>50 THEN 930
960 CALL CLEAR
970 CALL SCREEN(12)
980 PRINT "THERE MAY BE COEFFICIENT
    S"
990 PRINT "OF THE FIRST TERM,"
1000 PRINT "BUT THE RULES DON'T CHA
     NGE."
1010 PRINT ::"FOR EXAMPLE,"
1020 PRINT :TAB(15);"2Y + 5"
1030 PRINT :TAB(15);"3Y + 1"
1040 PRINT TAB(15);"______"
1050 PRINT :TAB(15);"2Y + 5"
1060 PRINT TAB(10);"^"
1070 PRINT TAB(8);"6Y  + 15Y"
1080 PRINT TAB(8);"_____________"
1090 PRINT TAB(10);"^"
1100 PRINT TAB(8);"6Y  + 17Y + 5":::
1110 GOSUB 1530
1120 CALL SCREEN(8)
1130 T=1
1140 SD=1
1150 SD$="+"
1160 SE=1
1170 SE$="+"
1180 GOSUB 1960
1190 CALL CLEAR
1200 CALL SCREEN(4)
1210 PRINT "BINOMIALS MAY CONTAIN"
1220 PRINT :"+ OR - NUMBERS."
1230 PRINT ::"MULTIPLY THE NUMBERS,"
1240 PRINT :"AND REMEMBER THE RULES"
1250 PRINT :"FOR THE SIGNS."
1260 PRINT ::"{3 SPACES}+ * + = +"
1270 PRINT :"{3 SPACES}+ * - = -"
1280 PRINT :"{3 SPACES}- * + = -"
1290 PRINT :"{3 SPACES}- * - = +"
1300 GOSUB 1530
```

Next month, we'll present the remainder of the program. ©

Multiscreen Atari Animation

D. K. Titchenell

Often when creating computer graphics, it is useful to be able to draw more than one picture at a time using alternate screens. It also helps to be able to flip through the pictures to compare them. This flexible graphics editor lets you use a joystick to draw, and allows you to flip, copy, erase, easily animate portions of a screen, and more—using up to three screens simultaneously.

Of the many remarkable graphics facilities provided by Atari's video chip, ANTIC, the load memory scan feature, is one of the most powerful. Among many other things, it permits screen flipping by allowing the programmer to select the area or areas of memory to be used for screen display.

Screen flipping, the process in which multiple screens are displayed in rapid succession, has been covered fairly thoroughly. But in order to implement this feature easily and to greatest advantage, an editor designed specifically for the purpose is needed. Such an editor should ideally contain a sketchpad utility, and provide special features for coordinating and offsetting images on multiple screens. In addition, the ability to save and reload the completed animation screens, display facilities, and color control is desirable.

The Sketchpad

Select option D (Draw) in the main menu to enter the sketchpad mode where all the plotting is done. It is impractical to implement a cursor in this mode because the cursor would need to be too small. With a cursor of about the size of one pixel, it would be difficult to distinguish between colors. The best solution is to make the cursor a player-missile that changes colors under user control.

As much as possible, input is restricted to the joystick. With just the stick and one button you won't have great input flexibility, but it can be improved considerably. When drawing, each push of the joystick button advances the color register to the next color, cycling through all four, including the background color, then repeating. Keep the button depressed, however, and the cursor may be moved freely and rapidly about the screen without plotting. This permits detailed work, but doesn't make it easy to color large areas. The special XIO 18 fill function is designed for this purpose, but does not lend itself particularly well to this application.

Rather than use it as it was intended, it serves here as a one-dimensional fill function—it simply draws a line from the cursor to the right until it encounters a previously plotted point or wraps around. The second dimension is added by moving the cursor while the fill function is turned on. Large and complex areas can be thus filled by drawing the right border first and turning on FILL before drawing the left side. Having stretched the joystick to its limits, the fill function is activated by pressing the console START switch. It turns off as soon as the joystick button is pressed.

Animation

Some interesting and practical effects can be created using full-screen cyclic animation. One of the easiest and most obvious is the dotted line. The dots seem to flow along in an endless stream and can be used to illustrate the flow of fluid in a piping diagram or the movement of current through an electrical circuit.

Many other figures are also possible

```
      6+32:GOSUB PMSET:GOSUB COLOUR
      SET:GOSUB PAGDRAW:GOTO 400
EG 290 IF ANS$="E" THEN GRAPHICS 7+1
      6:GOTO 400
JM 300 IF ANS$="S" THEN GOSUB SAV:GO
      TO 400
CG 310 IF ANS$="R" THEN GRAPHICS 7+1
      6:GOSUB REED:GOTO 400
DI 320 IF ANS$="C" THEN GOSUB COLOUR
      SELECT:GOTO 400
GF 350 IF ANS$="K" THEN GOSUB DUPAGE
      :GOTO 400
NG 360 IF ANS$="F" THEN GOSUB FLIP:G
      OTO 400
LB 370 ? "SORRY, I DON'T UNDERSTAND
      ";ANS$:FOR W=1 TO 200:NEXT W
FP 400 GOTO 200
EG 410 REM ********** PMSET ******
      ********
KL 430 A=PEEK(106)-52:POKE 54279,A:P
      MBASE=256*A:REM SET PLAYER AD
      DRESS
ID 440 POKE 559,46:POKE 53277,3:REM
      ENABLE PM GRAPHICS
GE 450 POKE PMBASE+512,0:D=USR(ADR(M
      OV$),PMBASE+512,PMBASE+513,12
      8):REM CLEAR PLAYER AREA
ED 455 XP=X-47:YP=Y-5
FM 470 POKE 623,1:REM CURSOR PRIORIT
      Y OVER BACKGROUND
AB 475 D=USR(ADR(UPDOWN$),ADR(IMG$),
      PMBASE+512+Y,13,0)
HM 480 RETURN
AB 500 REM ********* COLOUR SELECT *
      ********
BC 510 ? "SELECT COLOR WITH STICK"
CN 512 ? "LEFT-RIGHT -- HUE"
EI 514 ? "UP-DOWN -- INTENSITY"
BC 516 ? "PUSH TRIGGER TO CHOOSE";
JM 518 IF STICK(0)=15 THEN 518
FE 519 ? "{CLEAR}":GOSUB COLOURSET:P
      OKE 752,1:REM CURSOR OFF
KP 520 ? :FOR C1=0 TO 4
GD 530 IF C1=3 THEN 650:REM COLOR 3
      IS NOT USED
MP 540 SETCOLOR C1,COL(C1),IN(C1)
HM 545 ? CHR$(28);"SETCOLOR ";C1;","
      ;COL(C1);",";IN(C1);"
      {3 SPACES}"
BO 550 FOR W=1 TO 50:NEXT W
MA 560 COL(C1)=COL(C1)+DIRH(STICK(0)
      )
JM 570 IN(C1)=IN(C1)+DIRV(STICK(0))*
      2
LC 580 IF COL(C1)>15 THEN COL(C1)=0
LB 590 IF COL(C1)<0 THEN COL(C1)=15
BM 600 IF IN(C1)>14 THEN IN(C1)=0
BL 610 IF IN(C1)<0 THEN IN(C1)=14
PJ 620 IF STRIG(0) THEN 540
MC 630 SOUND 0,64,10,12:FOR W=1 TO 5
      0:NEXT W
GH 640 SOUND 0,0,0,0
ED 650 NEXT C1
HM 660 RETURN
NH 700 REM ********** COLOURSET ****
      ********
AC 710 SETCOLOR 0,COL(0),IN(0)
AG 720 SETCOLOR 1,COL(1),IN(1)
AK 730 SETCOLOR 2,COL(2),IN(2)
BB 740 SETCOLOR 4,COL(4),IN(4)
HM 750 RETURN
BI 800 REM ********** DRAW *********
      ********
EJ 810 XP=X-47:YP=Y-5
BL 815 A=STICK(0)
OB 820 IF STRIG(0)=0 THEN ANIM=0:FIL
      L=0:IF A<>15 THEN 900
BL 830 IF STRIG(0)=0 THEN FILL=0:C=C
      +1:IF C>4 THEN C=1
HO 840 IF STRIG(0)=0 AND STICK(0)=15
       THEN 840:REM RELOOP UNTIL BU
      TTON RELEASED
NA 850 POKE 704,COL(C-1)*16+6:REM CU
      RSOR COLOR
BO 860 COLOR C:IF STRIG(0) THEN PLOT
       XP,YP
ID 865 IF PEEK(764)<>255 THEN GOSUB
      KEYIN
KC 867 IF A<>15 THEN IF ANIM>1 THEN
      AD=AD+1:IF AD>=ANIM THEN AD=0
      :RETURN
OF 870 IF PEEK(53279)=6 THEN FILL=1
II 880 IF FILL AND X<206 AND C<>4 TH
      EN POSITION XP+1,YP:POKE 765,
      C:XIO 18,#6,0,0,"S:":REM FILL
       FUNCTION
AH 890 IF PEEK(53279)<6 THEN RETURN
      :REM EXIT ROUTINE, SELECT OR
      OPTION BUTTON PRESSED
HJ 900 REM MOTION ROUTINE
DL 905 OX=X:X=X+DIRH(A):IF X>206-FIL
      L OR X<47 THEN X=OX
MC 907 OY=Y:Y=Y+DIRV(A):IF Y>100 OR
      Y<5 THEN Y=OY
CK 908 D=USR(ADR(UPDOWN$),ADR(IMG$),
      PMBASE+512+Y,13,X)
JO 909 IF A<>15 THEN IF ANIM=1 THEN
      AD=AD+1:IF AD>=ANIM THEN AD=0
      :RETURN
GM 910 GOTO 810
PM 990 REM ********** SET UP DIRECTIO
      N ARRAYS ************
HJ 1000 DIM DIRV(15):DIM DIRH(15)
KM 1005 RESTORE 1100
HL 1010 FOR W=5 TO 15
DA 1020 READ Q
CB 1030 DIRH(W)=Q
DC 1040 READ Q
DB 1050 DIRV(W)=Q
FN 1060 NEXT W
KI 1070 RETURN
LC 1100 DATA 1,1,1,-1,1,0,0,0,-1,1,-
      1,-1,-1,0,0,0,0,1,0,-1,0,0
AD 1110 REM ********** SAV **********
      **
GB 1115 D=USR(ADR(MOV$),ADR(ANS$)+1,
      SCREEN3+SCREENSIZE,62)
FB 1120 GRAPHICS 7+32:? "{CLEAR}";
CA 1130 ? "ENTER FILE NAME":INPUT SP
      EC$
DI 1135 IF SPEC$="" THEN RETURN
KD 1140 TEMP$(1,2)="D:":TEMP$(3)=SPE
      C$
MH 1145 TRAP 1220
GE 1150 OPEN #2,8,128,TEMP$:TRAP 400
      00
KN 1190 SIO=11:RW=8
LF 1200 GOSUB REDIN
KJ 1210 CLOSE #2:RETURN
IH 1220 CLOSE #2:? SPEC$;" DOESN'T S
```

```
      EEM TO WORK. TRY AGAIN":? "O
      R PRESS RETURN FOR MENU":GOT
      O 1130
DK 1250 REM ********** REED *******
      *********
FK 1255 GRAPHICS 7+32:? "{CLEAR}";
CE 1260 ? "ENTER FILE NAME":INPUT SP
      EC$
DM 1265 IF SPEC$="" THEN RETURN
YH 1270 TEMP$(1,2)="D:":TEMP$(3)=SPE
      C$
MO 1275 TRAP 1340
FN 1300 OPEN #2,4,128,TEMP$:TRAP 400
      00
HI 1310 SIO=7:RW=4
LI 1320 GOSUB REDIN
GE 1325 D=USR(ADR(MOV$),SCREEN3+SCRE
      ENSIZE,ADR(ANS$)+1,62)
KM 1330 CLOSE #2:RETURN
LM 1340 CLOSE #2:? SPEC$;" DOESN'T S
      EEM TO WORK. TRY AGAIN":? "O
      R PRESS RETURN FOR MENU.":GO
      TO 1260
GN 1400 REM ********** KEYIN *******
      *********
DH 1410 K=PEEK(764):POKE 764,255
BP 1430 IF K=30 THEN ANIM=2:RETURN
CG 1440 IF K=26 THEN ANIM=3:RETURN
CG 1450 IF K=24 THEN ANIM=4:RETURN
CN 1460 IF K=29 THEN ANIM=5:RETURN
CH 1465 IF K=31 THEN ANIM=1:RETURN
HI 1470 ANIM=0:RETURN
FO 2110 REM ********* REDIN ********
      *********
EN 2120 POKE 832+IOCB+2,SIO
EH 2130 POKE 832+IOCB+4,SCL
DA 2140 POKE 832+IOCB+5,SC3
DM 2150 POKE 832+IOCB+8,LENGTH-(INT(
      LENGTH/256)*256)
DH 2160 POKE 832+IOCB+9,INT(LENGTH/2
      56)
DP 2170 POKE 832+IOCB+10,RW
DD 2180 POKE 832+IOCB+11,128
ID 2190 DUM=USR(ADR(CALLIO$),IOCB)
KE 2200 RETURN
HJ 2210 REM ********* DUPAGE *******
      *********
NE 2220 DUM=USR(ADR(MOV$),SCREEN1,SC
      REEN2,SCREENSIZE)
NG 2230 DUM=USR(ADR(MOV$),SCREEN1,SC
      REEN3,SCREENSIZE)
YI 2240 RETURN
JP 2300 REM ********** PAGDRAW *****
      *********
HE 2310 GOSUB DRAW
LM 2320 IF PEEK(53279)=5 THEN 2440:R
      EM OPTION SWITCH EXITS MODE
KN 2330 IF PEEK(53279)<>7 THEN 2330:
      REM RELOOP UNTIL SWITCH IS R
      ELEASED
MH 2340 POKE LMSH,SC2:POKE 89,SC2:RE
      M POINT ANTIC AND OS TO NEW
      SCREEN
HI 2350 GOSUB DRAW
EF 2360 IF PEEK(53279)=5 THEN 2440
IH 2370 IF PEEK(53279)<>7 THEN 2370
PE 2380 POKE LMSH,SC3:POKE 89,SC3
HM 2390 GOSUB DRAW
EA 2400 IF PEEK(53279)=5 THEN 2440
HN 2410 IF PEEK(53279)<>7 THEN 2410
DL 2420 POKE LMSH,SC1:POKE 89,SC1
MI 2430 GOTO 2310
KK 2440 RETURN
EE 2500 REM ********** FLIP *******
      *********
PA 2505 GRAPHICS 7+16+32:GOSUB COLOU
      RSET
KE 2510 POKE LMSH,SC1:GOSUB 2550
DJ 2515 IF PEEK(53279)<>7 THEN RETUR
      N :REM ANY CONSOLE SWITCH EX
      ITS MODE
HB 2520 POKE LMSH,SC2:GOSUB 2550:REM
       ROTATE HIGH BYTE OF LMS OPE
      RAND
KI 2530 POKE LMSH,SC3:GOSUB 2550
MM 2540 GOTO 2510
DN 2550 FOR W=1 TO 5:NEXT W:REM SHOR
      T DELAY
KN 2560 RETURN
GM 2600 REM ********** DLSET *******
      *********
HD 2610 GRAPHICS 7+32+16
JM 2620 DLIST=PEEK(560)+256*PEEK(561
      )
KK 2630 LMSL=DLIST+4:LMSH=DLIST+5
IB 2640 SCL=PEEK(LMSL):SC1=PEEK(LMSH
      )
MJ 2650 SC2=SC1-16:SC3=SC2-16
KD 2660 SCREEN1=256*SC1+SCL:SCREEN2=
      256*SC2+SCL:SCREEN3=256*SC3+
      SCL
NH 2670 SCREENSIZE=3841
LA 2680 RETURN
IK 2999 REM ********** MLSET *******
      *********
KP 3000 RESTORE 3005
DH 3002 DIM MOV$(39):FOR W=1 TO 39:R
      EAD P:MOV$(W,W)=CHR$(P):NEXT
       W
MH 3005 DATA 104,104,133,215,104,133
      ,214,104
NE 3006 DATA 133,217,104,133,216,104
      ,133,218
HF 3007 DATA 104,170,160,0,177,214,1
      45,216
GJ 3008 DATA 200,208,4,230,215,230,2
      17,202
NA 3009 DATA 208,242,198,218,16,238,
      96
OJ 3019 REM UPDOWN$ IS MOSTLY MOV$ W
      ITH A LITTLE ADDED
FJ 3020 DIM UPDOWN$(44)
LG 3025 RESTORE 3050
BK 3030 UPDOWN$=MOV$
HE 3040 FOR W=39 TO 44:READ P:UPDOWN
      $(W,W)=CHR$(P):NEXT W
LH 3050 DATA 104,104,141,0,208,96
LJ 3060 RESTORE 3090
FG 3070 DIM CALLIO$(7):FOR W=1 TO 7:
      READ P:CALLIO$(W,W)=CHR$(P):
      NEXT W
KL 3080 RETURN
LM 3090 DATA 104,104,104,170,76,86,2
      28
HH 3105 REM ******* SET UP CURSOR IM
      AGE *****
LA 3110 RESTORE 3130
DE 3120 FOR W=1 TO 13:READ P:IMG$(W,
      W)=CHR$(P):NEXT W
KA 3130 DATA 0,7,7,14,14,28,28,56,56
      ,112,96,64,0
KI 3140 RETURN
```

Computers And Society

David D. Thornburg, Associate Editor

That's not a game, that's a microworld...

Although computer manufacturers extol the utility of home computers, the overwhelmingly popular use of these machines has been games. Many owners of computer stores tell me that customers come into their stores to purchase a computer as, for example, an educational tool for the family, but then purchase five entertainment programs and only one educational program.

From my perspective there is nothing wrong with this. Games and playing are an important part of life. A game gives the player a safe environment to test the responses of a culture in a controlled way. Baby tigers play at fighting with each other, and thus acquire skills they will need later for hunting and self-protection. Someone once said that play is the child's work.

Misplaced Calvinism

It is all too easy to get caught up in the idea that because games are entertaining they are "bad" for us. This misplaced Calvinism has had some positive consequences, however. In particular, it may have caused us to look closely at some of our games in an effort to provide a rationale for continuing to play them. For example, in the early days of personal computing a standard comment was "That's not a game, that's a simulation."

This comment, only partially in jest, was applied to many of the programs that embodied understandable (if somewhat deficient) representations of the real world. A teacher who wanted to use the game *Lemonade* could justify its use to concerned parents by showing that children were learning about the marketplace by running a simulated lemonade stand. By playing in this environment, they were developing an intuition on their own for the types of decisions (and consequences) that might face them if they were to engage in business in the real world.

This is not to suggest that all games are simulations, or that games which aren't simulations are not worthwhile. Just the same, it became accepted that simulations had a special quality that made them different and thus acceptable for use in environments where play was somehow to be discouraged.

Icon-Based Languages

While simulation was a popular topic in the late 1970s, the early 1980s gave us a new set of games about which I have said, "That's not a game, that's a language." As regular readers of this column will recall, I have treated such activities as *Lode Runner* and *Pinball Construction Set* as though they were icon-based, two-dimensional computer languages. The most recent entry to this field, *Robot Odyssey I* from The Learning Company, was the subject of last month's column. The important point regarding this class of games is that, by playing them, the user is also learning that the computer is a rich and flexible environment which can be tailored to each user's whims. If you want to play a simple pinball game, you can build one; if you want to play a pinball game that no one can win, you can build that too. The responsibility for the level and nature of the game activity has now shifted from the game designer to the player. The authors of these new games provide the player with a set of tools and an environment with which the player can explore, experiment, and create.

Moldable Microworlds

What happens when a game is both a simulation and a language at the same time? In that case we can say "That's not a game, that's a microworld."

The microworld concept is discussed by Seymour Papert in his classic book, *Mindstorms: Children, Computers and Powerful Ideas.* While a universally accepted definition of microworlds has yet to be formulated, I believe that it should contain at least these basic elements:

First, the microworld must be moldable by the user. This means that the user should be able

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to make his or her own constructions within the context of the microworld, and perhaps to change some of the underlying characteristics of the environment. This is a characteristic of *Pinball Construction Set* where, for example, the user can build his or her own pinball games and can even adjust the "gravity" field in which the game is played.

Second, the microworld must support a fantasy that has some relevance or connection to the real world. The skills that one obtains in the microworld are clearly more beneficial if they have some connection to the rest of the user's life.

A question that arises is just how much of a real-world connection is needed to qualify a program as a microworld. *Lemonade* is a fine representation of a real-world environment, but it is not a microworld simply because the program does not allow the user to modify the rules by which the lemonade stand is run. Logo's turtle geometry is a microworld since drawing and movement are real-world activities, and the user has the flexibility to explore and modify the environment at will. I feel that *Rocky's Boots* and *Robot Odyssey* are microworlds as well, since these programs develop an understanding of formal logic by allowing the user to construct and operate machines of the user's own design.

Papert Speaks Out

My view of microworlds is perhaps a bit broader than that of Seymour Papert who, at the Logo 84 conference in Boston, had this to say about the topic:

> If we look at environments such as Budge's program for building pinball machines, I feel that these programs have many of the elements of a well-designed microworld: They are child-centered; they're driven in a constructive way; no one is giving you exercises, you can sit there, working with the system without anybody saying "Do this, solve this problem." But they do lack something that the turtle world has: a set of recognizable mathematical programming ideas.
>
> Our task has to be to continue to invent worlds that have both open-endedness and a connection to other ideas in our culture.
>
> *Rocky's Boots* is an example of something significant: It does incorporate some very fundamental ideas. The idea that you can build, from several logic elements, any computational device, is surely one of the most powerful ideas of all time. It's one of the ideas that one might say gave rise to the whole microcomputer revolution. So you can't say of *Rocky's Boots* that it doesn't tap into powerful ideas. But you can say that hardly any of the people who use it—be they teachers or children—acquire through using it any appreciation of this particular powerful idea or any uses of this particular powerful idea outside of the use of this program.
>
> The major task of our microworlds is to link what we learn to the outside world. With the turtle, there is a cultural resonance with the outside world. I don't think that the idea of a universal logical element has such a resonance. Not in the lives of children anyway. How could it acquire one? It could only do it through quite profound change on a cultural level in the learning world. There are certain ideas of the turtle world, like drawing, that are already part of our culture. So, through the turtle, we pick up a mathematical form of that idea that fits in with our world.

Adult Environments

Except for his perception of *Rocky's Boots*, Papert's view of microworlds is not so different from mine. I would argue more for the creation of microworlds for adults and children alike. To the extent that they are useful (and entertaining) environments for children, appropriately designed microworlds can be captivating environments for adults as well.

Regarding the future of microworld development, Papert went on to say:

> If we look ahead ten years to the future of Logo, we might find, to a large part, that it presented us with the first of many microworlds that have become, if not the substitute for what we call curriculum, the vitally important part of what constitutes the learning environment for children. I envision the existence of 10 to 30 microworlds of which the turtle world is but one example. Some of these might be controlled by a computer language like Logo, and some of them won't, but they will all be computer-based worlds in which powerful central ideas either exist already in our scientific and intellectual heritage, or will come about in the interim. This network of microworlds will have a different

kind of life. If something like *Rocky's Boots* is one of them, it will have its cultural resonances, and will have a form that will let you meet these ideas in appropriate manners when you are six, and again as you grow older. The shape of the learning environment will be influenced by the kinds of movements that Logo is part of, and I see that as the immediate task of the next ten years.

The Computing Horizon

What I find so absolutely fascinating about all of this is that the personal computer software industry is far from falling into a rut. Just as we start to identify and classify certain types of software, entirely new categories appear on the horizon. Games become simulations, simulations become languages, and in the process the combinations become microworlds. As all of these advances are taking place, the computer itself appears to be drifting ever further into the background. We are increasingly interested in computing and decreasingly interested in the computer per se.

Even as I find myself getting tempted to design new microworlds of my own, I have the nagging suspicion that by next year I'll be saying, "That's not a game, that's a ...." ©

Commodore Disk Pattern Matching
Part 2

Jim Butterfield, Associate Editor

Last month we looked at some of the features of pattern matching. Now let's see how to deal with those annoying comma files.

Most disk users who do a little programming end up with one or more files on disk with an odd name: a comma. The files seem to be good, but the name makes them impossible to handle: It seems that you can't open or scratch such a file since attempting to use such a name always gives a syntax error response.

Such files seem so inaccessible that many users start to wonder how they managed to create them in the first place. Any attempt to create them deliberately usually ends up in the same syntax error message.

Just in case you've never seen one, or wonder how they happen, the following program has a bug which will cause a comma file to be created. You may want to try it.

```
100 INPUT "NAME OF FILE";N$
110 OPEN 1,8,3,"0:"+F$+",S,W"
120 FOR J=1 TO 50
130 PRINT#1,SQR(J)
140 NEXT J
150 CLOSE 1
```

The above program puts 50 square root values on a file. The user is asked to give a filename, which becomes the string variable N$. The program then opens a sequential file for writing, but there's an oops: We mistakenly use variable F$ for the filename instead of N$. F$ contains nothing; so we create a "no name" file—our open name file string ends up as "0:,S,W". The disk opens the file, but can't find a name; so it uses the first character it sees where the name should be: the comma.

The same thing could happen on a Commodore 64 or VIC even if the program were correct, with N$ instead of F$ in line 110. If the user pressed the RETURN key instead of typing in a filename, N$ would contain nothing—it would be a "null string," and the same comma file would be written. By contrast, a "nothing" input on a PET/CBM would cause the program to stop and the file wouldn't be written.

Oddly, you can have more than one comma file on a disk. You won't get a FILE EXISTS message.

Scratching Comma Files

If your disk has one or more comma files and you just want to get rid of them, the job is fairly easy. Use pattern matching to find out how many files you have with one-character names. Type:

```
LOAD "$0:?",8
LIST
```

or, with the DOS wedge:

```
@$0:?
```

and you'll see all the one-character names, including all the comma files.

If you have any files other than the comma ones with one-character names, change their names using the RENAME command. For example, if you have a file named X, you could temporarily change it to X99. After the comma files are gone, you can change the name back again. To change name X to X99, type:

```
OPEN 15,8,15
PRINT#15,"R0:X99=0:X"
CLOSE 15
```

or, with the DOS wedge:

```
@R0:X99=0:X
```

Now, take the same directory command as before to get a new list of the files with single-character names. If you've correctly renamed the legitimate files, you'll get only the comma files. If you have missed any, go back and rename them.

When you are sure that the only one-character

names belong to comma files, get rid of them with the Scratch command. Type:

```
OPEN 15,8,15
PRINT#15,"S0:?"
CLOSE 15
```

or, with the DOS wedge:

```
@S0:?
```

One command scratches all the files. The job is done.

Reclaiming Data

It would be nice if we could rename files using the same pattern-matching system. Sometimes the data on a file is of value, and we'd like to reclaim it. Providing we need only the first comma file, we can usually get the information back.

We follow the previous procedure of insuring that the comma program is the only single-character name on the disk. If it's a program (and this is rare), we can usually get it with LOAD "?",8 followed by a save with an appropriate name. If it's a sequential file (by far the most common situation), we must write a small program to read the data.

If we just want to read the data, and not copy it to a new file, the following simple program will work with most files:

```
100 OPEN 1,8,2,"0:?,S,R"
120 INPUT#1,A$
140 PRINT A$
160 IF ST=0 GOTO 120
180 CLOSE 1
```

If we want to copy the data to a new file, the above program needs to be expanded a little:

```
100 OPEN 1,8,3,"0:?,S,R"
110 OPEN 2,8,4,"0:RECLAIM,S,W"
120 INPUT#1,A$
130 SW=ST
140 PRINT A$
150 PRINT#2,A$
160 IF SW=0 GOTO 120
170 CLOSE 2
180 CLOSE 1
```

As you can see, we're still using pattern matching to get the data. If your file is more complex, you may still use the same techniques to go after the information. Line 110 has named the new file RECLAIM; you may of course give it any name you like.

Pattern matching is useful for a variety of disk tasks. It's almost indispensable for dealing with the comma file.

Comma files are caused by programming or user mistakes. Get after them quickly, since you might be able to reclaim information written there. And, of course, look to the cause of these files—something needs fixing. ©

TI Disassembler

James Dunn

Since information on the operating system and BASIC interpreter used by the TI-99 is scarce, "TI Disassembler" will come in handy if you want to try your hand at programming in TI-9900 machine language.

A disassembler converts the jumble of numbers that actually constitute a machine language program into a more readily understandable form. For each machine language instruction (called an opcode), TI has established a one- to four-letter representation called a *mnemonic*. This disassembler decodes the contents of memory into standard TI mnemonics, making ML programs less difficult to understand. However, this program will not teach you machine language programming. To use this program, you must have at least an elementary understanding of TI machine language and a familiarity with TI's standard format for ML assemblers. Refer to any of the several books on this subject for further information.

This Disassembler is written in Extended BASIC. However, it can be easily translated for the *Mini Memory* or *Editor/Assembler* cartridges. All that is necessary is to unstack the lines so that there is only one statement on a line. All the commands can be found in console BASIC except the PEEK command which is in Extended BASIC, and also available when the *Mini Memory* or *Editor/Assembler* cartridge is installed.

Printer Output

Depending upon your printer setup, you may have to modify line 110 or the subroutine starting on line 860, which prints to the screen. It might be wiser to leave that routine as is and just add the extra lines necessary to output to your printer.

Notice that all computations and input are in decimal. If you want hexadecimal numbers, you can modify the program to add conversions. Be warned, however, that this will slow down the program. When you are disassembling 16K blocks, that can be something to think about.

The Disassembler does an excellent job on machine language programs; however, it has one weakness. It cannot tell if the area of memory you ask it to disassemble contains data, text, or jump tables. It will attempt to disassemble these as if they were legitimate opcodes. To tell if this is happening, watch for the BYT output, which indicates that the area you are disassembling contains something other than machine language.

Where You Can't PEEK

The Disassembler can only look into the CPU address space. This is a fault of the architecture of the computer itself. Since the 16K RAM area used by console BASIC is not connected to the CPU, but rather to the VDP (Video Display Processor), the Disassembler cannot access it. Also unreadable are the GROMs which contain the GPL. If you have expansion memory, it is accessible, as are the command modules. Both the *Mini Memory* and the *Editor/Assembler* cartridges provide PEEK and POKE commands which can access these areas.

In order to be consistent with TI machine language conventions, the Disassembler uses the same field symbols and addressing mode symbols used in the TI *Editor/Assembler* package. In case you don't have that package, Tables 1 and 2 show the symbols.

Explanation Of Program

30–110	Initialization and input.
120	Start of main loop.
140	PEEK locations.
150–260	Determines the format of the opcode and sends program to appropriate line number for decoding.
270–370	Decodes Format VIII opcodes.
380–420	Decodes Format VI opcodes.
430–450	Decodes Format V opcodes.
460–530	Decodes Format II opcodes.
540–590	Decodes Format IV opcodes.
600–680	Decodes Format III and IX opcodes.
690–780	Decodes Format I opcodes.
790–810	Decodes Format VII opcodes.

820	If not one of the above, byte is not a valid opcode.
840	Optional sound signal and hold when no opcode found.
860	Print to screen routine.
900	Subroutine to READ DATA and pick out mnemonic.
930	Subroutine to decode the Ts address mode.
1000–	DATA statements which contain mnemonics listed according to their Format.

Variables Used

A	Start address
A1	Temporary variable to cover quirk of PEEK statement
A$	Opcode
B	End address
B$	Source field
C$	Destination field
H	High byte of PEEK address
I	Temporary loop variable
J	Base to which value K is added
J$	Want printout
K	Displacement variable for loop
L	Low byte of PEEK address
N	Computed total of H and L
01 02 03 04	} next bytes in order after L
PR	Printout variable (0 = no, 1 = y)
Q$	Temporary storage for txfr to A$
R	Register number
TR	Loop indicator
Z	Number of opcodes in format type

Table 1: TI Opcode Field Symbols

CO	Count
D	Destination operand
NU	Number
S	Source operand
Td	Specific address mode of destination operand
Ts	Specific address mode of source operand
WR	Workspace register

Table 2: TI Addressing Mode Symbols

*	means Indirect address mode
(R)	means Indexed address mode
+	after * means Auto Increment address mode
#	means Workspace Register address mode
@	means Direct address mode

TI Disassembler

```
30 REM INITIALIZE
40 TR=0 :: CALL CLEAR :: PR=0
50 PRINT "START ADDRESS (MUST BE AN
    EVEN DECIMAL NUMBER )?" :: INPU
   T A
60 IF A=0 THEN 80
70 IF A/2<>INT(A/2)THEN 50
80 PRINT "END ADDRESS ?" :: INPUT B
90 PRINT "DECODE FROM : ";A;" TO :
   ";B
100 PRINT "WANT PRINTOUT?" :: INPUT
     J$
110 IF J$="Y" THEN PR=1 :: CLOSE #1
    :: OPEN #1:"RS232",OUTPUT
120 IF A>=B THEN 50
130 A1=A :: IF A>32767 THEN A1=A-65
   536
140 CALL PEEK(A1,H,L,01,02,03,04)
150 REM TEST FOR OP CODES & ADDRESS
    MODES
160 N=H*256+L :: IF N>16383 THEN 69
   0
170 IF N>14335 THEN 600
180 IF N>12287 THEN 540
190 IF N>11263 THEN 600
200 IF N>8191 THEN 600
210 IF N>4095 THEN 460
220 IF N>2047 THEN 430
230 IF N>1023 THEN 380
240 IF N>831 THEN 790
250 IF N>511 THEN 270
260 GOTO 820
270 REM FORMAT VIII OP-CODES
280 IF (L AND 16)=16 THEN 820
290 RESTORE 1020 :: J=480 :: Z=5 ::
    K=32 :: R=(L AND 15):: N=((H A
   ND 3)*256)+(L AND 224):: GOSUB
   900
300 IF TR<>1 THEN 330
310 C$=STR$(01*256+02):: A=A+4
320 B$="R"&STR$(R)&"," :: GOTO 370
330 Z=2 :: GOSUB 900 :: IF TR<>1 TH
   EN 350
340 C$="" :: A=A+2 :: B$="R"&STR$(R
   ):: GOTO 370
350 Z=2 :: GOSUB 900 :: IF TR<>1 TH
   EN 820
360 B$=STR$(01*256+02):: A=A+4 :: C
   $=""
370 GOSUB 860 :: TR=0 :: GOTO 120
380 REM FORMAT VI OP-CODES
390 N=(H*256)+(L AND 192):: J=960 :
   : Z=14 :: K=64 :: RESTORE 1000
   :: GOSUB 900
400 GOSUB 930
410 C$="" :: IF A$="B" AND B$="*R11
   " THEN C$="(SAME AS RTS)"
420 GOSUB 860 :: TR=0 :: GOTO 120
430 REM FORMAT V OP-CODES
440 N=(H AND 11)*256 :: J=1792 :: C
   O=(L AND 240):: WR=(L AND 15)::
    RESTORE 1040 :: Z=4 :: K=256 :
   : GOSUB 900
450 B$="R"&STR$(WR)&"," :: C$=STR$(
   CO):: A=A+2 :: GOSUB 860 :: TR=
   0 :: GOTO 120
460 REM FORMAT II OP-CODES
470 RESTORE 1050 :: J=3840 :: TR=0
   :: Z=13 :: K=256 :: N=H*256 ::
   GOSUB 900
480 IF TR=0 THEN 500
490 B$=STR$(2*L+2):: GOTO 520
500 Z=3 :: K=256 :: GOSUB 900
510 B$=STR$(L)
520 C$="" :: A=A+2 :: IF A$="JMP" A
   ND B$="2" THEN C$="(SAME AS NOP
   )"
530 GOSUB 860 :: TR=0 :: GOTO 120
540 REM FORMAT IV OP-CODES
550 IF (H AND 252)=48 THEN A$="LDCR
   " :: GOTO 580
```

```
560 IF (H AND 252)=52 THEN A$="STCR
    " :: GOTO 580
570 GOTO 820
580 GOSUB 930 :: NU=((H AND 3)*4)+(
    (L AND 192)/64)
590 C$=","&STR$(NU):: GOSUB 860 ::
    TR=0 :: GOTO 120
600 REM FORMAT III & IX OP-CODES
610 RESTORE 1070 :: J=7168 :: N=((H
     AND 60)*256):: D=((H AND 3)*4)
    +((L AND 192)/64):: Z=3 :: K=10
    24 :: GOSUB 900
620 IF TR<>1 THEN 650
630 C$=","&"R"&STR$(D)
640 GOSUB 930 :: GOSUB 860 :: TR=0
    :: GOTO 120
650 IF N<>11264 THEN 670
660 A$="XOP" :: C$="XOP OP #"&STR$(
    D):: GOTO 640
670 J=13312 :: Z=2 :: K=1024 :: GOS
    UB 900 :: IF TR<>1 THEN 820
680 GOTO 640
690 REM FORMAT I OP-CODES
700 RESTORE 1080 :: J=12288 :: N=(H
     AND 224)*256 :: Z=12 :: K=4096
     :: GOSUB 900
710 TD=(H AND 12):: D=((H AND 3)*4)
    +((L AND 192)/64):: GOSUB 930
720 IF TD=0 THEN C$=","&"R"&STR$(D)
    :: GOTO 770
730 IF TD=4 THEN C$=","&"*R"&STR$(D
    ):: GOTO 770
740 IF TD=12 THEN C$=","&"R"&STR$(S
    )&"+" :: GOTO 770
750 IF (TD=8)AND(D=0)THEN C$=","&"@
    "&STR$(01*256+02):: A=A+2 :: IF
     TS=32 THEN C$=","&"@"&STR$(03*
    256+04)
760 IF (TD=8)AND(D<>0)THEN C$=",@"&
    STR$(01*256+02)&"(R"&STR$(S)&")
    " :: A=A+2 :: IF TS=32 THEN C$=
    ",@"&STR$(03*256+04)&"(R"&STR$(
    S)&")"
770 GOSUB 860 :: TR=0 :: GOTO 120
780 IF (TD=8)AND(D=0)THEN C$=",@"&S
    TR$(01*256+02):: A=A+2 :: IF TS
    =32 THEN C$=",@"&STR$(03*256+04
    )
790 REM FORMAT VII
800 N=(H*256+L):: A=A+2 :: B$="" ::
     C$="" :: Z=6 :: J=800 :: K=32
    :: RESTORE 1100
810 GOSUB 900 :: GOSUB 860 :: TR=0
    :: GOTO 120
820 REM NOT OP-CODE
830 A$="BYTE" :: B$=STR$((H*256)+L)
    :: C$=CHR$(H)&" "&CHR$(L):: A=A
    +2 :: GOSUB 860
840 REM CALL SOUND(800,400,0):: ACC
    EPT Q4$ :: GOTO 97
850 GOTO 120
860 REM PRINT ROUTINE
870 PT$=STR$(A1)&"  "&A$&" "&B$&C$
    :: PRINT PT$ :: A1=A
880 IF PR=1 THEN PRINT #1;TAB(10);P
    T$
890 RETURN
900 REM FIND OP-CODE FROM DATA
910 FOR I=1 TO Z :: J=J+K :: READ Q
    $ :: IF N=J THEN A$=Q$ :: TR=1
920 NEXT I :: RETURN
930 REM SUBROUTINE TS ADDRESS
940 S=(L AND 15):: TS=(L AND 48)::
    IF TS=0 THEN B$="R"&STR$(S):: A
    =A+2 :: RETURN
950 IF TS=16 THEN B$="*R"&STR$(S)::
     A=A+2 :: RETURN
960 IF TS=48 THEN B$="*R"&STR$(S)&"
    +" :: A=A+2 :: RETURN
970 IF (TS=32)AND(S=0)THEN B$="@"&S
    TR$(01*256+02):: A=A+4 :: RETUR
    N
980 IF (TS=32)AND(S<>0)THEN B$="@"&
    STR$(01*256+02)&"(R"&STR$(S)&")
    " :: A=A+4 :: RETURN
990 BREAK
1000 DATA BLWP,B,X,CLR,NEG,INV,INC,
     INCT,DEC
1010 DATA DECT,BL,SWPB,SETO,ABS
1020 DATA LI,AI,ANDI,ORI,CI
1030 DATA STWP,STST,LWPI,LIMI
1040 DATA SRA,SRL,SLA,SRC
1050 DATA JMP,JLT,JLE,JEQ,JHE,JGT,J
     NE
1060 DATA JNC,JOC,JNO,JL,JH,JOP,SBO
     ,SBZ,TB
1070 DATA COC,CZC,XOR,MPY,DIV
1080 DATA SZC,SZCB,S,SB,C,CB,A,AB
1090 DATA MOV,MOVB,SOC,SOCB
1100 DATA IDLE,RSET,RTWP,CKON,CKOF,
     LREX
```

Atari Speed-Reading

Clark Morrow

Everybody knows that the Atari plays great arcade games, but can it improve your reading skills? This program will turn your Atari into a private speed-reading tutor.

"Speed-Reading" is an enjoyable and effective way to increase your reading speed. This program flashes phrases on the screen at your choice of four speeds.

While the phrases flash on the center of the screen, keep your eyes focused in the middle to avoid reading from left to right.

At first, a menu is displayed. You can then select the speed by pressing OPTION and the line length by pressing SELECT. Pushing START runs the program. You can return to the menu by holding down the OPTION button.

Start with short lines and medium speed. As your speed increases, try the longer lines, but remember to keep your eyes on the center of the screen.

POKEs And PEEKs

There are several interesting POKE and PEEK statements in the program. One that is particularly useful is POKE 752,1. This POKE will turn the cursor off. To test if either the START, SELECT, or OPTION key is pressed, a PEEK(53279) is executed. A result of 7 means that no key is being pressed, 6 that START is pressed, 5 that SELECT is pressed, and 3 that OPTION is being pressed. POKEs to locations 84 and 85 position the cursor horizontally and vertically in the graphics window.

Creating More Data

By removing the first REM in line 670, the program will randomly select a line number that is greater than or equal to 2100 and is a multiple of 100. It will then read data until it reaches a /END. When a /END is encountered, this process is repeated.

To add more data, change the 5 in line 670 to reflect the total number of lines (beginning with a multiple of 100). If the first REM in line 670 is removed, the beginning line number of each group of words must be divisible by 100 and be 100 greater than the previous group. However, any lines between the beginning line number and the /END may have any statement number. When typing more data, place a comma after every two words. At the end of each group of words, type two commas as a delay then type /END.

Atari Speed-Reading

Refer to the "Automatic Proofreader" article before typing this program in.

```
LP 50  DIM A$(100),B$(100),SPEED$(30)
       ,L$(30)
IM 60  B=10:MENU=730
EL 70  REM
FH 80  REM *** PRINT TITLE ***
EN 90  REM
EL 100 GRAPHICS 18
HG 110 REM
DM 120 REM *** INITIALIZE STRING ***
HI 130 REM
NI 140 A$(1)=" ":A$(19)=" ":A$(2)=A$
       (1):A$(20)="S":B$="PEED READI
       NG":B$(13)=" ":B$(32)=" ":B$(
       14)=B$(13)
EO 150 B$(LEN(B$)+1)="by clark morro
       w"
NA 160 B$(49)=" ":B$(74)=" ":B$(50)=
       B$(49)
```

```
HM 170 REM
DC 180 REM *** MOVE TITLE ***
HO 190 REM
EF 200 A$=A$(2):A$(LEN(A$)+1)=B$(1,1
       ):B$=B$(2)
MJ 210 POSITION 0,5:? #6;A$:FOR X=1
       TO 30:NEXT X
KJ 215 IF A$(5,5)="S" OR A$(4,4)="b"
        THEN FOR X=1 TO 200:IF PEEK(
       53279)=7 THEN NEXT X
OP 220 IF LEN(B$)=4 THEN 240
NJ 230 IF PEEK(53279)=7 THEN 200
EL 240 GOSUB MENU
HM 250 GRAPHICS 0:POKE 752,1
PB 260 PRINT :PRINT " PRESS OPTION T
       O RETURN TO MENU"
EP 270 FOR X=1 TO 500:NEXT X
HA 280 TRAP 690
HP 290 REM
OK 300 REM *** MAIN PROGRAM LOOP ***
HI 310 REM
JH 320 READ A$:IF A$="/END" THEN 670
AD 330 IF L=1 THEN B$="":GOTO 380
MO 340 READ B$:IF B$="/END" THEN R=1
       :GOTO 670
HM 350 REM
ED 360 REM *** CENTER THE LINE ***
HO 370 REM
ML 380 T=19-(LEN(A$)+LEN(B$))/2
PC 390 POSITION T,10
LA 400 IF L=1 THEN ? A$
FD 410 IF L=2 THEN ? A$;B$
HK 420 REM
IF 430 REM *** DETERMINE SPEED ***
HM 440 REM
NJ 450 IF OPT=0 THEN SP=2
MN 460 IF OPT=1 THEN SP=4
NB 470 IF OPT=2 THEN SP=6
NF 480 IF OPT=3 THEN SP=8
PM 490 FOR X=1 TO SP*B
NN 500 IF PEEK(53279)=3 THEN 550
CN 510 NEXT X
HL 520 REM
JP 530 REM *** CLEAR SCREEN ***
HN 540 REM
BB 550 PRINT CHR$(125)
HP 560 REM
HN 570 REM *** IF OPTION IS PRESSED
       THEN RETURN TO MENU ***
IB 580 REM
AL 590 IF PEEK(53279)=3 THEN GOSUB M
       ENU:GOTO 250
GD 600 GOTO 310
HL 610 REM
ED 620 REM *** END OF MAIN LOOP ***
HN 630 REM
HO 640 REM
EI 650 REM *** RANDOMLY CHOOSE SELEC
       TION ***
IA 660 REM
IJ 670 REM SEL=INT(5*RND(1)+1):RESTO
       RE SEL*100+2000:IF R=1 THEN R
       =0:GOTO 340:REM _*RND= NUMBER
        OF SELECTIONS
GL 680 GOTO 310
NA 690 RESTORE :GOTO 280
HL 700 REM
MB 710 REM *** GRAPHIC MENU DISPLAY
       ***
HN 720 REM
CH 730 SPEED$="FAST":L$="SHORT";L=1:
       OPT=0
BB 740 GRAPHICS 2:SETCOLOR 2,0,0:POK
       E 752,1
JA 750 PRINT #6;"(4 SPACES)speed rea
       ding":? #6:? #6
HN 760 PRINT #6;" SPEED: ";SPEED$
DF 770 PRINT #6:? #6;" LINES: ";L$
ED 780 PRINT "PUSH OPTION TO CHANGE
       SPEED"
HM 790 PRINT "PUSH SELECT TO CHANGE
       LENGTH"
FP 800 PRINT "PUSH START TO BEGIN"
CB 810 IF PEEK(53279)<>7 THEN 810
HO 820 REM
AN 830 REM *** START OF MENU LOOP **
       *
IA 840 REM
EN 850 POKE 84,3:POKE 85,8:PRINT #6;
       SPEED$;:? #6;"(4 SPACES)"
CL 860 POKE 84,5:POKE 85,8:PRINT #6;
       L$;:? #6;"(7 SPACES)"
ID 870 REM
CA 880 REM *** CHECK CONSOLE BUTTONS
        ***
IF 890 REM
OE 900 IF PEEK(53279)=7 THEN 900
CL 910 IF PEEK(53279)=6 THEN RETURN
CI 920 IF PEEK(53279)<>5 THEN 970
DL 930 L=L+1:IF L=3 THEN L=1
GC 940 IF PEEK(53279)<>7 THEN GOTO 9
       40
JH 950 IF L=1 THEN L$="SHORT"
DJ 960 IF L=2 THEN L$="LONG"
FA 970 IF PEEK(53279)<>3 THEN 1040
NM 980 OPT=OPT+1:IF OPT=4 THEN OPT=0
GM 990 IF PEEK(53279)<>7 THEN GOTO 9
       90
CD 1000 IF OPT=0 THEN SPEED$="FAST"
CJ 1010 IF OPT=1 THEN SPEED$="MED. F
        AST"
LK 1020 IF OPT=2 THEN SPEED$="MEDIUM
        "
EA 1030 IF OPT=3 THEN SPEED$="SLOW"
JL 1040 GOTO 850
KK 1050 REM
IC 1060 REM *** END OF MENU LOOP ***
KM 1070 REM
KN 1080 REM
MN 2100 DATA It was, now the, eighte
        enth of, September and, my y
        acht, was ready, to sail.  ,
        ,/END
LH 2200 DATA We were, 40 miles, out
        when, I first, saw the, stor
        m. , It grew, larger, every
        second.  ,,/END
KB 2300 DATA The waves, were nearly,
         ten feet, high.
LO 2310 DATA I was, almost swept, in
        to the, sea; but, I managed,
         to grab, onto the, rail and
        , climb aboard.  ,,/END
JI 2400 DATA The storm, passed over,
         and my, yacht had, only rec
        eived, minimal damage, but I
        , had to, return to, port
DP 2410 DATA ,,/END
FO 2500 DATA Now I'll, leave it, to
        you, to add, to this, story
        or, write your, own.  ,,/END
```

How Computers Made Me Smarter After Only Thirteen Years Of Daily Use

On this occasion of my third anniversary as a COMPUTE! columnist, I am going to look back, back into the mists of time, and count (on my fingers and toes) all the blessings computers have brought me.

Blessing 1: Cuisinart-Brain Thinking

Sometime ago I was up in Toronto, Canada, making a speech to educators on using computers in the classroom, and after my speech, an educator came up to me and complimented me by telling me I was an "integrated brain thinker." She explained to me that, from my speech, it was obvious that I could think with my left brain (the analytical side), and I could think with my right brain (the creative side). Ergo, I must be an integrated brain thinker.

I was flattered, but modestly I said she was far too generous. I told her that I wasn't a left-brain thinker, a right-brain thinker, or an integrated-brain thinker. Instead, I said, I was a *Cuisinart-brain thinker*. As a Cuisinart-brain thinker I had the rare ability to process facts and ideas by slicing them, dicing them, mixing them together, then spinning them around. I told her I owed my talent to a long and deep association with computers.

Blessing 2: An Algorithmic Lifestyle

The next morning after I had talked to the educator in Toronto, I was in the shower in my hotel room. I had soaped up and rinsed off, so I was ready to turn the shower off.

With my computerlike memory I recalled that most showers have screw handles. You usually turn them to the left to get more water; and you turn them to the right to get less. Since I wanted less water, I turned my shower handle to the right. The algorithm was simple and clear, and I was determined to follow it.

However, when I turned the shower handle to the right, the water didn't turn off. Instead, it became cold—*freezing cold*.

Gasping from the ice-cold water and dancing around in the shower, I swiftly concluded that: (1) My algorithm had some bugs in it; (2) To the right was not the way to shut the water off in *this* shower; and (3) I had better find a way to shut off the water soon or I would succumb to acute hypothermia.

I clenched my teeth and coldly reasoned that if the shower didn't shut off by turning it to the right, it must have a reverse screw in the handle. This made sense. I was in Canada, wasn't I? Canada is a foreign country. In Canada they probably used reverse screws for everything.

If the handle had a reverse screw, that meant that if I wanted to turn off the shower I had to turn to the left. Boldly I turned the handle all the way to the left to shut off the water.

This time I got a blast of steaming, scalding hot water. "Aagh," I yelled. I backed away from the shower head and conked my head on the towel rack at the rear of the tub.

In another moment I would be boiled like a

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hot dog in my own shower. I had to think quickly. In a last-ditch effort, I called on my brain's full computer-trained reflexes and realized that my shower handle must not be a left-right, on-off shower handle at all. Instead, it must be a push-pull shower handle. Pull turned it on. (Something I had unfortunately forgotten.) And push must turn it off.

In a final, desperate gesture I charged toward the front of the shower and jammed the handle into the wall.

Instantly, miraculously, and logically, the shower stopped.

Blessing 3: Computers Give Me Lightning-Fast Logic

In the last year I have traveled to 13 conventions, made 49 speeches, given 11 interviews, and appeared on 18 radio programs and 14 TV programs. And I am not alone. There are dozens of others in the computer industry with a schedule similar to mine. We are roaming the country, playing with the latest gadgets, trading gossip about computer companies and their media superstars, and searching for juicy stories for our magazines.

Back in the spring I was attending so many events each week that sometimes I forgot which city I was in. But I never lost the lightning-fast logic that years of close association with computers had given me. That tided me over even during my most grievous overdoses of travel, speaking, and interviewing.

I remember well one conference I went to (which conference? which city?) when I was handed a name badge with a unique and wonderful feature. I noticed this feature the moment I put the badge on the lapel of my sport coat. The badge had been designed to allow me to look down at my chest and read my name as if it were rightside up.

During the day, as I made speeches at the convention and interviewed a number of illustrious conventioneers, I continually glanced down at the badge and marveled at its design.

That night I went out to dinner, so I took the badge off and stuffed it in my sport coat pocket.

The next morning, when I put the badge on again, I was startled. All of a sudden the badge no longer worked. When I glanced down at it, all the information on it was upside down and backwards.

I puzzled over this problem all during breakfast that morning. At last, as I was munching on a sprig of parsley that had come with my fried eggs, it hit me. The badge was not a special badge after all. I could read my name the first day because *I was wearing the badge upside down.*

Blessing 4: I've Become A Whiz Around Machines

When I first got into computers I was no wizard with machines or a do-it-yourselfer. In fact I had almost no mechanical savvy at all. As proof I need only cite a test I took in high school in which I achieved a score of 0.06 percent for mechanical aptitude.

Yet I've always loved computers.

However, since computers are machines (a fact that I frequently try to overlook), I often run into problems. It's not their software or their logic that waylays me, mind you, since I have become quite a thinker in these areas (see my blessings above). Instead it's their physical nature—their "machineness"—that confounds me.

For example, last spring I was ecstatic when my newest computer toy arrived, special delivery, in the mail. It was a portable Compaq computer, and I intended to take it with me to London, England, to teach a course on robotics.

Except I couldn't get it open.

So, after I unboxed this lovely machine, I spent half an hour just looking at it on the kitchen table. But I couldn't, for the life of me, figure out how it opened up. It looked like a big ivory-colored sewing machine or suitcase, except there were no handles, no latches—no *nothing.*

I was getting more and more nervous and depressed as the minutes ticked away. My plane to London would be taking off soon, and I had to get packed, yet I hadn't even turned the computer on. Maybe it didn't work. But how was I to know. I couldn't get inside to find out.

I sat there and stewed, and I cursed my miserable 0.06 percent mechanical aptitude.

Then Catie came home from school.

Catie is my daughter, and even though she was only seven years old at the time, she was very perceptive. She immediately noticed something was wrong when she saw me slumped over the kitchen table, crying on what looked like a sewing machine.

I told her my problem, and she began snooping around the computer case looking for a way to open it. About fifteen seconds later, she popped up from the other side with a big grin on her face. "No wonder you couldn't open it," she said. "You were looking at the top. The latch is on this side—on the bottom."

Five minutes later, Catie had the computer out on the table, plugged in, and running a word processing program. "You shouldn't cry over a computer, Daddy, " she advised me. "Wait until I come home from school next time, and I'll help you."

Apple Disk Checker

Bruce Wiseman

Here's a description of the technique and a program which is fast, simple, and doesn't require any modifications to DOS.

On sector 0 of track 17 of every diskette initialized by Apple DOS 3.3 is something called the Volume Table of Contents, or VTOC.

One of the things in the VTOC is the bitmap which tells which sectors are used and which are free. Each track on the diskette is represented by four bytes on the bitmap. There are 16 sectors per track in DOS 3.3. The first two bytes of the four assigned to each track keep count of the used and free sectors; the other two bytes are reserved for expansion and contain zeros. The problem, then, is how do you keep count of 16 sectors with just two bytes?

The bitmap is exactly what the name says: a map expressed in bits (binary 0's and 1's). It shows which sectors are used and which are free. When we look at memory in the Apple with the monitor, we see each byte as two hex characters. FF, for example, is one byte in memory. These hex characters represent the binary bits that make up that byte. In other words, the hex FF that we see represents 1111 1111 in the byte. The first F represents the first half-byte, and the second F the last half-byte. If the byte was, say, C1, then in binary it would be 1100 0001.

Recall that DOS is keeping track of 16 sectors for us. Recall also that DOS is using two bytes of eight bits each to do it. Each bit in the two bytes keeps track of one of the 16 sectors. The map is laid out like this:

```
Byte 1 Sectors F  E  D  C    B  A  9  8
Byte 2 Sectors 7  6  5  4    3  2  1  0
```

DOS uses a binary 1 to show a sector free and a binary 0 to show it used. Thus if sector F on a particular track is free, DOS sets the first bit of the first byte to 1.

Now for a few examples. Suppose track 8 on a diskette has only sectors 15 and 8 free. The bitmap for that track would be:

```
Byte 1  1000  0001
Byte 2  0000  0000
```

The first bit in the first byte is set to 1; this is the map location for sector $F (15). The locations for sectors E, D, C, B, A, and 9 are all set to 0 since these sectors are used. The bit location for sector 8, however, is set to 1 since that sector is free. In a similar fashion, the second byte containing the map to sectors 7, 6, 5, 4, 3, 2, 1, and 0 contains all zeros since the sectors are all used.

If we were to look at this bitmap, we would see it in hex as:

```
Byte 1  81
Byte 2  00
```

Let's take one more example. Suppose track 12 has sectors 15, 14, 11, 9, 7, 3, 2, and 1 all free. The bitmap would be:

```
Byte 1  1100  1010
Byte 2  1000  1110
```

If you check this against the layout for the map, you will see that the 1's bits correspond to the free tracks. If we look at the map, we'll see the hex representation of the binary as:

```
Byte 1  CA
Byte 8  8E
```

Understanding Disk Checker

The problem, then, is twofold. First we must get the VTOC into memory so we can look at the bitmap, and then we must count the binary 1's to see how many free sectors there are on the diskette.

Apple DOS has a machine language subroutine called the Read/Write Track Sector routine, or RWTS for short, that will read or write a sector on a diskette. We can enter the routine through a jump to subroutine (JSR) instruction to address $3D9. The RWTS routine requires some information from us about what it is we want to read and where in memory to place it, etc. We provide the routine with this information in the form of a couple of tables that we build in memory. The first table is called the Input Output Control Block, or IOCB for short. It will provide the RWTS subroutine with the slot, drive number, track, sector, and the address in memory to store what it reads. The other table we need to provide is called the Device Characteristics Table.

As you might guess from the name, it provides the RWTS subroutine with information about the disk drive itself.

The RWTS routine normally reads a whole sector at a time, and since a sector is 256 bytes long, we must reserve memory space of that size to place the information that the Read/Write Track Sector subroutine reads in. Technically, this space is referred to as a buffer.

Table 1 shows the IOCB that we will be using, while Table 2 shows the Device Characteristics we will need.

Table 1: The IOCB

Byte (in hex)	Value (in hex)	Description
$00	$01	Table type (always 1)
$01	$60	Slot number * 10 (slot 6)
$02	$01	Drive number
$03	$00	Volume ID (00 means any)
$04	$11	Track number ($11 is the track for the VTOC)
$05	$00	Sector number ($00 for the VTOC)
$06-07	$20, $03	Address of the Device Characteristics table, low/high format
$08-09	$00, $60	Address of the buffer, low/high format
$0A	$00	Not used
$0B	$00	Read whole sector
$0C	$01	Control code for a read
$0D	$00	Space for return code from DOS
$0E	$00	Volume ID of last access
$0F	$60	Slot number of last access
$10	$10	Drive number of last access

Table 2: Device Characteristics

Byte (in hex)	Value (in hex)	Description
$00	$00	Device type (always a 00 for Disk II)
$01	$01	Phases per track (always 01 for disk)
$02-03	$EF, $D8	Motor on time (always these values for disk II)

After we build these two tables in memory, we load the Y and A registers with the address of the IOCB table, and JSR to $3D9. The RWTS subroutine will then read the track and sector that we provided it in the IOCB table and place that sector in the buffer address we provided it in the IOCB. Half of our problem is now taken care of; we have the VTOC in memory. Now all we have to do is count the binary 1's in the bitmap to see how many free sectors we have.

The complication is that the bitmap will be in hex and we need to see it in binary. There are several ways in which we could do this. One is to use the machine language instruction ROL. ROL stands for rotate left. What this instruction does is roll the bits of a byte one bit to the left. It rolls the leftmost bit into the Carry flag, so if the bit was a 1, then the Carry flag gets set on.

As an example, say the accumulator held $C1. In binary this would be 1100 0001. The first ROL would set the Carry flag on, since the leftmost bit is a 1 and is rotated into the Carry flag. After that the contents of the accumulator look like this: 1000 0010. Now if we reset the Carry flag and ROL again, the flag gets set and the accumulator looks like this: 0000 0100.

What we will do is load the accumulator with the contents of the first byte of the bitmap. Then we will roll it left eight times as we count the number of times the Carry flag gets turned on. Each time the flag is set on we will increment (add one to) a special memory location that will hold our total. We then go get the next byte of the bitmap and repeat the entire operation again. The process continues until the whole bitmap is counted.

Recall that earlier we found out that each track has four bytes in the bitmap, but only the first two are really used. Our machine language program counts them all, but since the last two contain all zeros it doesn't matter. This is less complicated than trying to skip the unused bytes since it is easier to spend a few microseconds to count some zeros than to build the logic to go around them.

Program 1 is a BASIC program which POKEs in the machine language for "Disk Checker," then executes it. After you have typed in and run Program 1, you can save a copy of the machine language with:

```
BSAVE SPACE.OBJ,A768,L85
```

With this copy of the machine language, you can use Program 2 as your disk HELLO program, so that you'll be told the number of free sectors on the disk when you boot the system.

Program 1: Disk Checker Loader

```
10  HOME
20  FOR I = 768 TO 852
30  READ A:CK = CK + A: POKE I,A: NEXT

35  IF CK <  > 7986 THEN  PRINT "ERR
    OR IN DATA STATEMENTS": STOP
40  CALL 768
50 T =  PEEK (896) +  PEEK (897) * 2
    56
60  PRINT "THERE ARE ";T;" FREE SECT
    ORS"
61  REM
62  REM ************************
65  REM  DATA IS ASSEMBLY PROGRAM+IO
    B AND  DEVICE TABLES
67  REM
68  REM ************************
70  DATA  169,3,160,64,32,217,3,169,
    0,141
```

```
80  DATA   128,3,141,129,3,24,162,0,
    160,56
90  DATA  185,0,96,42,144,24,24,238,
    128,3
100 DATA  72,169,0,205,128,3,208,3,
    238,129
110 DATA  3,104,232,224,8,208,232,7
    6,55,3
120 DATA  232,224,8,208,224,162,0,2
    00,192,196
130 DATA  208,214,96,0,1,96,1,0,17,
    0
140 DATA    81,3,0,96,0,0,1,0,25,96
    ,1
150 DATA  0,1,239,216
```

Program 2: Free Sector HELLO

```
10  HOME :D$ =  CHR$ (4)
20  PRINT D$"BLOAD SPACE.OBJ"
30  CALL 768
40 T =  PEEK (896) +  PEEK (897) * 2
    56
50  PRINT "THERE ARE ";T;" FREE SECT
    ORS"
```

Donald W. Watson

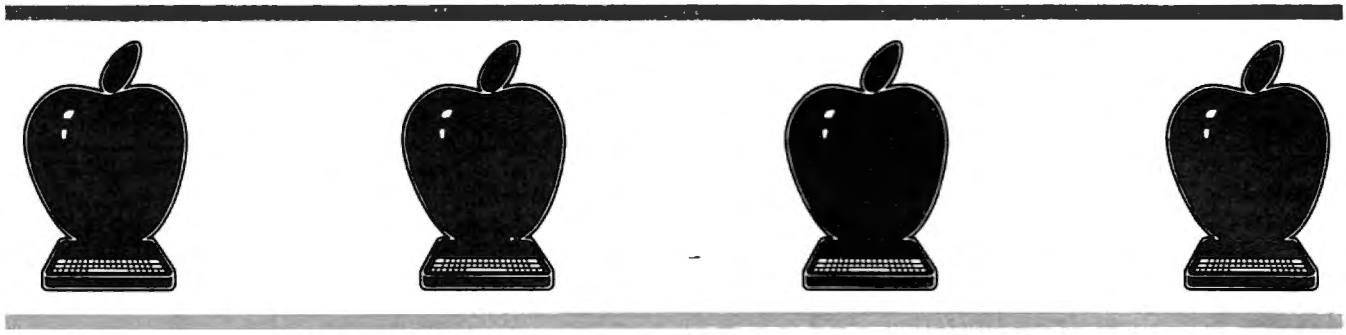
Ten minutes is all it takes to get a printer dump of your Apple II text screen. And there are dozens of uses for this simple subroutine.

Boot your system into Applesoft BASIC, type NEW to clear the program memory, type HOME to clear the screen, and type in the following seven short lines:

```
100 D$ =  CHR$ (4):I$ =  CHR$ (9)
105  PRINT D$"PR#1"
110  PRINT I$"80N";
115  FOR G = 0 TO 2: FOR L = 1 TO 8:
      PRINT  SPC( 20): FOR P = 0 TO
     39
120 C =  PEEK (896 + G * 40 + L * 12
    8 + P)
150  PRINT  CHR$ (C);: NEXT : PRINT
     : NEXT : NEXT
160  PRINT D$"PR#0"
```

With a parallel printer interface card in slot 1, you can use the program exactly as shown; with a serial printer interface card, delete the second statement in line 100 and delete line 110 completely.

With the listing correctly edited for your system, type HOME to clear the screen, type LIST to let Applesoft reformat the listing on the



screen, and then move your printer power switch to the ON position. If you wanted to print a copy of the listing, you would ordinarily have to set up the printer with (at least) an immediate mode PR#1 command followed by an immediate mode LIST command. Since the program you just entered is a screen dump program, why not use it to print itself? Just execute a RUN command and watch your system dump the full 960-character screen from the Apple II text screen memory to your printer.

The Okidata Microline 80 parallel printer will dump the text screen memory in about one and a half minutes. The Qume Sprint 5/55 serial printer will dump it in one minute.

Screen Organization

Lines 100 through 110 are explained in the printer control card manuals. Line 110 is required in the program if a parallel printer interface control card is used; in addition to setting the printer to accept 80-character lines, it directs output to the printer only—holding the screen display "frozen" while the screen memory is dumped.

Line 115 sets up three loop functions, indexing the dump routine to the requirements of the Apple II text screen memory address plan. See Figure 1 on page 16 of the *Apple II Reference Manual* for the map of the text screen. The screen is organized into three vertical sections or groups (G = 0 to 2) of eight lines each (L = 1 to 8), and each line contains 40 addresses for the characters to be printed (P = 0 to 39). The PRINT SPC(20) statement provides a 20-character left-hand margin to center the printed record in an 80-character horizontal print format.

At line 120, the three loop indices from line 115 are used with an offset starting value (896) in an expression to yield each successive text screen memory address. The expression yields the first screen position, decimal address (1024) for G = 0, L = 1, and P = 0; and it yields the correct value for each of the remaining 959 memory addresses as the loop variables are incremented. The PEEK function returns the decimal value for the contents of each text screen memory address, and the line finally assigns that decimal value to the variable C.

Line 150 directs the printer to print the ASCII character identified by the decimal value of the variable C, and terminates each of the index loops at the appropriate increments. The PRINT statement provides a linefeed and carriage return for each group of 40 characters printed.

The gap in the program line numbers is significant. The program as entered so far will dump the text screen memory correctly only if the memory does not contain INVERSE or FLASH mode character codes. Insert the following three lines to convert INVERSE and FLASH character codes to NORMAL mode character codes:

```
130  IF C < 32 THEN C = C + 192
135  IF C > 31 AND C < 96 THEN C = C
      + 128
140  IF C > 95 AND C < 128 THEN C =
     C + 64
```

Using It As A Subroutine

The program is easily converted to a subroutine for use in other Applesoft II programs. Just add a line 170 with a RETURN statement and call the subroutine from your program code with a line containing a GOSUB 100 statement.

For example, Figure 1 shows a Summary Screen used in a property management accounting program. In the instruction lines at the base of the screen, the operator is prompted for an E to make Final Entries, an X to Exit the program, or an M to return to the program Menu. The accounting program code supporting the prompts contains an INPUT X$ statement to halt program execution and wait for a keyboard response. No visual prompt is needed, but an S response from the keyboard will call the text screen dump subroutine if the following line is added to the accounting program code:

```
5000  IF X$ = "S" THEN  GOSUB 100
```

With line 5000 present in the accounting program, an S response at the Summary Screen

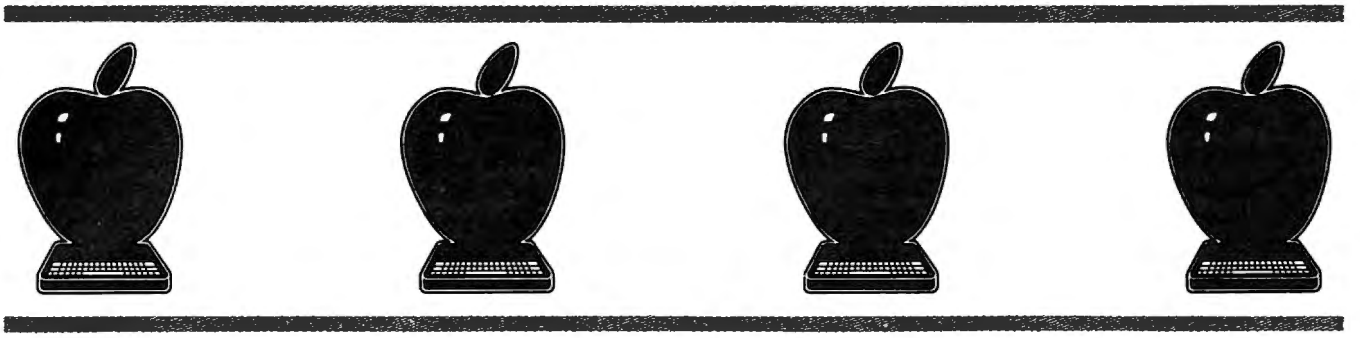
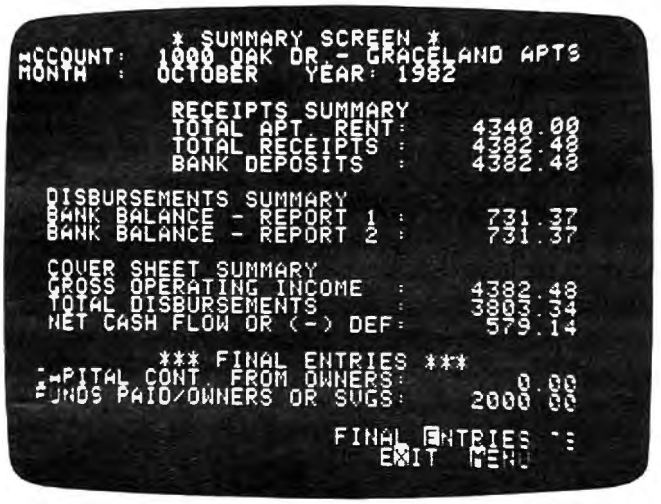


Figure 1:
Accounting Program Summary Screen



will dump the screen to the printer, producing a hard copy as shown in Figure 2.

Potential Uses

In the property management program, the manager and system operators can get a hard copy of the summary screen for any property in the data files in a moment or two. A paper record of the screen is very useful in monitoring the system and for reference in conferences (especially with property owners) away from the computer.

Screen dump copy is especially useful in inventory management systems. While filling orders, a stock clerk can interrogate the computer inventory files to get a screen display of quantity on hand and bin location for a needed part number. The screen dump copy can be carried to the bin location, the parts picked from the bin to fill the order, and the dump copy (marked with the quantity picked) becomes the transaction record for later use in correcting the computer inventory file information.

With a little screen format and label format planning, a text screen dump can be used to print labels or envelopes for addresses selected from a mailing or shipping file.

Figure 2:
Printer Copy Of The Summary Screen Dump

```
            * SUMMARY SCREEN *
ACCOUNT:  1000 OAK DR.- GRACELAND APTS.
MONTH  :  OCTOBER   YEAR: 1982

            RECEIPTS SUMMARY
            TOTAL APT. RENT:     4340.00
            TOTAL RECEIPTS :     4382.48
            BANK DEPOSITS  :     4382.48

  DISBURSEMENTS SUMMARY
  BANK BALANCE - REPORT 1 :       731.37
  BANK BALANCE -'REPORT 2 :       731.37

  COVER SHEET SUMMARY
  GROSS OPERATING INCOME  :     4382.48
  TOTAL DISBURSEMENTS     :     3803.34
  NET CASH FLOW OR (-) DEF:      579.14

         **** FINAL ENTRIES ****
CAPITAL CONT. FROM OWNERS:          0.00
FUNDS PAID/OWNERS OR SVGS:       2000.00

                      FINAL ENTRIES ?S
                         EXIT  MENU
```

There are many more very practical uses, of course. The benefits of the text screen dump routine presented here are that it is short, simple, and accessible—you can modify it to suit your own application requirements. Subroutines specifically written to format a report directly to the printer can often be avoided by use of the text screen dump.

An Even Shorter Method

If DOS is not present, if the screen contains no INVERSE or FLASH mode characters, and if you use a serial interface control card, the following one-line program (about 70 bytes) will dump the Apple II text screen to your printer:

```
100  PR# 1: FOR G = 0 TO 2: FOR L =
     1 TO 8: FOR P = 0 TO 39:C =  PEEK
     (896 + G * 40 + L * 128 + P): PRINT
      CHR$ (C);: NEXT : PRINT : NEXT
     : NEXT : PR# 0                    ©
```

64 EXPLORER

Larry Isaacs

This month we've got some powerful programming techniques to offer, including a way to keep your disk files straight and a versatile method to modify or control BASIC directly from disk. But first, let's finish up our discussion of graphics and character drawing from the previous two columns.

One thing we haven't pointed out in our discussions of graphics and character-drawing machine language was that the code could be saved as an object code file to disk or tape. This would save a lot of time over the BASIC programs which POKE the machine language into memory. If you have access to a machine language monitor, such as Supermon, you can use its save command to write the machine language to disk. After the code has been POKEd into memory, use the appropriate command to save the regions of memory given in the following table for the line- and character-drawing routines:

Drawing Routine	Address Of First Byte	Address Of Last Byte
Line	49152 (C000)	50087 (C3A7)
Character	50176 (C400)	51090 (C792)

Adding A Byte

The addresses are given in decimal and hex, with hex being the value in parentheses. It is important to note that the address is given for the last byte. Some machine language monitors, such as Supermon, require the ending address to be one byte beyond the last byte of the machine language program. You must be sure to enter the address of the last byte plus 1. For example, the two commands to save the routines to disk with Supermon might be:

```
S "0:LDRAWC64",08,C000,C3A8
```

and

```
S "0:CHDRAWC64",08,C400,C793
```

If you don't have a machine language monitor at your disposal, you can use the following BASIC program to accomplish the same thing.

```
10 REM PROGRAM TO WRITE OBJECT FILE
20 INPUT "ADDRESS OF FIRST BYTE";SA
30 INPUT "ADDRESS OF LAST BYTE";EA
40 INPUT "FILE NAME";NM$
50 OPEN 1,8,2,NM$+",P,W"
60 PRINT#1,CHR$(SA-INT(SA/256)*256);
70 PRINT#1,CHR$(INT(SA/256));
80 FOR I=SA TO EA
90 PRINT#1,CHR$(PEEK(I));:NEXT
100 CLOSE 1
```

The program asks for the address of the last byte, though it would not hurt if you entered that address plus 1. This would simply save one extra byte in the object file. If you wanted to, you could save the code as one file instead of two. This would save some unused memory which lies between the two routines, but would simplify reloading the routines. To load the object code, use the command:

```
LOAD "filename",8,1
NEW
```

where you supply the filename for the object code. The NEW command is necessary to restore some BASIC pointers which are corrupted by the load.

Though the object code file can simplify and speed up loading of the machine language routines, the BASIC program version (which POKEs the machine code) still has one advantage. The BASIC program version can be transferred from disk to disk very easily by using the BASIC LOAD and SAVE commands. The reason this doesn't work with machine language programs is that the starting and ending addresses of the code are not automatically communicated between the LOAD and SAVE commands.

If you have some machine language routines of your own, there may be occasions where it would be useful to convert the object file to a BASIC program version with the machine language in DATA statements. If you do the conversion by hand, the process will be very slow and error prone. To assist in the task, I used Program 1 to generate the DATA statements containing the line-drawing and character-drawing routines. This program generates DATA statements intended for use with the loader shown in Program 2.

Program Creator

The program works by writing the DATA statements to disk in the form of a BASIC program. If you would like to adapt this program to your own use, here is a brief explanation of what is involved.

The format of a saved BASIC program on disk is very simple. It starts with two bytes which specify the load address of the code, low byte followed by high byte. For BASIC programs, this address should be $801. Thus, the first two bytes should be 1 followed by 8. Following the load address comes a copy of the BASIC program the same as it would be found in memory. This would consist of a sequence of BASIC statements, each with the format shown in the table below:

Byte No.	Description
1	Link, low
2	Link, high
3	Line number, high
4	Line number, low
5 To N-1	BASIC statements
N	0

A *link* is a pointer to the beginning of the next line of the BASIC program. Actually, we do not need to be concerned with writing a valid link. The links are automatically recomputed each time a BASIC program is loaded. Following the link is the line number. Note that the two-byte line number is stored with the high byte first, followed by the low byte. Following the line number is the text of the BASIC line. This will be the same as the text you type for the line, except that the keywords (FOR, GOSUB, etc.) and arithmetic operators will be converted to single bytes called tokens. The end of the BASIC line is marked with a zero byte (that is, the ASCII value of the byte is 0). The end of a BASIC program is marked by two zero bytes following the last line. This means there will be three zero bytes at the end of a BASIC program.

Structured Output

The subroutine at line 300 is responsible for writing the link, line number, and the DATA token for each line. The subroutine at line 400 is responsible for outputting a number in the list which follows the DATA keyword. This list will consist of eight numbers which specify object code bytes, followed by the sum of the previous eight numbers. This sum is checked automatically by the loader (Program 2). An error and a line number will be printed if the sum doesn't match.

To prepare a finished program, run Program 1. Next, load Program 2 and list it to the screen. Then load the DATA statements program generated in the first step. Finally, cursor to each line of the listed program and press RETURN. This will combine the DATA statements with the loader program.

If you wish, you can adapt Program 1 to write DATA statements which contain data other than object code. The advantage of saving data in this manner is that the data can be easily examined from BASIC. To make use of the data, it will have to be combined with the appropriate program. This could be accomplished with another BASIC program as well, using the techniques described for adding the DATA statements to Program 2.

Now let's take a look at a couple of utility programs that you may find useful. The first computes a cyclic redundancy check, CRC for short, on the data in a file. This may sound strange, but can be quite useful in cleaning up disk files and keeping program versions straight. The second utility allows BASIC to enter a BASIC program from a sequential disk file. This utility can add some powerful features to your BASIC programming.

Redundancy Check

Whenever data is transferred from one device to another, it's always a good idea to do something to verify that the data was transferred correctly. A simple method is called the *checksum*. Since the data is usually transferred in bytes, this method usually involves adding the bytes of data together to form a sum. This is done by both the receiver and the sender. Once the data has been sent, the sum is sent. The receiver compares this sum with the sum it computed. If the sums don't match, the data wasn't received correctly.

Though simple, the checksum method is not foolproof. If the sum the receiver receives

matches the sum it computed, it does not guarantee that the data was received without error. There are several ways in which errors in the transmission won't show in the checksum. For one thing, it's possible for errors in different bytes to balance each other.

CRC's Work Better

When a better method is needed, the cyclic redundancy check is the one to turn to. The cyclic redundancy check (CRC) uses each bit of each data byte to compute the CRC value. As a result, a change in a single bit in the stream of bytes will have a significant change in the final CRC value.

You may think that you haven't used a CRC, but if you have the 1541 disk drive, you have been using it quite a lot. In fact, I don't know of any disk drive that doesn't go to the expense of computing a CRC to insure that data has been read from the disk correctly.

Where I work, we have a utility program which uses the CRC for a slightly different purpose. Over a period of time we tend to accumulate various versions of a file or program, spread among many diskettes. Often, many of the versions have the same filename. This can present problems when we're not sure which version we are dealing with on a particular disk. To handle this situation, we have a utility program which computes a CRC on the bytes in a file. By comparing the CRC computed for two different files, we can be certain if the two files are identical. Armed with the CRC for the most recent version, we can weed out the older versions with no problem.

To accomplish the same thing on the 64, you can use Program 1. This will load a small machine language routine which reads the data and computes the CRC. It loads into the cassette buffer, so it can be used as is only for disk files. Since this routine must return the CRC value, it must be called via the USR function. To link the routine to the USR function, enter the following in direct mode (no line number):

```
POKE 785,60: POKE 786,3
```

To obtain the CRC for a file, execute the following two commands:

```
OPEN 1,8,2,"file,type,R"
PRINT USR(0)
```

where *file* is the name of the desired file, and *type* is the associated file type, Sequential, Program, or User. The routine won't work on random access or relative files. It is important to use logical file 1, since the machine language routine is designed to read from that channel.

Sequential Merge

Now for the second utility. There are several methods for merging routines from one BASIC program into another. One way is to write a program which can merge two BASIC programs to form a third program. Another way, which is a little more flexible, is to have BASIC read the text from a file instead of the keyboard. I have worked with a couple of BASICs which can do this via an ENTER command. This not only allows you to merge a BASIC text file with the program already in memory, but allows you to enter BASIC text files that are transferred from other computer systems.

There is a way of fooling BASIC to input from the cassette instead of the keyboard while in command mode. Unfortunately this doesn't work when inputting from the disk. After inputting the first line and adding it to the program, BASIC makes a subroutine call which closes all serial bus channels. This prevents any further input from the disk file. If this subroutine call could be eliminated, we would be half way to making BASIC enter commands and program lines from the disk.

Modifying BASIC

Fortunately, there is a solution: the submerged RAM. With RAM underneath the BASIC ROMs, we can copy BASIC to RAM and make any changes we want. Running Program 2 will load the required machine language routines into the cassette buffer.

Once the routines are loaded, you may enter a text file by executing the following two commands:

```
OPEN 1,8,2,"file,S,R"
SYS 828
```

where *file* is the name of the file to enter. It is assumed that the text file will be a Sequential file, though it could be a User file and work the same. It is important to use logical file 1, since the machine language routine inputs from that logical file.

If the text file you enter was generated by LISTing a program to a disk file, then the file will probably have a READY prompt at the end. This doesn't affect the entry of the program, though it will cause a SYNTAX ERROR message to be displayed when the READY prompt is encountered.

Listing BASIC To Disk

For those who haven't listed a BASIC program to disk, it's done approximately the same way as listing to a printer. For example, the following two commands will list lines 100–200 from the

BASIC program in memory to a disk file:

```
OPEN 1,8,2,"file,S,W":CMD 1
LIST 100-200:
PRINT#1:CLOSE 1
```

where *file* is the name of the file in which to write the listing.

The routine works by first opening a channel to logical file 1. If this is successful, it then copies the BASIC ROMs to the RAM underneath. This task is simplified by the fact that writing to the ROMs will write the RAM underneath even though the ROMs are enabled.

Adding The Patches

Once copied, a couple of patches are made to the RAM copy of BASIC. The first patch modifies the subroutine call which is responsible for inputting a character. The subroutine call is modified to call our routine instead. The main difference in our routine is that it will fix things back to normal when the end of the file is reached. The second patch disables a subroutine call which closes all open channels on the serial bus when a line is added or deleted from a BASIC program in memory. The patch makes this subroutine call to go to a location which does an immediate return.

Once the patches are made, the BASIC ROMs are switched off. In addition, an input flag in page 0 is set to nonzero so that a carriage return will not be sent to the display as each line is input. When all this is complete, the setup routine returns to the patched version of BASIC. BASIC will think it is in command mode and begin inputting commands or program lines. BASIC is unaware that the text will be coming from a disk file instead of the keyboard.

When the end of the file is reached, the input file is closed, the BASIC ROMs are switched in, and the input flag is cleared. At this point, everything is back to normal, except that the text has been entered into the BASIC program. The result is exactly the same as if you'd typed it in yourself. This also means that lines that do not begin with a line number will be executed immediately instead of being added to the BASIC program.

Refer to the "Automatic Proofreader" article before typing these programs in.

Program 1: DATA Statement Generator

```
10 REM PROGRAM TO SAVE CODE IN BASIC PROG
   RAM                                    :rem 91
20 GOTO 1000                              :rem 92
100 REM OPEN OUTPUT FILE                  :rem 184
110 OPEN 2,8,2,NM$+",P,W"                 :rem 17
120 RETURN                                :rem 115
200 REM OUTPUT STARTING ADDRESS           :rem 217
210 PRINT#2,CHR$(1);CHR$(8);              :rem 36
220 RETURN                                :rem 116
300 REM OUTPUT NEW LINE DATA              :rem 148
310 PRINT#2,CHR$(1);CHR$(8);:REM LINK
                                          :rem 113
320 T=INT(LN/256)                         :rem 200
330 PRINT#2,CHR$(LN-T*256);CHR$(T);
                                          :rem 244
340 PRINT#2,CHR$(131);" ";:REM DATA TOKEN
                                          :rem 255
350 LN=LN+10                              :rem 149
360 RETURN                                :rem 121
400 REM OUTPUT BYTE                       :rem 157
410 BY$=STR$(BY):SUM=SUM+BY               :rem 193
420 BY$=RIGHT$(BY$,LEN(BY$)-1)            :rem 189
430 PRINT#2,BY$;",";                       :rem 74
440 RETURN                                :rem 120
500 REM OUTPUT SUM                         :rem 95
510 SU$=STR$(SUM):SUM=0                   :rem 158
520 SU$=RIGHT$(SU$,LEN(SU$)-1)            :rem 229
530 PRINT#2,SU$;CHR$(0);                  :rem 106
540 RETURN                                :rem 121
600 REM CLOSE FILE                         :rem 16
610 PRINT#2,CHR$(0);CHR$(0);               :rem 31
620 CLOSE 2                                :rem 64
630 RETURN                                :rem 121
1000 REM GET PARAMETERS                   :rem 121
1010 INPUT"STARTING ADDRESS=";SA           :rem 20
1020 INPUT"ENDING ADDRESS=";EA             :rem 80
1030 INPUT"STARTING LINE NUMBER";LN
                                          :rem 202
1040 INPUT"FILE NAME";NM$                 :rem 212
2000 REM WRITE PROGRAM                     :rem 73
2010 GOSUB 100:REM OPEN FILE               :rem 68
2020 GOSUB 200:REM OUTPUT ADDRESS:rem 235
2030 SUM=LN:GOSUB 300:REM FIRST LINE
                                          :rem 172
2040 GOSUB 500                            :rem 219
2050 GOSUB 300:REM SECOND LINE            :rem 220
2060 SUM=SA:GOSUB 500                     :rem 221
2070 GOSUB 300:REM THIRD LINE             :rem 157
2080 SUM=EA:GOSUB 500                     :rem 209
2100 FOR I=0 TO EA-SA                      :rem 74
2110 IF INT(I/8)*8=I THEN GOSUB 300
                                          :rem 105
```

```
2120 BY=PEEK(SA+I):GOSUB 400      :rem 105
2130 IF INT((I+1)/8)*8=(I+1) THEN GOSUB50
     0                            :rem 199
2140 NEXT                          :rem 6
2150 IF INT(I/8)*8<>I THEN GOSUB 500
                                   :rem 172
2160 GOSUB 600:END                 :rem 240
```

Program 2:
Loader For DATA Statement Generator

```
1 READ LN,SA,EA:LN=LN+30           :rem 146
10 FOR I=0 TO EA-SA                :rem 232
20 READ BY:POKE SA+I,BY:SUM=SUM+BY
                                   :rem 120
30 IF INT((I+1)/8)*8<>(I+1) THEN 60
                                   :rem 242
40 READ CS:IF CS<>SUM THEN 90      :rem 124
50 SUM=0:LN=LN+10                  :rem 254
60 NEXT                            :rem 165
70 IF INT(I/8)*8<>I THEN READ CS:IF CS<>S
   UM THEN 90                       :rem 78
80 PRINT "SUCCESSFUL LOAD":END     :rem 106
90 PRINT "ERROR IN LINE";LN:END    :rem 105
```

Program 3: Cyclic Redundancy Check

```
1 READ LN,SA,EA:LN=LN+30           :rem 146
10 FOR I=0 TO EA-SA                :rem 232
20 READ BY:POKE SA+I,BY:SUM=SUM+BY
                                   :rem 120
30 IF INT((I+1)/8)*8<>(I+1) THEN 60
                                   :rem 242
40 READ CS:IF CS<>SUM THEN 90      :rem 124
50 SUM=0:LN=LN+10                  :rem 254
60 NEXT                            :rem 165
70 IF INT(I/8)*8<>I THEN READ CS:IF CS<>S
   UM THEN 90                       :rem 78
80 PRINT "SUCCESSFUL LOAD":END     :rem 106
90 PRINT "ERROR IN LINE";LN:END    :rem 105
500 DATA 510                       :rem 69
510 DATA 828                       :rem 82
520 DATA 897                       :rem 89
530 DATA 162,1,32,198,255,169,0,133,950
                                   :rem 132
540 DATA 252,133,253,32,207,255,176,39,13
    47                             :rem 80
550 DATA 133,251,162,8,6,252,38,253,1103
                                   :rem 173
560 DATA 144,6,6,251,176,18,144,4,749
                                   :rem 42
570 DATA 6,251,144,12,165,252,73,5,908
                                   :rem 85
580 DATA 133,252,165,253,73,128,133,253,1
    390                            :rem 128
590 DATA 202,208,225,165,144,240,212,32,1
    428                            :rem 115
600 DATA 204,255,169,1,32,195,255,164,127
    5                              :rem 29
610 DATA 252,165,253,108,5,0,783   :rem 40
```

Program 4:
Entering BASIC From A Sequential File

```
1 READ LN,SA,EA:LN=LN+30           :rem 146
10 FOR I=0 TO EA-SA                :rem 232
20 READ BY:POKE SA+I,BY:SUM=SUM+BY
                                   :rem 120
30 IF INT((I+1)/8)*8<>(I+1) THEN 60
                                   :rem 242
40 READ CS:IF CS<>SUM THEN 90      :rem 124
50 SUM=0:LN=LN+10                  :rem 254
60 NEXT                            :rem 165
70 IF INT(I/8)*8<>I THEN READ CS:IF CS<>S
   UM THEN 90                       :rem 78
80 PRINT "SUCCESSFUL LOAD":END     :rem 106
90 PRINT "ERROR IN LINE";LN:END    :rem 105
500 DATA 510                       :rem 69
510 DATA 828                       :rem 82
520 DATA 937                       :rem 84
530 DATA 162,1,32,198,255,144,6,169,967
                                   :rem 148
540 DATA 1,32,195,255,96,169,0,133,881
                                   :rem 91
550 DATA 251,169,160,133,252,160,0,177,13
    02                             :rem 63
560 DATA 251,145,251,200,208,249,230,252,
    1786                           :rem 174
570 DATA 165,252,201,192,208,241,169,129,
    1557                           :rem 185
580 DATA 141,99,165,169,3,141,100,165,983
                                   :rem 245
590 DATA 169,128,141,97,166,169,3,141,101
    4                              :rem 37
600 DATA 98,166,165,1,41,254,133,1,859
                                   :rem 89
610 DATA 169,255,133,19,96,134,251,32,108
    9                              :rem 36
620 DATA 207,255,36,144,48,5,112,3,810
                                   :rem 74
630 DATA 166,251,96,72,132,252,32,204,120
    5                              :rem 18
640 DATA 255,169,1,32,195,255,165,1,1073
                                   :rem 185
650 DATA 9,1,133,1,169,0,133,19,465
                                   :rem 183
660 DATA 164,252,166,251,104,96,1033
                                   :rem 242
```

Commodore 64 Music:

Happy Birthday

Jim Butterfield, Associate Editor

"The trouble is," said my friend Andrew, "that you can't find the programs which are most wanted. For example, a program that plays 'Happy Birthday to You' is needed for several reasons. First, the 64 is often given as a birthday present; this should be its first program. Second, the computer is a member of the family, and should play a part in the celebrations...."

It didn't seem too hard a job to me. The music-playing program already existed in BASIC, and BASIC programs are easy to change and expand. The musically inclined SID chip gave BASIC lots of time to do extra things.

The music should be written rather slowly (people tend to sing along rather sluggishly), and the words should come up on the screen. A bouncing ball could be achieved by using sprites, but I chose a simpler approach.

Let's program along; I'll give brief notes on what's happening.

```
100 PRINT CHR$(147);CHR$(154)
```

Let's clear the screen, set the color to light blue (that's normal).

```
101 READ S:IFS=0GOTO109
102 READ S$:GOSUB1000
103 READ X1,Y1,X2,Y2,X3,Y3
104 GOTO101
```

The above code runs through the DATA statements, printing the words of the song. The subroutine at line 1000 does the actual printing; we'll look at it later.

```
109 RESTORE:PRINTCHR$(19);CHR$(5)
```

We back up to the start of the DATA statements with the RESTORE command. Now we HOME the cursor and change our printing color to white.

```
110 L1=54272:L2=54279:L3=54286
120 H1=L1+1:H2=L2+1:H3=L3+1
130 V1=L1+4:V2=L2+4:V3=L3+4
140 POKE 54296,15
```

This sets the locations of the various instruments in the SID chip. L and H will be the low and high parts of the frequency (pitch) for each note. V will be the "action" location where we strike the note. And we turn the volume up to its maximum value of 15.

```
150 POKE V1+1,9:POKE V1+2,0
160 POKE V2+1,36:POKE V2+2,36
170 POKE V3+1,18:POKE V3+2,170
```

This sets the "envelope" for each voice. Voice 1 is bell-like; voice 2 sounds something like a harmonica; and voice 3 has the sound of a bass guitar. As part of our POKE sequence we set the following characteristics:

Attack—how fast the sound appears. This will be fast for the bell and guitar, rather slow for the harmonica.

Decay—how quickly the initial sound settles. This will be fairly slow for the bell, fast for harmonica and guitar.

Sustain—at what level the sound will "hold" once it's settled in. Bell and guitar won't hold the sound at all; it must fade away. The harmonica can keep the sound going for some time.

Release—how long it will take for the sound to die away. The bell dies almost instantly; the harmonica holds for a brief period; and the bass guitar continues to sound longer after it has been plucked.

```
180 T=TI
```

We'll be using the timer TI to control the timing of each note. Synchronize your watches; here comes the music-playing part.

```
200 POKE V1,16:POKE V2,32:POKE V3,16
```

Release all the instruments. Let go of the string, stop blowing, take your finger off the keys. We must do this each time before we can start the next note. You might observe that the bell and guitar use a value of 16 for a mellow triangle sound; the harmonica uses a more raspy "sawtooth" created by value 32.

```
210 READ S:IFS=0GOTO290
212 READ S$:GOSUB1000
```

Read the timing of the next note. If it's zero, quit. Read the word or part of a word that goes with a note. Print it (this time in white).

```
220 READ X1,Y1,X2,Y2,X3,Y3
```

Get the pitch of each of the three notes. If an instrument is silent this time around, its pitch will be given as zero in the DATA statement.

```
230 IF X1 THEN POKEH1,X1:POKEL1,Y1:POKEV1
    ,17
240 IF X2 THEN POKEH2,X2:POKEL2,Y2:POKEV2
    ,33
250 IF X3 THEN POKEH3,X3:POKEL3,Y3:POKEV3
    ,17
```

For each instrument: If its pitch is not zero, set the pitch and hit the note. You will see that we make the note sound by adding 1 to the waveform value. Compare these values with the ones shown in line 200, above.

```
260 T=T+S
270 IF T>TI GOTO270
280 GOTO200
```

We calculate the note's timing, and wait until the proper amount of time has passed. Then we go back and get the next note.

```
290 FOR J=L1 TO 54296:POKE J,0:NEXT J
295 PRINT CHR$(154):END
```

Finally, we clear all the SID music registers, change the printing color back to light blue, and stop.

Here come the DATA statements to play the music and write the words. Note that whenever a word ends with a period or comma, it will be printed and then a new line will be started.

```
300 DATA 40,"{2 SPACES}HAP",34,75,0,0,0,0
310 DATA 20,"PY",34,75,0,0,0,0
320 DATA 60," BIRTH",38,126,28,214,5,185
330 DATA 60,"DAY",34,75,28,214,0,0
340 DATA 60," TO",45,198,38,126,5,185
350 DATA 60," YOU",43,52,30,141,4,73
360 DATA 60,",",0,0,0,0,0,0
370 DATA 40,"{2 SPACES}HAP",34,75,0,0,0,0
380 DATA 20,"PY",34,75,0,0,0,0
390 DATA 60," BIRTH",38,126,30,141,6,108
400 DATA 60,"DAY",34,75,30,141,0,0
410 DATA 60," TO",51,97,34,75,4,73
420 DATA 60," YOU",45,198,28,214,5,185
430 DATA 60,",",0,0,0,0,0,0
440 DATA 40,"{2 SPACES}HAP",34,75,0,0,0,0
450 DATA 20,"PY",34,75,0,0,0,0
460 DATA 60," BIRTH",68,149,22,227,5,185
470 DATA 60,"DAY",57,172,25,177,0,0
480 DATA 60," DEAR",45,198,28,214,7,53
500 DATA 60," AN",21,154,30,141,7,163
510 DATA 60,"DREW",19,63,30,141,0,0
520 DATA 60,",",0,0,0,0,0,0
530 DATA 40,"{2 SPACES}HAP",61,126,0,0,0,
    0
540 DATA 20,"PY",61,126,0,0,0,0
550 DATA 60," BIRTH",57,172,34,75,8,147
560 DATA 60,"DAY",45,198,28,214,0,0
600 DATA 60," TO",51,97,30,141,4,73
610 DATA 60," YOU.",45,198,28,214,2,220
620 DATA 0
1000 PRINTS$;:IF RIGHT$(S$,1)<"0"THENPRIN
     T
1010 RETURN
```

Finally, we see a subroutine at 1000 to print the word or part word, and to test if it ends in a nonalphabetic character. If so, a new line will be started. Be sure to include the semicolon after the PRINT statement in line 1000.

COMPUTE!

Modifications Or Corrections To Previous Articles

TI Jackpot

Our lister program garbled characters in several graphics definition lines of the TI-99/4A version of this program from the August issue (p. 83). Several readers have noted that lines 660, 680, and 690 should read as follows:

```
660 DISPLAY AT(12,2)SIZE(25):"w"&CH
    R$(133)&CHR$(134)&"wwwwwwwwwwst
    ststwwwwww" :: DISPLAY AT(13,2)
    SIZE(25):"wJJw~w~w>w2wwuvuvuvw>
    w14w"
680 DISPLAY AT(15,2)SIZE(25):"wJJJJ
    w~w>w5ww¦}¦}<=w>w18w" :: DISPLA
    Y AT(16,2)SIZE(25):"wdede:;wwww
    wwz{z{z{wwwwww"
690 DISPLAY AT(17,2)SIZE(25):"wfgfg
    <=w>10ww¦}¦}¦}w>w18w" :: DISPLA
    Y AT(18,2)SIZE(25):"wdededewwww
    ww:;:;:;wwwwww"
```

Also, the space near the end of the string in line 440 (between the characters 1F and 1F) should be omitted.

VIC Lightsaver ✓

The machine language for this program from the September issue (p. 96) is correct, but there are bugs in the version of "Tiny MLX" (p. 151) to be used to enter it. Lines 100 and 210 of Tiny MLX do not contain the proper values for "Lightsaver." Also, a change is necessary to line 763 to allow you to use BASIC's standard LOAD and RUN commands to activate Lightsaver. The corrected lines are as follows:

```
100 POKE 55,30:POKE 56,25:CLR:POKE 788,19
    4                              :rem 21
210 S=6430:E=7677                  :rem 135
763 POKE 780,1:POKE 781,DV:POKE 782,0:SYS
     65466                         :rem 68
```

64 Devastator ✓

Readers using the "Automatic Proofreader" to check the BASIC portion of the 64 version of this game from the August issue (Program 7, p. 79) have noticed a problem with line 60. The error does not affect the operation of the program, but if you'd like the checksum for line 60 to match the one which appears in the magazine, add {7 RIGHT} after the {12 DOWN} in that line. ©

COMPUTE!'s Guide To Typing In Programs

Before typing in any program, you should familiarize yourself with your computer. Learn how to use the keyboard to type in and correct BASIC programs. Read your manuals to understand how to save and load BASIC programs to and from your disk drive or cassette unit. Computers are precise—take special care to type the program *exactly* as listed, including any necessary punctuation and symbols. To help you with this task, we have implemented a special listing convention as well as a program to help check your typing—the "Automatic Proofreader." Please read the following notes before typing in any programs from COMPUTE!. They can save you a lot of time and trouble.

Since programs can contain some hard-to-read (and hard-to-type) special characters, we have developed a listing system that spells out in abbreviated form the function of these control characters. You will find these special characters within curly braces. For example, {CLEAR} or {CLR} instructs you to insert the symbol which clears the screen on the Atari or Commodore machines. A symbol by itself within curly braces is usually a control key or graphics key. If you see {A}, hold down the CONTROL key and press A. Commodore machines have a special control key labeled with the Commodore logo. Graphics characters entered with the Commodore logo key are enclosed in a new kind of special bracket. A graphics character can be listed as [<A>]. In this case, hold down the Commodore logo key as you type A. Our Commodore listings are in uppercase, so shifted symbols are underlined. A graphics heart symbol (SHIFT-S) would be listed as S.

If a number precedes a symbol, such as {5 RIGHT}, {6 S}, or [<8 Q>], you would enter five cursor rights, six shifted S's, or eight Commodore-Q's. On the Atari, inverse characters (printed in white on black) should be entered with the Atari logo key. Since spacing is sometimes important, any more than two spaces will be listed, for example, as: {6 SPACES}. A space is never left at the end of a line, but will be moved to the next printed line as {SPACE}. There are no special control characters found in our IBM PC/PCjr, TI-99/4A, and Apple program listings. For your convenience, we have prepared this quick-reference key for the Commodore and Atari special characters:

Atari 400/800/XL

When you see	Type	See	
{CLEAR}	ESC SHIFT <		Clear Screen
{UP}	ESC CTRL -	↑	Cursor Up
{DOWN}	ESC CTRL =	↓	Cursor Down
{LEFT}	ESC CTRL +	←	Cursor Left
{RIGHT}	ESC CTRL *	→	Cursor Right
{BACK S}	ESC DELETE		Backspace
{DELETE}	ESC CTRL DELETE		Delete character
{INSERT}	ESC CTRL INSERT		Insert character
{DEL LINE}	ESC SHIFT DELETE		Delete line
{INS LINE}	ESC SHIFT INSERT		Insert line
{TAB}	ESC TAB		TAB key
{CLR TAB}	ESC CTRL TAB		Clear tab
{SET TAB}	ESC SHIFT TAB		Set tab stop
{BELL}	ESC CTRL 2		Ring buzzer
{ESC}	ESC ESC		ESCape key

Commodore PET/CBM/VIC/64

When You Read:	Press:	See:	When You Read:	Press:	See:
{CLR}	SHIFT CLR/HOME		{GRN}	CTRL 6	
{HOME}	CLR/HOME		{BLU}	CTRL 7	
{UP}	SHIFT CRSR ↑		{YEL}	CTRL 8	
{DOWN}	CRSR ↓		{F1}	f1	
{LEFT}	SHIFT CRSR ←		{F2}	f2	
{RIGHT}	CRSR →		{F3}	f3	
{RVS}	CTRL 9		{F4}	f4	
{OFF}	CTRL 0		{F5}	f5	
{BLK}	CTRL 1		{F6}	f6	
{WHT}	CTRL 2		{F7}	f7	
{RED}	CTRL 3		{F8}	f8	
{CYN}	CTRL 4		←	←	
{PUR}	CTRL 5		↑	SHIFT ↑	

The Automatic Proofreader

Also, we have developed a simple, yet effective program that can help check your typing. Type in the appropriate Proofreader program for your machine, then save it for future use. On the VIC, 64, or Atari, run the Proofreader to activate it, then enter NEW to erase the BASIC loader (the Proofreader will still be active, hidden in memory, as a machine language program). Pressing RUN/STOP-RESTORE or SYSTEM RESET deactivates the Proofreader. You can use SYS 886 to reactivate the VIC/64 Proofreader, or PRINT USR(1536) to reenable the Atari Proofreader. The IBM Proofreader is a BASIC program that lets you enter, edit, list, save, and load programs that you type. It simulates the IBM's BASIC line editor.

Using The Automatic Proofreader

Once the Proofreader is active, try typing in a line. As soon as you press RETURN, either a number (on the Commodore) or a pair of letters

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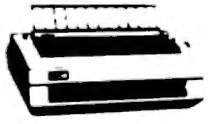

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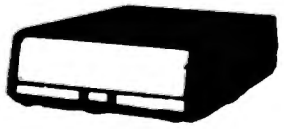

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(Atari or IBM) appears. The number or pair of letters is called a *checksum*. Try making a change in the line, and notice how the checksum changes.

All you need to do is compare the value provided by the Proofreader with the checksum printed in the program listing in the magazine. In Commodore listings, the checksum is a number from 0 to 255. It is set off from the rest of the line with *rem*. This prevents a syntax error if the checksum is typed in, but the REM statements and checksums need *not* be typed in. It is just there for your information.

In Atari and IBM listings, the checksum is given to the left of each line number. Just type in the program, a line at a time (without the printed checksum) and compare the checksum generated by the Proofreader to the checksum in the listing. If they match, go on to the next line. If not, check your typing: You've made a mistake. On the Commodore and Atari Proofreader, spaces are not counted as part of the checksum, and no check is made to see that you've typed in the characters in the right order. If characters are transposed, the checksum will still match the listing. Because of the checksum method used, do not use abbreviations, such as ? for PRINT. However, the Proofreader does catch the majority of typing errors most people make. The IBM Proofreader is even pickier; it *will* detect errors in spacing and transposition. Also, be sure you leave Caps Lock on, except when you need to enter lowercase characters.

Special Proofreader Notes For Commodore Cassette Users

The Proofreader resides in the cassette buffer, which is used during tape LOADs and SAVEs. Be sure to press RUN/STOP-RESTORE before you save or load a program, to get the Proofreader out of the way. If you want to use the Proofreader with tape, run the Proofreader, then enter these two lines *exactly* as shown, pressing RETURN after each one:

```
A$="PROOFREADER.T":B$="{10 SPACES}"
    :FORX=1TO4:A$=A$+B$:NEXT
FORX=886TO1018:A$=A$+CHR$(PEEK(X))
    :NEXT:OPEN 1,1,1,A$:CLOSE1
```

Then press RECORD and PLAY on a blank tape, and a special version of the Proofreader will be saved to tape. Anytime you need to reload the Proofreader after it has been erased, just rewind the tape, type OPEN1:CLOSE1, then press PLAY. When READY comes back, enter SYS 886.

IBM Proofreader Commands

Since the IBM Proofreader replaces the computer's normal BASIC line editor, it has to include many of the direct-mode IBM BASIC commands. The syntax is identical to IBM BASIC. Commands simulated are LIST, LLIST, NEW, FILES, SAVE, and LOAD. When listing your program, press any key (except Ctrl-Break) to stop the listing. If you enter NEW, the Proofreader will prompt you to press Y to be especially sure you mean yes.

Two new commands are BASIC and CHECK. BASIC exits the Proofreader back to IBM BASIC, leaving the Proofreader in memory. CHECK works just like LIST, but shows the checksums along with the listing. After you have typed in a program, save it to disk. Then exit the Proofreader with the BASIC command, and load the program into the normal BASIC environment (this will replace the Proofreader in memory). You can now run the program, but you may want to resave it to disk. This will shorten it on disk and make it load faster, but it can no longer be edited with the Proofreader. If you want to convert a program to Proofreader format, save it to disk with SAVE "filename",A.

Program 1: VIC/64 Proofreader

```
100 PRINT"{CLR}PLEASE WAIT...":FORI=886TO10
    18:READA:CK=CK+A:POKEI,A:NEXT
110 IF CK<>17539 THEN PRINT"{DOWN}YOU MADE
    {SPACE}AN ERROR":PRINT"IN DATA STATEMEN
    TS.":END
120 SYS886:PRINT"{CLR}{2 DOWN}PROOFREADER A
    CTIVATED.":NEW
886 DATA 173,036,003,201,150,208
892 DATA 001,096,141,151,003,173
898 DATA 037,003,141,152,003,169
904 DATA 150,141,036,003,169,003
910 DATA 141,037,003,169,000,133
916 DATA 254,096,032,087,241,133
922 DATA 251,134,252,132,253,008
928 DATA 201,013,240,017,201,032
934 DATA 240,005,024,101,254,133
940 DATA 254,165,251,166,252,164
946 DATA 253,040,096,169,013,032
952 DATA 210,255,165,214,141,251
958 DATA 003,206,251,003,169,000
964 DATA 133,216,169,019,032,210
970 DATA 255,169,018,032,210,255
976 DATA 169,058,032,210,255,166
982 DATA 254,169,000,133,254,172
988 DATA 151,003,192,087,208,006
994 DATA 032,205,189,076,235,003
1000 DATA 032,205,221,169,032,032
1006 DATA 210,255,032,210,255,173
1012 DATA 251,003,133,214,076,173
1018 DATA 003
```

Program 2: Atari Proofreader

```
100 GRAPHICS 0
110 FOR I=1536 TO 1700:READ A:POK
    E I,A:CK=CK+A:NEXT I
120 IF CK<>19072 THEN ? "ERROR IN
     DATA STATEMENTS.  CHECK TYPI
    NG.":END
130 A=USR(1536)
140 ? :? "AUTOMATIC PROOFREADER N
    OW ACTIVATED."
150 END
```

```
1536 DATA 104,160,0,185,26,3
1542 DATA 201,69,240,7,200,200
1548 DATA 192,34,208,243,96,200
1554 DATA 169,74,153,26,3,200
1560 DATA 169,6,153,26,3,162
1566 DATA 0,189,0,228,157,74
1572 DATA 6,232,224,16,208,245
1578 DATA 169,93,141,78,6,169
1584 DATA 6,141,79,6,24,173
1590 DATA 4,228,105,1,141,95
1596 DATA 6,173,5,228,105,0
1602 DATA 141,96,6,169,0,133
1608 DATA 203,96,247,238,125,241
1614 DATA 93,6,244,241,115,241
1620 DATA 124,241,76,205,238,0
1626 DATA 0,0,0,0,32,62
1632 DATA 246,8,201,155,240,13
1638 DATA 201,32,240,7,72,24
1644 DATA 101,203,133,203,104,40
1650 DATA 96,72,152,72,138,72
1656 DATA 160,0,169,128,145,88
1662 DATA 200,192,40,208,249,165
1668 DATA 203,74,74,74,74,24
1674 DATA 105,161,160,3,145,88
1680 DATA 165,203,41,15,24,105
1686 DATA 161,200,145,88,169,0
1692 DATA 133,203,104,170,104,168
1698 DATA 104,40,96
```

Programs using the IBM Proofreader will appear beginning next month.

Program 3: IBM Proofreader

```
100 DIM L$(500),LNUM(500):COLOR 0,7,7:K
    EY OFF:CLS:MAX=0:LNUM(0)=65536!
110 ON ERROR GOTO 120:KEY 15,CHR$(4)+CH
    R$(70):ON KEY(15) GOSUB 640:KEY (15
    ) ON:GOTO 130
120 RESUME 130
130 DEF SEG=&H40:W=PEEK(&H4A)
140 ON ERROR GOTO 650:PRINT:PRINT"Proof
    reader Ready."
150 LINE INPUT L$:Y=CSRLIN-INT(LEN(L$)/
    W)-1:LOCATE Y,1
160 DEF SEG=0:POKE 1050,30:POKE 1052,34
    :POKE 1054,0:POKE 1055,79:POKE 1056
    ,13:POKE 1057,28:LINE INPUT L$:DEF
    SEG:IF L$="" THEN 150
170 IF LEFT$(L$,1)=" " THEN L$=MID$(L$,
    2):GOTO 170
180 IF VAL(LEFT$(L$,2))=0 AND MID$(L$,3
    ,1)=" " THEN L$=MID$(L$,4)
190 LNUM=VAL(L$):TEXT$=MID$(L$,LEN(STR$
    (LNUM))+1)
200 IF ASC(L$)>57 THEN 260 'no line num
    ber, therefore command
210 IF TEXT$="" THEN GOSUB 540:IF LNUM=
    LNUM(P) THEN GOSUB 560:GOTO 150 ELS
    E 150 'delete line
220 CKSUM=0:FOR I=1 TO LEN(L$):CKSUM=(C
    KSUM+ASC(MID$(L$,I))*I) AND 255:NEX
    T:LOCATE Y,1:PRINT CHR$(65+CKSUM/16
    )+CHR$(65+(CKSUM AND 15))+" "+L$
230 GOSUB 540:IF LNUM(P)=LNUM THEN L$(P
    )=TEXT$:GOTO 150 'replace line
240 GOSUB 580:GOTO 150 'insert the line
250 'command processor.  step 1: conver
    t to uppercase
260 TEXT$="":FOR I=1 TO LEN(L$):A=ASC(M
    ID$(L$,I)):TEXT$=TEXT$+CHR$(A+32*(A
    >96 AND A<123)):NEXT
270 DELIMITER=INSTR(TEXT$," "):COMMAND$
    =TEXT$:ARG$="":IF DELIMITER THEN CO
    MMAND$=LEFT$(TEXT$,DELIMITER-1):ARG
    $=MID$(TEXT$,DELIMITER+1) 'separate
     command from argument
280 IF COMMAND$<>"LIST" THEN 410
290 OPEN "scrn:" FOR OUTPUT AS #1
300 IF ARG$="" THEN FIRST=0:P=MAX-1:GOT
    O 340
310 DELIMITER=INSTR(ARG$,"-"):IF DELIMI
    TER=0 THEN LNUM=VAL(ARG$):GOSUB 540
    :FIRST=P:GOTO 340
320 FIRST=VAL(LEFT$(ARG$,DELIMITER)):LA
    ST=VAL(MID$(ARG$,DELIMITER+1))
330 LNUM=FIRST:GOSUB 540:FIRST=P:LNUM=L
    AST:GOSUB 540:IF P=0 THEN P=MAX-1
340 FOR X=FIRST TO P:N$=MID$(STR$(LNUM(
    X)),2)+" "
350 IF CKFLAG=0 THEN A$="":GOTO 370
360 CKSUM=0:A$=N$+L$(X):FOR I=1 TO LEN(
    A$):CKSUM=(CKSUM+ASC(MID$(A$,I))*I)
     AND 255:NEXT:A$=CHR$(65+CKSUM/16)+
    CHR$(65+(CKSUM AND 15))+" "
370 PRINT #1,A$+N$+L$(X)
380 IF INKEY$<>"" THEN X=P
390 NEXT :CLOSE #1:CKFLAG=0
400 GOTO 130
410 IF COMMAND$="LLIST" THEN OPEN "lpt1
    :" FOR OUTPUT AS #1:GOTO 300
420 IF COMMAND$="CHECK" THEN CKFLAG=1:G
    OTO 290
430 IF COMMAND$<>"SAVE" THEN 450
440 GOSUB 600:OPEN ARG$ FOR OUTPUT AS #
    1:ARG$="":GOTO 300
450 IF COMMAND$<>"LOAD" THEN 490
460 GOSUB 600:OPEN ARG$ FOR INPUT AS #1
    :MAX=0:P=0
470 WHILE NOT EOF(1):LINE INPUT #1,L$:L
    NUM(P)=VAL(L$):L$(P)=MID$(L$,LEN(ST
    R$(VAL(L$)))+1):P=P+1:WEND
480 MAX=P:CLOSE #1:GOTO 130
490 IF COMMAND$="NEW" THEN INPUT "Erase
     program - Are you sure";L$:IF LEFT
    $(L$,1)="y" OR LEFT$(L$,1)="Y" THEN
     MAX=0:GOTO 130:ELSE 130
500 IF COMMAND$="BASIC" THEN COLOR 7,0,
    0:ON ERROR GOTO 0:CLS:END
510 IF COMMAND$="FILES" THEN FILES:GOTO
     130
520 PRINT"Syntax error":GOTO 130
530 'find line
540 P=0:WHILE LNUM>LNUM(P) AND P<MAX:P=
    P+1:WEND:RETURN
550 'delete line
560 MAX=MAX-1:FOR X=P TO MAX:LNUM(X)=LN
    UM(X+1):L$(X)=L$(X+1):NEXT:RETURN
570 'insert line
580 MAX=MAX+1:FOR X=MAX TO P+1 STEP -1:
    LNUM(X)=LNUM(X-1):L$(X)=L$(X-1):NEX
    T:L$(P)=TEXT$:LNUM(P)=LNUM:RETURN
590 'filename adjustments
600 IF LEFT$(ARG$,1)<>CHR$(34) THEN 520
     ELSE ARG$=MID$(ARG$,2)
610 IF RIGHT$(ARG$,1)=CHR$(34) THEN ARG
    $=LEFT$(ARG$,LEN(ARG$)-1)
620 IF INSTR(ARG$,".")=0 THEN ARG$=ARG$
    +".BAS"
630 RETURN
640 PRINT"Stopped.":RETURN 150
650 PRINT "Error #";ERR:RESUME 150
```

MLX Machine Language Entry Program For 64 And Atari

Charles Brannon, Program Editor

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

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

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 appears in the 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 delete 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 for the 64 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-L: Load
SHIFT-N: New Address
SHIFT-D: Display

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

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

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.

64 MLX: Machine Language Entry

```
10 REM LINES CHANGED FROM MLX VERSION 2.0
   0 ARE 750,765,770 AND 860       :rem 50
100 PRINT"{CLR}{6}";CHR$(142);CHR$(8);:
    POKE53281,1:POKE53280,1        :rem 67
101 POKE 788,52:REM DISABLE RUN/STOP
                                   :rem 119
110 PRINT"{RVS}{39 SPACES}";       :rem 176
120 PRINT"{RVS}{14 SPACES}{RIGHT}{OFF}
    {*}{£}{RVS}{RIGHT} {RIGHT}{2 SPACES}
```

```
    £*₹{OFF}£*₹£{RVS}£{RVS}
    {14 SPACES}";                    :rem 250
130 PRINT"{RVS}{14 SPACES}{RIGHT} £G₹
    {RIGHT} {2 RIGHT} {OFF}£{RVS}££*₹
    {OFF}£*₹{RVS}{14 SPACES}";       :rem 35
140 PRINT"{RVS}{41 SPACES}"          :rem 120
200 PRINT"{2 DOWN}{PUR}{BLK} MACHINE LANG
    UAGE EDITOR VERSION 2.01{5 DOWN}"
                                     :rem 237
210 PRINT"£5₹{2 UP}STARTING ADDRESS?
    {8 SPACES}{9 LEFT}";             :rem 143
215 INPUTS:F=1-F:C$=CHR$(31+119*F)
                                     :rem 166
220 IFS<256ORS>40960ANDS<49152)ORS>53247
    THENGOSUB3000:GOTO210            :rem 235
225 PRINT:PRINT:PRINT                :rem 180
230 PRINT"£5₹{2 UP}ENDING ADDRESS?
    {8 SPACES}{9 LEFT}";:INPUTE:F=1-F:C$=
    CHR$(31+119*F)                   :rem 20
240 IFE<256OR(E>40960ANDE<49152)ORE>53247
    THENGOSUB3000:GOTO230            :rem 183
250 IFE<STHENPRINTC$;"{RVS}ENDING < START
    {2 SPACES}":GOSUB1000:GOTO 230
                                     :rem 176
260 PRINT:PRINT:PRINT                :rem 179
300 PRINT"{CLR}";CHR$(14):AD=S:POKEV+21,0
                                     :rem 225
310 A=1:PRINTRIGHT$("0000"+MID$(STR$(AD),
    2),5);":";                       :rem 33
315 FORJ=ATO6                        :rem 33
320 GOSUB570:IFN=-1THENJ=J+N:GOTO320
                                     :rem 228
390 IFN=-211THEN 710                 :rem 62
400 IFN=-204THEN 790                 :rem 64
410 IFN=-206THENPRINT:INPUT"{DOWN}ENTER N
    EW ADDRESS";ZZ                   :rem 44
415 IFN=-206THENIFZZ<SORZZ>ETHENPRINT"
    {RVS}OUT OF RANGE":GOSUB1000:GOTO410
                                     :rem 225
417 IFN=-206THENAD=ZZ:PRINT:GOTO310
                                     :rem 238
420 IF N<>-196 THEN 480              :rem 133
430 PRINT:INPUT"DISPLAY:FROM";F:PRINT,"TO
    ";:INPUTT                        :rem 234
440 IFF<SORF>EORT<SORT>ETHENPRINT"AT LEAS
    T";S;"{LEFT}, NOT MORE THAN";E:GOTO43
    0                                :rem 159
450 FORI=FTOTSTEP6:PRINT:PRINTRIGHT$("000
    0"+MID$(STR$(I),2),5);":";       :rem 30
451 FORK=0TO5:N=PEEK(I+K):PRINTRIGHT$("00
    "+MID$(STR$(N),2),3);",";        :rem 66
460 GETA$:IFA$>""THENPRINT:PRINT:GOTO310
                                     :rem 25
470 NEXTK:PRINTCHR$(20);:NEXTI:PRINT:PRIN
    T:GOTO310                        :rem 50
480 IFN<0 THEN PRINT:GOTO310         :rem 168
490 A(J)=N:NEXTJ                     :rem 199
500 CKSUM=AD-INT(AD/256)*256:FORI=1TO6:CK
    SUM=(CKSUM+A(I))AND255:NEXT      :rem 200
510 PRINTCHR$(18);:GOSUB570:PRINTCHR$(146
    );                               :rem 94
511 IFN=-1THENA=6:GOTO315            :rem 254
515 PRINTCHR$(20):IFN=CKSUMTHEN530
                                     :rem 122
520 PRINT:PRINT"LINE ENTERED WRONG : RE-E
    NTER":PRINT:GOSUB1000:GOTO310:rem 176
530 GOSUB2000                        :rem 218
540 FORI=1TO6:POKEAD+I-1,A(I):NEXT:POKE54
    272,0:POKE54273,0                :rem 227
550 AD=AD+6:IF AD<E THEN 310         :rem 212
560 GOTO 710                         :rem 108
570 N=0:Z=0                          :rem 88
580 PRINT"££₹";                      :rem 81
581 GETA$:IFA$=""THEN581             :rem 95
582 AV=-(A$="M")-2*(A$=",")-3*(A$=".")-4*
    (A$="J")-5*(A$="K")-6*(A$="L"):rem 41
583 AV=AV-7*(A$="U")-8*(A$="I")-9*(A$="O"
    ):IFA$="H"THENA$="0"             :rem 134
584 IFAV>0THENA$=CHR$(48+AV)         :rem 134
585 PRINTCHR$(20);:A=ASC(A$):IFA=13ORA=44
    ORA=32THEN670                    :rem 229
590 IFA>128THENN=-A:RETURN           :rem 137
600 IFA<>20 THEN 630                 :rem 10
610 GOSUB690:IFI=1ANDT=44THENN=-1:PRINT"
    {OFF}{LEFT} {LEFT}";:GOTO690     :rem 62
620 GOTO570                          :rem 109
630 IFA<48ORA>57THEN580              :rem 105
640 PRINTA$;:N=N*10+A-48             :rem 106
650 IFN>255 THEN A=20:GOSUB1000:GOTO600
                                     :rem 229
660 Z=Z+1:IFZ<3THEN580               :rem 71
670 IFZ=0THENGOSUB1000:GOTO570       :rem 114
680 PRINT",";:RETURN                 :rem 240
690 S%=PEEK(209)+256*PEEK(210)+PEEK(211)
                                     :rem 149
691 FORI=1TO3:T=PEEK(S%-I)           :rem 67
695 IFT<>44ANDT<>58THENPOKES%-I,32:NEXT
                                     :rem 205
700 PRINTLEFT$("{3 LEFT}",I-1);:RETURN
                                     :rem 7
710 PRINT"{CLR}{RVS}*** SAVE ***{3 DOWN}"
                                     :rem 236
715 PRINT"{2 DOWN}(PRESS {RVS}RETURN{OFF}
     ALONE TO CANCEL SAVE){DOWN}":rem 106
720 F$="":INPUT"{DOWN} FILENAME";F$:IFF$=
    ""THENPRINT:PRINT:GOTO310        :rem 71
730 PRINT:PRINT"{2 DOWN}{RVS}T{OFF}APE OR
     {RVS}D{OFF}ISK: (T/D)"          :rem 228
740 GETA$:IFA$<>"T"ANDA$<>"D"THEN740
                                     :rem 36
750 DV=1-7*(A$="D"):IFDV=8THENF$="0:"+F$:
    OPEN15,8,15,"S"+F$:CLOSE15       :rem 212
760 T$=F$:ZK=PEEK(53)+256*PEEK(54)-LEN(T$
    ):POKE782,ZK/256                 :rem 3
762 POKE781,ZK-PEEK(782)*256:POKE780,LEN(
    T$):SYS65469                     :rem 109
763 POKE780,1:POKE781,DV:POKE782,1:SYS654
    66                               :rem 69
765 K=S:POKE254,K/256:POKE253,K-PEEK(254)
    *256:POKE780,253                 :rem 17
766 K=E+1:POKE782,K/256:POKE781,K-PEEK(78
    2)*256:SYS65496                  :rem 235
770 IF(PEEK(783)AND1)OR(191ANDST)THEN780
                                     :rem 111
775 PRINT"{DOWN}DONE.{DOWN}":GOTO310
                                     :rem 113
780 PRINT"{DOWN}ERROR ON SAVE.{2 SPACES}T
    RY AGAIN.":IFDV=1THEN720         :rem 171
781 OPEN15,8,15:INPUT#15,E1$,E2$:PRINTE1$
    ;E2$:CLOSE15:GOTO720             :rem 103
790 PRINT"{CLR}{RVS}*** LOAD ***{2 DOWN}"
                                     :rem 212
795 PRINT"{2 DOWN}(PRESS {RVS}RETURN{OFF}
     ALONE TO CANCEL LOAD)"          :rem 82
800 F$="":INPUT"{2 DOWN} FILENAME";F$:IFF
    $=""THENPRINT:GOTO310            :rem 144
810 PRINT:PRINT"{2 DOWN}{RVS}T{OFF}APE OR
     {RVS}D{OFF}ISK: (T/D)"          :rem 227
820 GETA$:IFA$<>"T"ANDA$<>"D"THEN820
                                     :rem 34
830 DV=1-7*(A$="D"):IFDV=8THENF$="0:"+F$
                                     :rem 157
840 T$=F$:ZK=PEEK(53)+256*PEEK(54)-LEN(T$
    ):POKE782,ZK/256                 :rem 2
```

```
841 POKE781,ZK-PEEK(782)*256:POKE780,LEN(
    T$):SYS65469                  :rem 107
845 POKE780,1:POKE781,DV:POKE782,1:SYS654
    66                            :rem 70
850 POKE780,0:SYS65493            :rem 11
860 IF(PEEK(783)AND1)OR(191ANDST)THEN870
                                  :rem 111
865 PRINT"{DOWN}DONE.":GOTO310    :rem 96
870 PRINT"{DOWN}ERROR ON LOAD.{2 SPACES}T
    RY AGAIN.{DOWN}":IFDV=1THEN800
                                  :rem 172
880 OPEN15,8,15:INPUT#15,E1$,E2$:PRINTE1$
    ;E2$:CLOSE15:GOTO800          :rem 102
1000 REM BUZZER                   :rem 135
1001 POKE54296,15:POKE54277,45:POKE54278,
     165                          :rem 207
1002 POKE54276,33:POKE 54273,6:POKE54272,
     5                            :rem 42
1003 FORT=1TO200:NEXT:POKE54276,32:POKE54
     273,0:POKE54272,0:RETURN     :rem 202
2000 REM BELL SOUND               :rem 78
2001 POKE54296,15:POKE54277,0:POKE54278,2
     47                           :rem 152
2002 POKE 54276,17:POKE54273,40:POKE54272
     ,0                           :rem 86
2003 FORT=1TO100:NEXT:POKE54276,16:RETURN
                                  :rem 57
3000 PRINTC$;"{RVS}NOT ZERO PAGE OR ROM":
     GOTO1000                     :rem 89
```

Atari MLX: Machine Language Entry

```
DA 100 GRAPHICS 0:DL=PEEK(560)+256
       *PEEK(561)+4:POKE DL-1,71:P
       OKE DL+2,6
NJ 110 POSITION 8,0:? "MLX":POSITI
       ON 23,0:? "failsafe entry":
       POKE 710,0:?
JK 120 ? "Starting Address";:INPUT
        BEG:? "  Ending Address";:
       INPUT FIN:? "Run/Init Addre
       ss";:INPUT STARTADR
DD 130 DIM A(6),BUFFER$(FIN-BEG+12
       7),T$(20),F$(20),CIO$(7),SE
       CTOR$(128),DSKINV$(6)
JJ 140 OPEN #1,4,0,"K:":? :? ,"Tap
       e or Disk:";
BM 150 BUFFER$=CHR$(0):BUFFER$(FIN
       -BEG+30)=BUFFER$:BUFFER$(2)
       =BUFFER$:SECTOR$=BUFFER$
GC 160 ADDR=BEG:CIO$="hhh":CIO$(4)
       =CHR$(170):CIO$(5)="LV":CIO
       $(7)=CHR$(228)
EJ 170 GET #1,MEDIA:IF MEDIA<>84 A
       ND MEDIA<>68 THEN 170
PO 180 ? CHR$(MEDIA):? :IF MEDIA<>
       ASC("T") THEN BUFFER$="":GO
       TO 250
PL 190 BEG=BEG-24:BUFFER$=CHR$(0):
       BUFFER$(2)=CHR$(INT((FIN-BE
       G+127)/128))
KF 200 H=INT(BEG/256):L=BEG-H*256:
       BUFFER$(3)=CHR$(L):BUFFER$(
       4)=CHR$(H)
EC 210 PINIT=BEG+8:H=INT(PINIT/256
       ):L=PINIT-H*256:BUFFER$(5)=
       CHR$(L):BUFFER$(6)=CHR$(H)
PB 220 FOR I=7 TO 24:READ A:BUFFER
       $(I)=CHR$(A):NEXT I:DATA 24
       ,96,169,60,141,2,211,169,0,
       133,10,169,0,133,11,76,0,0
DP 230 H=INT(STARTADR/256):L=START
       ADR-H*256:BUFFER$(15)=CHR$(
       L):BUFFER$(19)=CHR$(H)
KL 240 BUFFER$(23)=CHR$(L):BUFFER$
       (24)=CHR$(H)
HI 250 IF MEDIA<>ASC("D") THEN 360
OO 260 ? :? "Boot Disk or Binary Fi
       le:";
LI 270 GET #1,DTYPE:IF DTYPE<>68 A
       ND DTYPE<>70 THEN 270
GM 280 ? CHR$(DTYPE):IF DTYPE=70 T
       HEN 360
PJ 290 BEG=BEG-30:BUFFER$=CHR$(0):
       BUFFER$(2)=CHR$(INT((FIN-BE
       G+127)/128))
KG 300 H=INT(BEG/256):L=BEG-H*256:
       BUFFER$(3)=CHR$(L):BUFFER$(
       4)=CHR$(H)
HH 310 PINIT=STARTADR:H=INT(PINIT/
       256):L=PINIT-H*256:BUFFER$(
       5)=CHR$(L):BUFFER$(6)=CHR$(
       H)
AO 320 RESTORE 330:FOR I=7 TO 30:R
       EAD A:BUFFER$(I)=CHR$(A):NE
       XT I
GA 330 DATA 169,0,141,231,2,133,14
       ,169,0,141,232,2,133,15,169
       ,0,133,10,169,0,133,11,24,9
       6
OB 340 H=INT(BEG/256):L=BEG-H*256:
       BUFFER$(8)=CHR$(L):BUFFER$(
       15)=CHR$(H)
DO 350 H=INT(STARTADR/256):L=START
       ADR-H*256:BUFFER$(22)=CHR$(
       L):BUFFER$(26)=CHR$(H)
JP 360 GRAPHICS 0:POKE 712,10:POKE
        710,10:POKE 709,2
JK 370 ? ADDR;":";:FOR J=1 TO 6
NF 380 GOSUB 570:IF N=-1 THEN J=J-
       1:GOTO 380
BF 390 IF N=-19 THEN 720
OI 400 IF N=-12 THEN LET READ=1:GO
       TO 720
AI 410 TRAP 410:IF N=-14 THEN ? :?
        "New Address";:INPUT ADDR:
       ? :GOTO 370
JO 420 TRAP 32767:IF N<>-4 THEN 48
       0
AJ 430 TRAP 430:? :? "Display:From
       ";:INPUT F:? ,"To";:INPUT T
       :TRAP 32767
ML 440 IF F<BEG OR F>FIN OR T<BEG
       OR T>FIN OR T<F THEN ? CHR$
       (253);"At least ";BEG;", No
       t More Than ";FIN:GOTO 430
MH 450 FOR I=F TO T STEP 6:? :? I;
       ":";:FOR K=0 TO 5:N=PEEK(AD
       R(BUFFER$)+I+K-BEG):T$="000
       ":T$(4-LEN(STR$(N)))=STR$(N
       )
MA 460 IF PEEK(764)<255 THEN GET #
       1,A:POP :POP :? :GOTO 370
FM 470 ? T$;",";:NEXT K:? CHR$(126
       );:NEXT I:? :? :GOTO 370
```

```
GA 480 IF N<0 THEN ? :GOTO 370
MH 490 A(J)=N:NEXT J
JM 500 CKSUM=ADDR-INT(ADDR/256)*25
       6:FOR I=1 TO 6:CKSUM=CKSUM+
       A(I):CKSUM=CKSUM-256*(CKSUM
       >255):NEXT I
KK 510 RF=128:SOUND 0,200,12,8:GOS
       UB 570:SOUND 0,0,0,0:RF=0:?
        CHR$(126)
CN 520 IF N<>CKSUM THEN ? :? "Inco
       rrect";CHR$(253);:? :GOTO 3
       70
EK 530 FOR W=15 TO 0 STEP -1:SOUND
        0,50,10,W:NEXT W
FL 540 FOR I=1 TO 6:POKE ADR(BUFFE
       R$)+ADDR-BEG+I-1,A(I):NEXT
       I
HB 550 ADDR=ADDR+6:IF ADDR<=FIN TH
       EN 370
GM 560 GOTO 710
FI 570 N=0:Z=0
PH 580 GET #1,A:IF A=155 OR A=44 O
       R A=32 THEN 670
FB 590 IF A<32 THEN N=-A:RETURN
EB 600 IF A<>126 THEN 630
ML 610 GOSUB 690:IF I=1 AND T=44 T
       HEN N=-1:? CHR$(126);:GOTO
       690
GN 620 GOTO 570
GJ 630 IF A<48 OR A>57 THEN 580
AN 640 ? CHR$(A+RF);:N=N*10+A-48
EB 650 IF N>255 THEN ? CHR$(253);:
       A=126:GOTO 600
EH 660 Z=Z+1:IF Z<3 THEN 580
JH 670 IF Z=0 THEN ? CHR$(253);:GO
       TO 570
KC 680 ? ",";:RETURN
NO 690 POKE 752,1:FOR I=1 TO 3:? C
       HR$(30);:GET #6,I:IF I<>44
       AND I<>58 THEN ? CHR$(A);:N
       EXT I
PI 700 POKE 752,0:? " ";CHR$(126);
       :RETURN
KM 710 GRAPHICS 0:POKE 710,26:POKE
        712,26:POKE 709,2
FF 720 IF MEDIA=ASC("T") THEN 890
OJ 730 REM DISK
OK 740 IF READ THEN ? :? "Load Fil
       e":?
IG 750 IF DTYPE<>70 THEN 1040
AE 760 ? :? "Enter AUTORUN.SYS for
        automatic use":? :? "Enter
        filename":INPUT T$
GF 770 F$=T$:IF LEN(T$)>2 THEN IF
       T$(1,2)<>"D:" THEN F$="D:":
       F$(3)=T$
NJ 780 TRAP 870:CLOSE #2:OPEN #2,8
       -4*READ,0,F$:? :? "Working.
       . ."
JM 790 IF READ THEN FOR I=1 TO 6:G
       ET #2,A:NEXT I:GOTO 820
PO 800 PUT #2,255:PUT #2,255
DJ 810 H=INT(BEG/256):L=BEG-H*256:
       PUT #2,L:PUT #2,H:H=INT(FIN
       /256):L=FIN-H*256:PUT #2,L:
       PUT #2,H
NF 820 GOSUB 970:IF PEEK(195)>1 TH
       EN 870
IF 830 IF STARTADR=0 OR READ THEN
       850
FD 840 PUT #2,224:PUT #2,2:PUT #2,
       225:PUT #2,2:H=INT(STARTADR
       /256):L=STARTADR-H*256:PUT
       #2,L:PUT #2,H
HH 850 TRAP 32767:CLOSE #2:? "Fini
       shed.":IF READ THEN ? :? :L
       ET READ=0:GOTO 360
HF 860 END
FO 870 ? "Error ";PEEK(195);" tryi
       ng to access":? F$:CLOSE #2
       :? :GOTO 760
MC 880 REM BOOT TAPE
HN 890 IF READ THEN ? :? "Read Tap
       e"
HI 900 ? :? :? "Insert, Rewind Tap
       e.":? "Press PLAY ";:IF NO
       T READ THEN ? "& RECORD"
LP 910 ? :? "Press RETURN when rea
       dy:";
JH 920 TRAP 960:CLOSE #2:OPEN #2,8
       -4*READ,128,"C:":? :? "Work
       ing..."
NH 930 GOSUB 970:IF PEEK(195)>1 TH
       EN 960
HH 940 CLOSE #2:TRAP 32767:? "Fini
       shed.":? :? :IF READ THEN L
       ET READ=0:GOTO 360
HF 950 END
CD 960 ? :? "Error ";PEEK(195);" w
       hen reading/writing boot ta
       pe":? :CLOSE #2:GOTO 890
MB 970 REM CIO Load/Save File#2 op
       ened  READ=0 for write, REA
       D=1 for read
EA 980 X=32:REM File#2,$20
EF 990 ICCOM=834:ICBADR=836:ICBLEN
       =840:ICSTAT=835
MD 1000 H=INT(ADR(BUFFER$)/256):L=
        ADR(BUFFER$)-H*256:POKE IC
        BADR+X,L:POKE ICBADR+X+1,H
FH 1010 L=FIN-BEG+1:H=INT(L/256):L
        =L-H*256:POKE ICBLEN+X,L:P
        OKE ICBLEN+X+1,H
MD 1020 POKE ICCOM+X,11-4*READ:A=U
        SR(ADR(CIO$),X)
BG 1030 POKE 195,PEEK(ICSTAT):RETU
        RN
KA 1040 REM SECTOR I/O
GC 1050 IF READ THEN 1100
HE 1060 ? :? "Format Disk In Drive
         1? (Y/N):";
FC 1070 GET #1,A:IF A<>78 AND A<>8
        9 THEN 1070
EC 1080 ? CHR$(A):IF A=78 THEN 110
        0
CP 1090 ? :? "Formatting...":XIO 2
        54,#2,0,0,"D:":? "Format C
        omplete":?
AC 1100 NR=INT((FIN-BEG+127)/128):
        BUFFER$(FIN-BEG+2)=CHR$(0)
        :IF READ THEN ? "Reading..
        ":GOTO 1120
```

```
LE 1110 ? "Writing..."
LI 1120 FOR I=1 TO NR:S=I
IO 1130 IF READ THEN GOSUB 1220:BU
        FFER$(I*128-127)=SECTOR$:G
        OTO 1160
PL 1140 SECTOR$=BUFFER$(I*128-127)
AM 1150 GOSUB 1220
DN 1160 IF PEEK(DSTATS)<>1 THEN 12
        00
FB 1170 NEXT I
GM 1180 IF  NOT READ THEN END
DH 1190 ? :? :LET READ=0:GOTO 360
JJ 1200 ? "Error on disk access.":
        ? "May need formatting.":G
        OTO 1040
KI 1210 REM
BL 1220 REM SECTOR ACCESS SUBROUT
        INE
IG 1230 REM Drive ONE
IH 1240 REM Pass buffer in SECTOR$
MP 1250 REM sector # in variable S
EG 1260 REM READ=1 for read,
KJ 1270 REM READ=0 for write
BN 1280 BASE=3*256
GL 1290 DUNIT=BASE+1:DCOMND=BASE+2
        :DSTATS=BASE+3
NL 1300 DBUFLO=BASE+4:DBUFHI=BASE+
        5
AI 1310 DBYTLO=BASE+8:DBYTHI=BASE+
        9
JA 1320 DAUX1=BASE+10:DAUX2=BASE+1
        1
PN 1330 REM DIM DSKINV$(4)
CA 1340 DSKINV$="hLS":DSKINV$(4)=C
        HR$(228)
PF 1350 POKE DUNIT,1:A=ADR(SECTOR$
        ):H=INT(A/256):L=A-256*H
BP 1360 POKE DBUFHI,H
CO 1370 POKE DBUFLO,L
PD 1380 POKE DCOMND,87-5*READ
AA 1390 POKE DAUX2,INT(S/256):POKE
         DAUX1,S-PEEK(DAUX2)*256
KJ 1400 A=USR(ADR(DSKINV$))
KG 1410 RETURN
```


NEWS&PRODUCTS

Color Printer For Commodore And Atari

A $239, full-color thermal transfer printer that doesn't require special paper has been introduced for Commodore and Atari home computers by Okidata.

The Okimate 10 prints on almost any kind of paper. It also will print on acetate, to make transparencies for overhead projectors.

The printer uses a color or black ribbon cartridge. Okimate 10's print head has a life expectancy of 10 million characters, and prints at a speed of 60 characters per second (240 words per minute).

The Okimate 10 can produce more than 40 different shades of color. For printing without a ribbon, thermal paper may be used.

The printer comes with a software tutorial, color and black ribbons, and a Plug 'n Print module, which is required to operate the equipment.

The $239 Okimate 10 color thermal transfer printer doesn't require special paper. For Commodore and Atari computers.

Okidata
532 Fellowship Road
Mt. Laurel, NJ 08054
(609) 235-2600

Finance Manager For Apple II Family

Finance Manager, a software program designed to handle home management operations such as checking accounts, expenses, and tax records, has been announced by Human Engineered Software.

Available for the Apple II series of computers, *Finance Manager*'s capabilities include tracking income, expenses, and personal assets; building budgets and comparing results; balancing multiple checking accounts; paying bills; and printing checks.

Finance Manager includes built-in help files as well as message windows. The program also offers a wildcard search

capability for access to specific transactions, as well as the ability to make financial calculations.

Suggested retail price is $99.95.

Human Engineered Software
150 North Hill Drive
Brisbane, CA 94005
(415) 468-4111

New Educational Software

DesignWare has released several educational programs that test and teach grammar, geography, math, and music skills.

In *The Notable Phantom*, ghosts, spiders, and a music-loving phantom teach children ages 5–10 the basics of piano playing.

Suggested retail price is $49.95. Versions for the Apple, Atari, Commodore, and IBM computers are available.

In *States and Traits*, families and children (ages 9 and above) can hone their knowledge of United States geography, history, and current trivia.

The map-maker/user has two options: charting states into their proper locations on a master map, or plotting topographic features into their correct geographic positions.

States and Traits has versions available for the Apple, Commodore 64, and IBM PC and PCjr. Suggested retail price is $49.95.

In *Mission: Algebra*, the right answer to a linear equation will locate the position of an errant sister ship, saving it from destruction.

Mission: Algebra is available for the Apple, Atari, Commodore, and IBM computers at a suggested retail price of $44.95.

Children ages 10–14 can improve their grammar skills with *The Grammar Examiner*. Players start the game as a cub reporter with the Grammar Examiner newspaper.

Editing copy and answering grammar questions pay off as the junior reporter earns promotions and moves his way up the masthead, to editor in chief.

Suggested retail price is $44.95. Available for the Apple, Atari, Commodore, and IBM computers.

DesignWare
185 Berry Street
San Francisco, CA 94107
(415) 546-1866

Story And Music Creation Software

Mindscape, Inc., has introduced two software programs in its *Bank Street Creativity* series. One allows children to create illustrated storybooks and the other to compose music.

Bank Street Storybook is designed for children ages 6–12. It allows them to draw pictures with a joystick in six colors on the screen. Then, using the keyboard, they can edit and color the pictures and write the story.

Storybook, available for Apple computers, retails for $39.95. A Commodore version will be released later.

In *Bank Street Musicwriter*, the user arranges notes on two musical staffs displayed on the screen. Notes are placed where the cursor is positioned, and as they are entered, are seen and heard.

Four voices—soprano, alto, bass and tenor—can be programmed and played at once. Eight editing modes allow the user to save and print the music.

Available for Atari and Commodore 64 computers, *Musicwriter* retails for $49.95. Apple and IBM PC versions will be available later.

Mindscape, Inc.
3444 Dundee Road
Northbrook, Il 60062
(312) 480-7667

Strategy, Action Games

Electronic Arts has introduced *Archon II: ADEPT*, a sequel to its strategy game, and *Skyfox*, a flying adventure game.

Skyfox is a single-player, disk-based game for the Apple II family. It pits Sky-Pilot against the enemy, whose mother ships are attacking Federation asteroid bases with aircraft and tanks.

After trying training missions, the player can attempt any one of 15 scenarios to advance in rank from Cadet to Ace.

In *Archon II: ADEPT*, chesslike strategy and action are combined. Players have the ability to conjure up spells, and the strategic goal is to gain magic power by capturing energy points.

Action play results when opposing pieces contest the ownership of a board square. The game may be played against the computer or another player.

Available for Atari computers with 48K of memory and the Commodore 64. Suggested retail price for each game is $40.

Electronic Arts
2755 Campus Drive
San Mateo, CA 94403
(415) 571-7171

Music Program, Economics Game

Spinnaker Software has introduced *Rock N' Rhythm*, a music writing program, and *President's Choice: Guns or Butter*, a simulation game that teaches economics and finance.

Rock N' Rhythm lets one to three players simulate a recording studio and record songs using a microcomputer. Players write their own music, or recreate favorite songs, and then perform them.

The melody, tempo, and rhythm can be changed by recalling songs from a storage area.

Available for the Atari and Commodore 64, *Rock N' Rhythm* retails for $39.95.

President's Choice: Guns or Butter uses data from the past five presidential administrations. The player in the role of president must review the state of the economy and prepare a national budget in order to keep the American economy running smoothly.

Success is reflected in positive opinion polls and reelection.

Available for the IBM PC and Apple II series, it retails for $39.95. Suggested age range is 13–adult.

Spinnaker Software
215 First Street
Cambridge, MA 02142
(617) 868-4700

New Arcade Games

Two Bally/Midway arcade games, *Spy Hunter* and *Tapper*, have been introduced in disk and cartridge formats for the Commodore 64, IBM PC and PCjr, Atari and Apple II families by Sega Enterprises, Inc.

In *Spy Hunter*, a shooting and driving game, the player is in command of an arsenal of weapons, including machine guns, oil slicks, smoke screens, and heat-seeking missiles.

Tapper features four different bar screens, which are crowded with unruly and thirsty customers. The bartender has to scramble to draw and serve drinks.

If he gets the tip on the bar, dancing girls appear. In the bonus round, players match wits with a riverboat gambler.

Suggested retail price for

Spy Hunter and *Tapper* is $39.95 each.

Sega Enterprises, Inc.
360 N. Sepulveda Blvd., Suite 3000
El Segundo, CA 90245
(213) 640-7087

Problem-Solving Program

Amazing Thinktanks, a mathematical/problem-solving program for ages 8–13, has been released by Sunburst Communications, Inc., for the Apple II series of microcomputers.

It is designed to put students in a situation where they must invent ideas, try them out, and if necessary, revise them. The program develops critical thinking and problem-solving skills while reinforcing the concepts of addition, subtraction, multiplication, and division.

Players are given two tanks and a storage tank, which they must fill and empty. There are four play levels, and the game can be played alone or competitively.

Retail price is $55.

Sunburst Communications, Inc.
Pleasantville, NY 10570
(914) 769-5030

New Product releases are selected from submissions for reasons of timeliness, available space, and general interest to our readers. We regret that we are unable to select all new product submissions for publication. Readers should be aware that we present here some edited version of material submitted by vendors and are unable to vouch for its accuracy at time of publication.

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LQ/3 11" carriage, 13 CPS

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For printers that are not Commodore-ready, Cardco offers the C/?+G PRINTER INTERFACE including all cables and connectors for the following printers: all new Epson MX, RX and FX series, Star Gemini 10X and Delta 10, Prowriter, C.-Itoh 8510, NEC 8023, Okidata 82, 83, 84, 92, 93 and 94, Mannesman Tally Spirit and MT-160, Seikosha GX-100, BMC BX-80 and the Gorilla Banana. Prints the full Commodore character set; graphics, characters, reversed characters and reversed graphics characters.

"WRITE NOW" WORD PROCESSOR SOFTWARE
An excellent time saver, CARDCO OFFERS THE CØ2 "Write Now" program with built-in 80 column display. You see exactly what will print. All special codes can be transmitted to printers maintaining justification. Easy full-screen editing; works with any printer.

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CARDCO D/Ø1 quickly (in memory) sorts by zip, category, name and state; fully compatible with "WRITE NOW". Other fine features include: User-oriented; menu-driven operation; each disk supports 600 entries. Format can print single, double or triple labels across.

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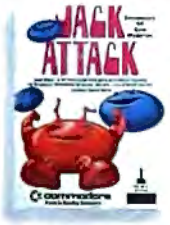
"The world's largest manufacturer of Commodore accessories."

LOOK WHAT'S ON TELEVISION TONIGHT.

6:00

JACK ATTACK



(Gold Medallion Game) Cartoon animation plus strategic challenge. 64 different screens. A Commodore original, rated "must buy" by Electronics Game Magazine. (Cartridge)

6:30

MATH FACTS

(Ages 5 to 10) (Micro School) Educational TV. Practice in basic math facts. Several levels (Easy to hard) (Diskette)

7:00

FRENZY/ FLIP FLOP

(Ages 6 to 14) (Milliken Edufun) FRENZY (subtraction and division) The hungry gator arrives save the fish play the BONUS game. FLIP FLOP (transformed geometry) look at the two figures . . do they need to flip, turn or slide? (Diskette)

7:30

SOLAR FOX

It's erase or be erased as you navigate spaceship over a grid of colorful pulsating entities, armed with laser. Unlimited levels. A BALLY MIDWAY original. (Cartridge)

8:00

EASY SCRIPT

Our best wordprocessor. Displays 764 lines by 40 characters. Prints over 130 columns. Global/local search/replace/hunt/find. Super/subscripts. Insert/delete characters, lines, sentences, paragraphs. (Diskette)

8:30

THE MANAGER

A powerful database management system. For business, educational or personal files. Not for Rockford's files. With four built-in applications. Or design your own (Diskette)

9:00

MAGIC DESK I

The scene opens on an office desk, complete with digital clock, typewriter, wastebasket and file cabinet. Select functions (typing, filing, editing) by pointing animated finger. (Cartridge)

9:30

INTER-NATIONAL SOCCER

(Gold Medallion Game) Sports highlight. With passing, kicking, diving goalies, even trophies! Great color, 3-D realism. No locker room interviews. (Cartridge)

10:00

SIMONS' BASIC

Rated PG. Expands Commodore BASIC by an additional 114 commands. Convenient programming commands such as RE-NUMBER and TRACE plus graphics plotting command. (Cartridge)

Announcing the most exciting variety show on television.

Featuring many of the stars of arcade games, education and the business world.

Produced by (and for) Commodore, the people who bring you the Commodore 64,™ a 64K computer that would be a value at three times its price. In fact, many of its competitors are three times its price.

Produced in living high resolution graphics with 16 available colors and with eight 3-dimensional sprites.

With a real high fidelity sound that covers a 9-octave range.

And a supporting cast of low-price, high capacity disk drives, printers, monitors (a better way to watch Commodore 64) and modems.

So, if you're not pleased with what's on your tv set tonight, simply turn on your Commodore 64.

COMMODORE 64

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