

review and further editing that might be needed. Keep a valid copy for future reference.

The Monthly Report And Corrected Forecast

Each month, you need only to survey your checkbook, salary check stubs, and one or two other records to get the real expense and income data for that month. The monthly cash report, with the year-end forecast numbers automatically corrected with new data entries, is easily produced with the following procedures, using the prior month's report as a worksheet:

1. Remove the parentheses from the current month-column heading.
2. Enter the actual payment amounts made for the month, line by line. If a planned payment is not made, delete any existing entry; reschedule the payment, if necessary, by entering it in a future month or by adding it to an existing entry for a future month.
3. Enter actual income dollars as received.
4. Make appropriate modifications to future months' payment and income data.
5. Save the current month's report to your VisiCalc data file diskette, using a unique file name.
6. Print the current month report. Edit it, make necessary corrections, then save and print it again.

This six-step, monthly effort should take less than one hour to complete. Keep each final monthly report for comparison with future reports. At year's end, the January and December report comparison will provide marvelous guidance for even more effective cash reporting and conservation in the following year. You will have made yourself something of an expert in personal accounting and personal finance management – no small accomplishment.

Some Practical Tips

1. Pocket Cash. Once or twice a month, write a check for pocket cash; include those checks in Miscellaneous (Monthly) expense or provide a separate Monthly line for Pocket Cash to keep it more visible and under better control.
2. In your VisiCalc cash report template, keep Column A (as in Table 1) to provide a left-hand margin for the printed reports. The margin will allow for three-ring binder punching.
3. Don't build column and line numbers into your template; they are shown in Table 1 only for convenience in this article.
4. Save each printed monthly report, and save the latest version of the cash report on your VisiCalc data file diskette. Be sure to keep an up-

to-date backup copy of the data file diskette, of course.

5. You can modify your report format at any time by inserting or deleting expense and income lines anywhere. If you insert a line, remember to use the summation function to get the data into the Total column at the right.

6. Don't fret over items you find hard to predict, such as Medical and Auto Repair expense. If you know there's an expense coming up, estimate it as best you can or ignore it, being sure to enter it when you actually pay the bill.

If you are using a spreadsheet other than VisiCalc, just remember that you must provide eight characters per column in the template design. A printer must have a compressed print mode (commonly, 132 characters per line) to print the report on a single standard 8½ x 11 sheet.

Your computer system, along with this practical cash reporting method, will help you to conserve and build your cash stash. The monthly cash report will provide:

- an excellent record of expenses and income to date
- a useful document for planning and scheduling future expenses and income
- advance warning of months where cash resources are likely to be low or non-existent, often avoiding the embarrassment of having to borrow money unexpectedly or on short notice
- peace of mind, especially when the cash assets outlook is good.

Some have remarked that personal accounting software isn't worth the time and effort required to maintain it every month. The spreadsheet-based system defined here solves that problem. You'll probably agree that an hour or less each month is well worth the results. ©

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VIC-20/C64 Word Processor: *The Quick Brown Fox*

Gregg Peele

The *Quick Brown Fox* is a word processor for VIC-20 and Commodore 64 microcomputers. The Commodore 64 version is the subject of this review, but both versions are substantially the same.

The production version of the *Fox* will be in cartridge form and will leave over 34K of memory (about 34,000 characters) available for text. The production version will also support an 80-column board which is in the works at this time.

The manual which accompanies the word processor is designed for the user who is totally unfamiliar with computers or word processing. The text is uncomplicated and includes many exercises which provide hands-on experience to supplement the concepts in the text. Included within the text are explanations of the idiosyncrasies of using a computer keyboard instead of a typewriter keyboard.

Since the software package was designed for use with several computers, specific instructions are given for each particular model, and explanations of the limitations of each computer are discussed at length.

A Simple Menu System

One point about this software deserves notice. The manual's

appearance is impressive. The cover appears durable, and the overall appearance of the manual is professional. This software would not seem out of place in an office atmosphere.

The word processor uses a simple system of menus and prompts to guide the user through the difficulties in producing professional text. The key to the effectiveness of this software is in the simplicity of the commands used to perform text manipulation. For instance, the main menu supports 12 different functions. Each of these is accessible by pressing the key which represents the first letter of the command. (T for text, D for delete, etc.)

Edit mode can be reached from text mode by pressing the left arrow key (located in the left upper corner of the keyboard). Pressing this twice provides an "escape" to the main menu. The availability of this function makes learning to use the *Fox* an easy process. If the user is ever in doubt about a command, he or she can use this key to return to the menu and review the available options.

Do you often repeat portions of text when you write letters or other documents? For instance, do you find that a letter to your grandmother may contain much of the same text as the letter you

sent to your aunt? *The Quick Brown Fox* has a special feature just for this and similar problems. This feature is called *boilerplating*. It allows you to store parts of text and retrieve them at any point within a document.

With this aid, you can write a letter to one person and use parts of the same letter to write to someone else. Both letters will contain some identical text (easily stored on a boilerplate). If your relatives are in close communication with each other, you can compose other parts of the letter to personalize the text for each relative. Boilerplates also come in handy for storing addresses, letterheads, and other repetitive text.

Boilerplates are retrievable through the use of embedded commands within the text. Unfortunately, boilerplates cannot be saved on disk or tape. The ability to save boilerplates would have made boilerplating a much more valuable tool. It is possible to edit boilerplates, but the manual warns not to delete the markers which delineate the boilerplate from the rest of the text.

Other embedded commands include: centering text, tabbing, right and left justification, margins, and page-end markers. Special print commands provide underlining, double-printed characters, proportional spacing, and a provision for changing the number of lines per inch. There are embedded commands which will automatically stop the printer while printing, allowing the user to insert text or change the type font or pitch, and then con-

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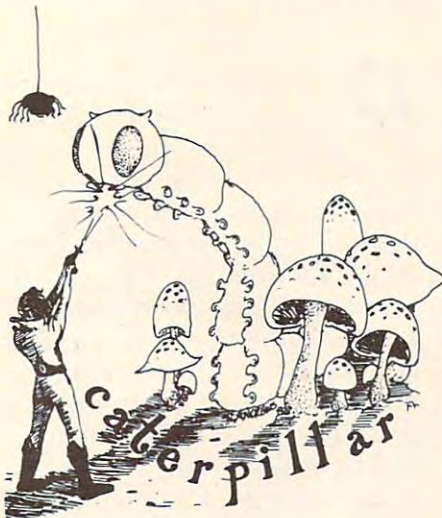
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These Adventures are written in BASIC, are full featured, fast action, full plotted adventures that take 30-50 hours to play. (Adventures are interactive fantasies. It's like reading a book except that you are the main character as you give the computer commands like "Look in the Coffin" and "Light the torch.")

Adventures require 16k on TRS80, TRS80 color, and Sinclair. They require 8k on OSI and 13k on Vic-20. Derelict takes 12k on OSI. \$14.95 each.



CATERPILLAR

O.K., the Caterpillar does look a lot like a Centipede. We have spiders, falling fleas, monsters traipsing across the screen, poison mushrooms, and a lot of other familiar stuff. COLOR 80 requires 16k and Joysticks. This is Edson's best game to date. \$19.95 for TRS 80 COLOR.

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It does have some limitations. It takes at least 8k of RAM to run the compiler and it does only support a subset of BASIC—about 20 commands including FOR, NEXT, END, GOSUB, GOTO, IF, THEN, RETURN, END, PRINT, STOP, USR (X), PEEK, POKE, *, /, +, -, >, <, =, VARIABLE NAMES A-Z, SUBSCRIPTED VARIABLES, and INTEGER NUMBERS FORM 0-64K.

TINY COMPILER is written in BASIC. It generates native, relocatable 6502 or 6809 code. It comes with a 20-page manual and can be modified or augmented by the user. \$24.95 on tape or disk for OSI, TRS-80 Color, or VIC.

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tinue printing the rest of the document. Not all printers can perform all the commands that the Fox is capable of producing.

The manual provides a helpful guide so users can deal with possible printer incompatibilities. Most problems with printers stem from the lack of standardization in printer control codes and the inability of some printers to accept some of the Fox's special features.

The Quick Brown Fox is easy to use and costs less than many word processors with similar features. I recommend it, especially for those users with limited word processing experience, but advanced word processing needs.

Quick Brown Fox
548 Broadway, Suite 4F
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\$65 (C64 or VIC-20)

Atari Data Perfect

Steve Steinberg

Data Perfect may well be the most powerful data base program to appear on the market for the Atari computer to date. Some of the things this program does are truly remarkable. How about, for example, flipping through 96 full-screen name, address and phone number files in ten seconds – that's right, 96 full-screen "pages" in ten seconds! In addition, the search function is about the fastest I have ever seen. But the pluses in this generally first-rate program make its one significant minus all the more irritating. The documentation is weak, and the result is a good deal of confusion and wasted time in trying to create data bases.

©

This does not come as a

total surprise. LJK's other major program, the word processor *Letter Perfect*, has a similar weakness. Even after experimenting with *Data Perfect* for more than a month, I find that while I love the program's capabilities, I dread having to learn the next part of the package that I want to use.

What makes this lapse particularly unfortunate with *Data Perfect* is that once creating a data base with the program is mastered, using it is really quite easy. It's what you could call a "user-friendly" program with "user-hostile" instructions!

But, at the moment, the only real competition is the very popular and widely acclaimed *File Manager.800* data base program.

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Working Well Together

Data Perfect is compatible with LJK's *Letter Perfect* for the Atari, which provides the capability of generating form letters and lengthy, complicated record formats. I have experimented with using *Data Perfect* and *Letter Perfect* together and they work like a charm.

Data Perfect can be used for doing some mathematical calculations. It permits adding, subtracting, dividing and multiplying various numerical fields, and also can do logarithms, exponents, and square roots, all of which are entered as formulas into a data base. *Data Perfect* also can provide totals and subtotals of the various fields, both while in the editing mode and while using the program's record-producing function. In addition, *Data Perfect* can do global deletions and additions when editing files (entering one command to change a field entry in every record). The program also can

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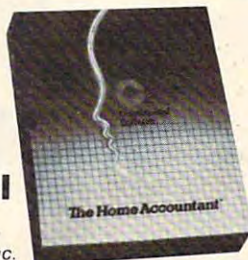
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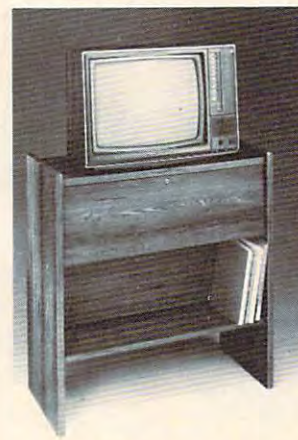
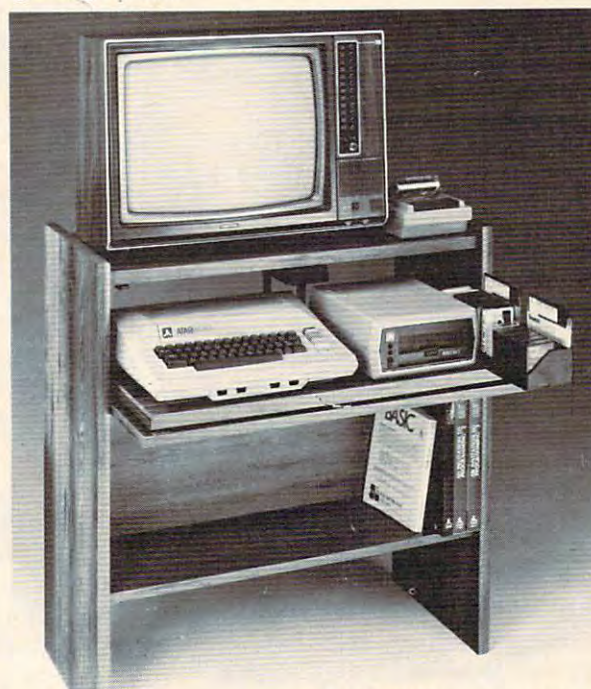


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automatically enter the current date in any file wherever specified by the user.

Data Perfect has all the functions one would expect of a quality data base. Fields can be added or deleted from an existing data base, columnar reports and mailing list formats can be generated and saved, and a variety of search and editing options are available. *Data Perfect* permits only one data base per disk, but this is not really a serious disadvantage.

Safety First

I have always wanted a fairly simple method for keeping track of my stock portfolio – nothing fancy, mind you, just stock name, original purchase price, number of shares and original value and present purchase price, number of shares and value. *Data Perfect* is indeed perfect for this kind of data base, and also gives me a total of any of these figures that I want.

When it came to saving my data base, however, I learned of another unique feature of *Data Perfect* – when saving a format, the program forces you to create a backup. This is certainly a good practice anyway, but with one disk drive it is a bit time consuming, since it is necessary to go back and forth between your source and backup disks, like the "Duplicate Disk" function of Atari DOS.

Sorts are accomplished the same way – going back and forth between your original and backup disks. When you have completed the sorting process, only the backup disk contains the sorted file. If it's a mailing list, this means you now need to turn your original into a backup disk to have two copies of the sorted data base.

The report-creating function is one area where *Data Perfect* really excels, but here again, the documentation doesn't help as much as it should. If you own the Bit 3 board that gives your

Atari 80-column capability, here is an opportunity to use it, since *Data Perfect* provides for an 80-column display. Even with 40 columns, you can get a good idea of what your finished product will look like, since the program provides for a horizontal scroll of 80 columns. You can also provide for a subtotal of any figures at up to four points in any report, plus a grand total.

Data Perfect's search function is also unusually good. While *File Manager 800* is certainly comparable in the speed of single criterion searches, when it comes to using multiple criteria, *Data Perfect* is far ahead in speed because of the difference in the way searches are initiated.

Some early copies of *Data Perfect* (including one reviewer's copy) had problems with data dropouts during sorts and while packing data bases. When we called LJK about this, we were told courteously to return the disk for a new copy. The new disk arrived within five days.

We were also told by LJK that the company is aware of the documentation problem and is planning to put out a pamphlet that, in effect, explains how to use the manual.

Data Perfect is an outstanding data base program for anyone who is willing to take the trouble to learn how to use it properly.

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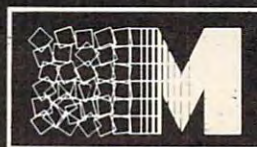
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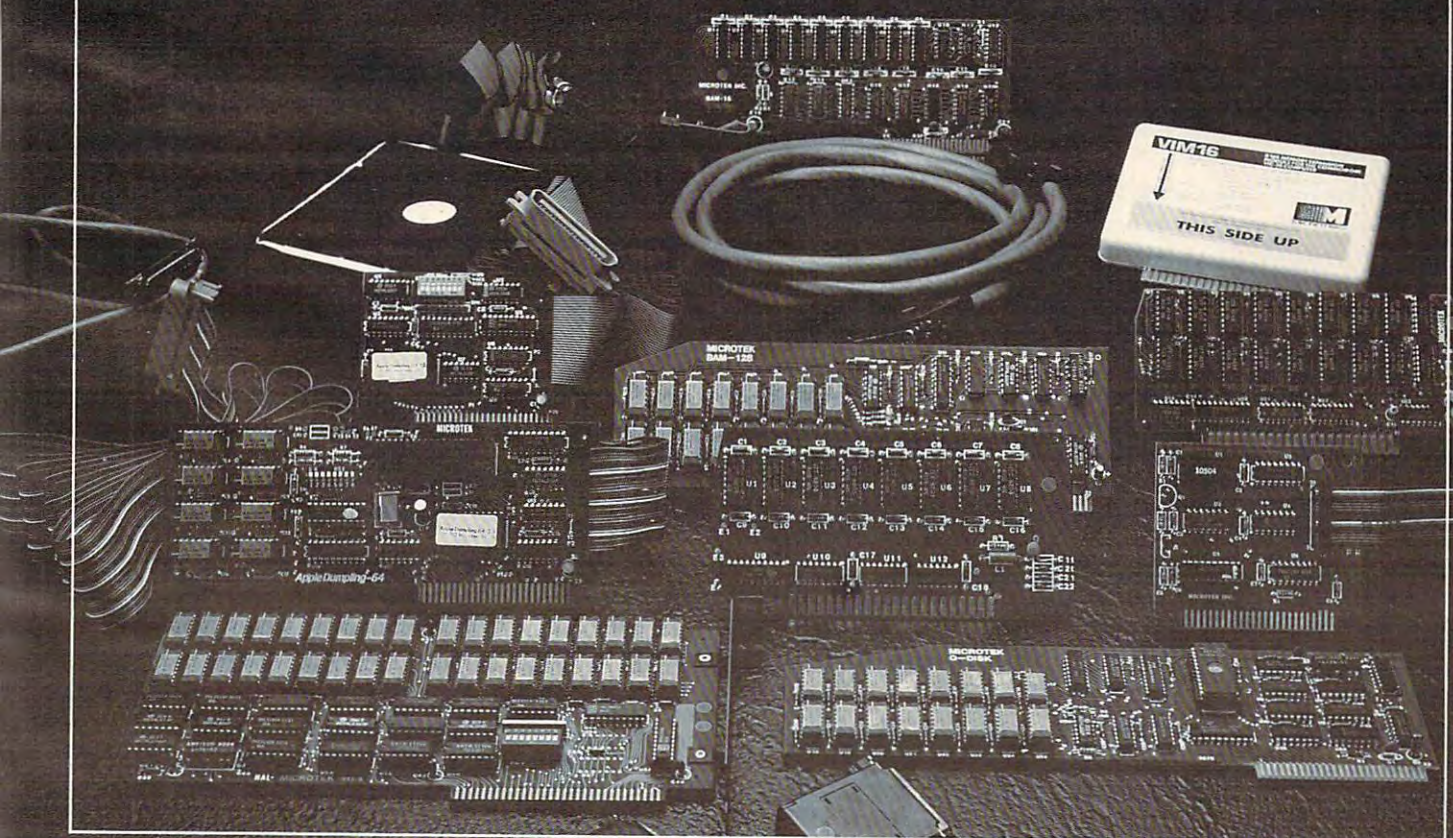
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VIC Practi-Calc

Emily Herman

One of the most popular programs ever written for microcomputers is *VisiCalc*. Since I use *VisiCalc* on my Apple III at work, I was curious to see how *PractiCalc* on the VIC would measure up. I was surprised to discover how similar the programs are, considering the difference in cost.

PractiCalc is a spreadsheet, a matrix of rows and columns. Data in the matrix can be manipulated for business reports and records. A VIC with a 16K upgrade has a 600-cell capacity; a 24K upgrade has a 2000-cell capacity. The location of each cell is given by a letter for the row and a number for the column. For example, A0 is the top left cell, B0 is directly below it, A1 is to the right of A0. Each cell in the matrix may contain either a label or a value. The value can be a number, the location of another cell (and therefore the same value as that cell), or a formula.

The manual is clearly written and well organized. It even has notes to help the experienced programmer modify the program if desired. An example spreadsheet is used as a step by step introduction to most of the available features. These features are: erase contents of cell, clear entire sheet, delete, insert or move a row or column, format a cell or the entire sheet (numeric display as decimal, \$ mode (two decimal places) or integer), change column width, 16 functions (ex., SUM, AVG, RND, trig functions), load a previously constructed sheet from tape or disk, save a newly constructed sheet to tape or disk, print a sheet or part of a sheet, sort rows, repli-

cate cells, show amount of space available, show cell contents and calculate. The "fix titles" feature allows horizontal or vertical headings to be fixed so that, no matter how far you scroll to the side or down, the headings remain displayed on the screen.

You must designate the number of rows and columns (any multiple less than or equal to 600 for 16K Upgrade) of your matrix when you start the program. It's worthwhile planning carefully, before you begin, what your maximum number of rows and columns will be. It is impossible to add more once you have started. Also, it takes about three and a half minutes to load the spreadsheet from tape. If you have several projects to work on, begin with as large a spreadsheet as possible. Then, when you have finished one project and saved it, you can clear the spreadsheet rather than reload

the program.

Added Options

The column widths are all the same size (your choice with a minimum of three). Again, planning ahead is in order as you would probably want columns as wide as or wider than your largest number. Column widths can be changed at any time; however, if you have included lines of text, they will need to be redone if the column widths are changed. Color contrast is used to good advantage in the screen display of the spreadsheet. The odd columns are light blue, the even columns are orange, and the current cell is highlighted in green.

Rows and columns can be added (if you have not used your maximum number) or deleted. They can also be moved. However, formulas are not re-referenced. For instance, sup-

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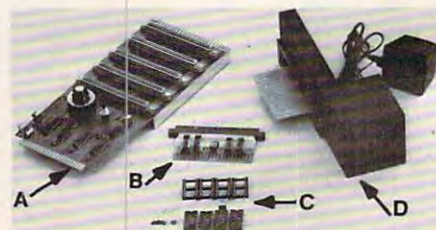
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pose cell C3 has the formula $A0 + A1$ in it. If you then add a column between 0 and 1, the cell A1 would become A2 but the formula in C3 would still read $A0 + A1$. Again, careful planning before you begin is in order.

As formulas are entered, they are not calculated until "!" is typed. This saves time. When "!" is typed, all formulas entered thus far are recalculated. Therefore, if you have made corrections or additions to your data or formulas, these new values will be used. The disadvantage to this is that the more formulas there are, the longer it takes to recalculate. *VisiCalc* is a little more sophisticated in this respect. It has a manual mode which performs calculations only on the current cell.

To experiment with *PractiCalc*, I set up my financial records. My sheet was 30 x 30. The first column had the months of the year; the remaining columns had a heading for each area under which money either comes in or goes out during the year. I then entered the data. Using the SUM function, I typed in the formula to total salary income. Next, I replicated this formula to get the totals for all the other columns. I tried out several of the other functions, AVG, MAX, MIN. Each time, I entered the first formula, replicated it across all the other columns (one step), and then recalculated. The last one took about 15 seconds to replicate and recalculate. By this time there were over 100 formulas to recalculate.

Overall, I was very impressed with *PractiCalc*. It could be very useful to a small company or for keeping home records. At \$35 it is certainly a bargain.

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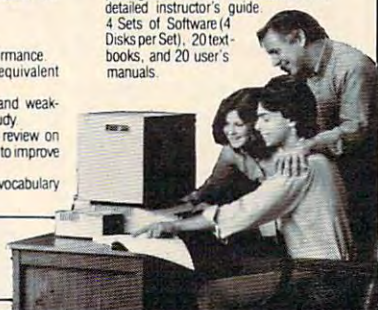
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PaperClip

Word Processor For PET/CBM

Louis F. Sander

PaperClip is a full-featured word processor for the PET/CBM with BASIC 4.0, 32K of memory, and Commodore disk drive. Another version, substantially the same, is available for the Commodore 64, although this version was not reviewed. The PET/CBM version of *PaperClip* includes a single diskette, a 112-page manual, and a ROM chip which must be installed before the program will work. The package includes a registration card, but nothing is said about the availability or price of future updates.

Documentation

The manual is well-written, thorough, and nicely constructed, and describes *PaperClip* in a better than adequate, but somewhat short of excellent way. It is written for people with at least an intermediate level of computer knowledge and experience, and office-oriented users may find it hard to use at first. For example, it includes few illustrative examples of anything except simple text editing, and no detailed information on inserting the ROM or backing up the master diskette. The dealer could of course provide information on these subjects.

Those who like colorful covers and strong, black printing on heavy paper stock will find much to appreciate here. Overall, the book is well-made.

When I opened my manual, I thought I was in for another "awful computer manual" experience, but fortunately that did not materialize. In general, the manual is logically organized, with simple matters covered first and advanced topics

left until last. There is a well-done errata/addenda sheet accompanying the manual. The absence of an index, however, is a shortcoming – this program has 106 control functions and 41 formatting directives, but there is no fast way to find where they are covered in the text.

A Flexible Word Processor

PaperClip is a very powerful word processor, with so many features that most people will need only a fraction of them. Its text editing features are nicely constructed, with PET's cursor control keys being used wherever possible. The OFF/RVS key is used as a CONTROL key for initiating the more complicated commands. (The Commodore 64 version uses the C-64's actual CONTROL key.) There are so many of these that I felt a real need for stick-on key labels to help me find them.

As with most word processors, you can correct text on the screen, and move it easily from place to place. *PaperClip* offers two ways of moving: any number of complete screen lines, or any part of a paragraph. The insert mode lets you set the mode, then just begin typing, without having to pay attention to the length of the insertion; this is an improvement over other word processors I have seen.

Some other *PaperClip* features not found in all word processors are:

- One keystroke can put the cursor at end of text.
- Text can be saved to tape as well as to disk.
- When saving text, the line

number being saved appears on the screen, as a handy indicator of progress or trouble.

- While the disk directory is on the screen, any text file can be loaded just by moving the cursor to its directory entry.
- A Table of Contents mode lets you flag text items for automatic inclusion in a printed Table of Contents.
- Text searching has a "wild card" mode.
- Numeric mode allows easy alignments of decimal points in columns of figures.
- Horizontal scrolling allows screen lines to be wider than the screen itself, simplifying production of wide documents.
- Column manipulation mode allows powerful moving, adding, and sorting of anything printed in columns. This mode seems to have been well thought out, and will be invaluable to those whose work includes columnar data. It is not as powerful as a good spreadsheet program, but it provides more than enough power for elementary applications.

- The program supports a wide range of printers and claims (undocumented) to be able to support even more, using a custom printer setup file.

No brief review can detail all the features of any powerful program, and this one is no exception. The list above shows that *PaperClip* has a lot of power.

Overall, *PaperClip* is a very good word processor with a pretty good manual. It includes most of the features found in other word processors and has some excellent, uncommon features of its own. The manual is complete.

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Silicon Office For PET

Richard Mansfield, Senior Editor

Two of the main uses for computers in offices – word processing and data base management – are combined in *Silicon Office*, an impressive business software package, now available in the United States. It is written entirely in machine language and uses up 54K bytes. Because it is so large, it will only work on an 8032 PET which has been expanded via 64K additional RAM memory. This unit is sometimes called the CBM 8096. The 8096 can be purchased from dealers or a memory board can be added to an ordinary CBM 8032 in about five minutes.

There are versions of the program for the 8050 disk drive and for the Commodore 9060 or 9090 hard disk. Because the software takes up so much of the computer's RAM, the disk is accessed frequently and its use is automatic and safeguarded against loss of information. The program is well designed in several ways, not least of which is the protection it offers against I/O (input/output) disasters.

The built-in word processor supports all the necessary features for generating text documents. You can work with lines varying from 20 up to 125 characters in length. The convenience of the CBM cursor control keys is retained and even expanded. For example, the screen can only display lines up to 80 characters, but if you cursor to the left or right side, the document instantly adjusts itself to reveal any hidden text. If you have experience on WordPro or other advanced word processors, the functions of the *Silicon Office* word processor are easy to learn. It can also make arithmetic calculations during printout and works hand in hand with the other capabilities of *Silicon Office*.

The data base is directly available to the word processor.

Data Base Programming

Unlike other data base programs, you have significant control over the behavior of *Silicon Office*.

There is a built-in language for data manipulation, filing, accounting, word processing, and system control. It contains over 30 commands such as "Prior Record" which can be used either directly or from within a program (much like BASIC). There are an additional 25 words for word processing. If you type Edit Program (or "EP," each command has a short form), the screen displays a format in which you type line numbers, commands, and arguments. Whenever you type GO, the program currently in memory will take control and can calculate, print documents or reports, update or rearrange files, and so forth. Above all, this facility makes it easy to customize *Silicon Office*, to make it efficient and responsive to your needs.

Programs, text formats, and file formats can all be created on screen, saved or recalled from disk, and linked to one another within programs.

Automatic Sorts

The data base is *relational*. You can create interactions between up to six completely separate files. In addition, you can expand the size of records (in characters) from the normal 256 by linking records together. Records are easily created on screen, can be of varying length, and can work together in as simple or as complex a fashion as your needs dictate. *Silicon Office* manages to combine great flexibility with ease of use. That's a difficult marriage to arrange as anyone who's written a complicated

program will attest. *Silicon Office* is one of the most impressive pieces of software I've seen.

Sorting records is one of the essential tasks of a data base. First-time users of *Silicon Office* might look for a Sort command. There isn't one. Records are sorted *as you enter them*. If you've typed in 100 names and addresses, they can be accessed either by record number (the order in which they were entered) or in sorted order. An equally impressive, very fast search command will fly through a file looking for a match.

How fast is *Silicon Office* in general? It's quick where it needs to be. If you are using a 50 characters per second printer with some memory of its own, you can enter invoice data for each record and the invoices will print out continuously. *Silicon Office* will not slow things up.

It is slow to accomplish some relatively rare functions. For example, if you decide to merge two large files, you might want to give it several hours and that could mean letting it merge after working hours. In general, however, the program is quick, efficient, and flexible. *Silicon Office's* documentation is excellent, too. Two well-written books accompany the product: a *Training Guide* and a *Reference Guide*.

Communications capabilities are built in. *Silicon Office* can talk to other *Silicon Offices* across the room or thousands of miles distant, through a modem. This feature, too, benefits from the interactivity which characterizes all aspects of the program. All in all, this is an outstanding product which deserves serious consideration when small- to medium-sized businesses decide it's time to automate the office.

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Turbocharger For Apple

Richard Cornelius

Turbocharger is a Disk Operating System (DOS) and date-stamping program for the Apple II written by Roland Gustafsson. The disk comes in a plastic bag with a folded sheet of heavy stock on which the documentation is printed. The disk "may be copied by the original purchaser only as necessary for use on the computer for which it was purchased," according to the instructions.

The feature of *Turbocharger* that many users would find most impressive is the increased speed for the DOS commands BLOAD, BRUN, LOAD, and RUN. The DOS in memory is changed to the fast DOS when the file TURBO is BRUN. How much are the DOS commands speeded up?

To answer that question I wrote a simple BASIC program to BLOAD a high-resolution picture (a 34-sector file containing 8K of graphic image) ten times in succession. Normal DOS ran this program in 90 seconds. The *Turbocharger* DOS completed the task in 25 seconds.

For comparison, I tried another "fast" DOS which is used by a major commercial software publisher, and the same program took 32 seconds. I also tested each of the DOS variations with an Applesoft program. Normal DOS required 22 seconds to load an Applesoft program that occupied 89 sectors on the disk. Both *Turbocharger* and the other fast DOS that I tried loaded the same program from the same disk in about five seconds. Since loading times include the start-up time for the disk drive, the actual time for loading the pro-

gram was decreased roughly by a factor of five.

On the surface, the fast DOS seems to operate very well. When I began to use it in my own software development, however, I quickly encountered a problem. The two programs below show circumstances under which the *Turbocharger* DOS seems to be failing to CLOSE the DOS input/output buffers properly.

Program 1.

```
100 D$ = CHR$(4)
110 PRINT D$ "BSAVE BINARY FILE,
    A768,L1"
120 PRINT D$ "BRUN TURBO"
130 PRINT D$ "MAXFILES1"
140 PRINT D$ "RUN SECOND
    PROGRAM"
```

Program 2.

```
200 REM .....
210 REM .....
220 REM .....
230 REM .....
240 REM .....
250 REM .....
260 D$ = CHR$(4)
270 PRINT D$ "BLOAD BINARY FILE"
```

I initialized a disk with the first program and saved the second program as SECOND PROGRAM. When I booted the disk, I received a NO BUFFERS AVAILABLE error in the last line of the second program. I do not understand the source of the error. If line 120 in the first program is changed to BRUN a dummy file, no error occurs. If one of the lines 200-250 in the second program is deleted, then no error occurs! Whatever the source of the problem, it can apparently be overcome by placing a PRINT D\$ "CLOSE" statement into a new line 265 in the second program. For personal use the fast DOS is probably satisfactory, but for serious developmental work, caution is in order.

Date Stamping

The other major feature available with *Turbocharger* is the "date-stamping" of files. A one-line Applesoft program that is supplied on the disk is used to

change the date. Whenever you save a file, the current date is also saved. The catalog has the normal appearance except when the command MON O (a standard DOS command) is used. This command shows the date at the right-hand edge of the screen.

For long file names (DOS allows up to 30 characters) as many as seven characters at the end of the file name may be wiped off the screen by the date. RESET or the DOS command NOMON O makes the catalog appear in the normal manner. In either catalog display, the number of free sectors on the disk is given at the top.

Two other programs are available on the *Turbocharger* disk. One is a DOS command changer that allows you to change the DOS commands on a disk. The documentation says that you can change the commands to "anything that you want." The limitations that do exist (for example, the length of the commands) are not explained in the documentation, but these limitations are not ones that a user would likely encounter. The greatest value of changing the words used for the various DOS commands is generally in shortening them so that one or two characters can be used in place of the standard commands. For the purpose of changing the commands to one or two letters, the command changer program performs its task without any problems.

The other program on the disk is a "quick-copy" program. The added features of the *Turbocharger* DOS have replaced the INIT command so that you cannot initialize disks with the fast DOS. Other fast DOS programs generally operate in the same manner. You must initialize disks either by using the normal DOS or by using the COPYA program on the System Master Disk to copy a disk that is already

initialized. Once you have an initialized disk, the quick-copy program will copy the contents of one disk onto the newly initialized disk.

The documentation that accompanies the *Turbocharger* disk is brief but complete. It includes a suggestion on what to include in your HELLO programs to make changing the date easy, and it presents information on which zero-page locations are used, how the date is linked to the file name, and where in DOS the altered routines lie.

Turbocharger
Silicon Valley Systems
1625 El Camino Real
Suite #4
Belmont, CA 94002
\$29.95

Pathfinder For Atari

John DiPrete

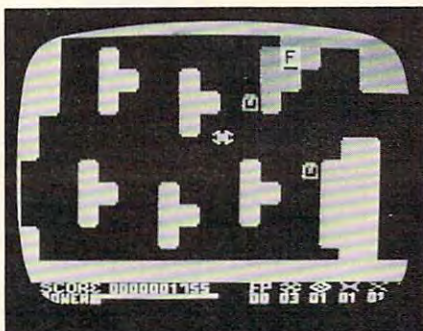
Programmer Randy Jongens may have taken his cue from *Three Mile Island* when he decided it was time for a game about radioactive materials in Gebelli Software's latest release for the Atari, *Pathfinder*.

Your *Pathfinder* is a "being" which moves at a velocity similar to that of *Pac-Man*'s through a maze several times larger than the viewing screen. Each time you glide over a canister of nuclear waste, you absorb energy. Hoping to out-power you is a foe called Nuke which also collects energy. Until it's strong enough to pose a threat, however, Nuke flees from you. A bodyguard called Minelayer safeguards Nuke by planting mines to block you. If your *Pathfinder* blasts the booby-traps, a fire ignites. The only way to douse the electro-light is to get fire-retardant pellets from a fire station. To enliven the

spectacle, Phantoms zigzag through walls at you.

Pathfinder zaps the enemy at long-distance, recharging itself by gulping down "hot" spillage. A display at the bottom of the screen offers helpful data regarding power indicators, target numbers, and remaining *Pathfinders*. You control the waste-eater's motions by aiming the joystick in eight possible directions, pressing the button to fire plasma-blasts. With enough fire-energy, you can abolish maze walls. Angle shots, in any 45-degree direction (NE, NW, SE, SW), are not easy.

©



Searching for canisters of nuclear waste in the mazes of Pathfinder.

The graphics in *Pathfinder* are abstract. Squares, angles, and bric-a-brac constitute Nuke, *Pathfinder*, and the rest of the characters in the game. The shapes are flat, one-dimensional. No human, extra-terrestrial, or vessel-bearing features exist. No sharply-defined expressions signify the type of life (human, alien, or robotic). The rapidly-blinking geometric figures are hazy, vague, and specter-like. Maze walls remain completely solid, except at the beginner's level, where lattice-type structures exist. The instruction sheet doesn't identify the squashed-up pretzel-things that turn up now and again, so it's hard to realize at first that they're "residue" of half-crumpled targets. (A succession of plasma-blasts is required to vaporize a wall - if only a tiny dose is received, it remains in partial form.)

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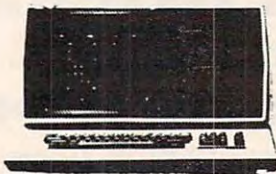
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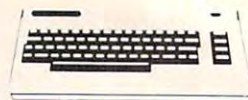
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Combined Themes

In *Pathfinder*, the strategy of planning ahead, locking horns with Lady Luck, and using ESP is stressed above coordination. Instead of relying upon firing ability, you've got to weigh facts and judge carefully: Which path is best? Where will I gain points? How much energy must I expend?

Pathfinder combines some general themes found in other types of games. One, for example, is the football theme, characterized by "running to the finish line" (i.e., clearing the maze completely of waste), deft "blockers" like Minelayer thwarting your dives at Nuke (when it's weak), and so on.

Another is the chess theme, in electronic form. Each character in *Pathfinder* has its own peculiar move-and-attack ability. There

are Phantoms breezing through walls, fires spreading bit by bit, and Nuke, *Pathfinder*, and Minelayer possessing different levels of strength.

Finally, there is the treasure hunt theme, exemplified by finding and following the most efficient paths to the random scattering of canisters in the maze. The map of the screen changes with every reappearance, and you must be wary of pirates (Nuke, Minelayer) and trapholes (mines, fires).

You can choose from a selection of 15 difficulty levels. The upper levels throw a lot of out-of-control fire at you, loads of high-spirited Nukes, and helter-skelter effects, making for more challenging play.

It's rather like *Pac-Man* in 3-D. A *Pac-Man* aficionado might insist that any similarity to the

Prince of Mazes is superficial (like comparing *Space Invaders* to *Galaxians*). So, why not? Both are classic examples of excellent variations on a theme. Likenesses, differences. In *Pathfinder*, the break-away obstacles, detonating bombs, and sprinting ghosts stretch into a super highway of sloping, curving space.

Pathfinder's simulation of reality may turn off hard-core scientific purists (for whom the idea of gobbling nuclear garbage in a maze simply won't wash). But for players less scientifically straight-laced, the fiery dynamics will glow through.

Pathfinder
Gebelli Software
1787 Tribute Road
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ZX-81 Home Computer Package For Sinclair/ Timex

Arthur B. Hunkins

The ZX-81 Home Computer Package is a sampler of four programs for the Sinclair ZX-81, Timex TS-1000, MicroAce, and 8K ROM ZX-80. An alternate version, also priced at \$9.95, is available for the standard 4K ROM ZX-80. Running in all cases within 1K RAM, each program is written largely in machine language, and is a tribute to what can be done with only 1K of memory using machine code. The programs, *Etch-A-Screen*, *Music Composer*, *Checkbook Balancer*, and *Billboard*, are all small miracles of creativity in 1K. (I should add that, for all programs except *Billboard*, suggestions are given for fruitfully extending program capability if more than 1K is available.)

The package is produced by LAMO-LEM Laboratories, a fact presumably related to the inclusion of a laminated cover on the

excellent eight-page instruction manual, and two laminated keyboard overlays (for *Music Composer* and *Checkbook Balancer*). An interesting collaboration/application indeed (the overlays are designed to be taped to the keyboard). Other materials included in the packet are handy reference cards for all programs except *Billboard*, a screen display matrix (for *Etch-A-Screen*), and a music coding sheet. (For some reason, the *Composer* reference card omits one of the four available octaves, and so is unnecessarily confusing.)

The programs, all gems in their own right, have several features in common. All run immediately upon loading; all have built-in provisions for saving program data (so that when a saved program is loaded it goes right on doing whatever it did the time before). Thus it will

display a previously stored message or screen design, play a previously coded melody, or list a previous checkbook balance along with currently uncleared entries.

Three complete sequences of the four programs are recorded on the cassette. I experienced no LOADING difficulties.

Billboard is clever and simple. You enter a message of up to 250 characters, and it scrolls slowly, in large letters (and I mean large), from right to left across the screen. (Only about half of Sinclair's graphics characters are implemented.) This is a novel way to leave a message for someone — a message that can't easily be ignored!

Etch-A-Screen is much more complex — perhaps a bit overly so (it takes some time to become proficient). Essentially, it permits you to place any keyboard char-

acter (including most reverse field characters and all graphics) anywhere on the screen, and save the display. Keys repeat automatically (a very nice feature), and the cursor can go diagonally as well as sideways and vertically. (It also wraps around the display.) In the 1K version, the display is limited to 17 lines; a 2K extension (two POKEs) expands to full screen capability. Additional features include cursor turnoff and CLEAR SCREEN commands. The instructions indicate that "it may be possible to use the printer to copy the picture." I was unable to test this feature.

Checkbook Balancer also works well for its intended purpose. An initial balance is entered, then credits and debits with dollar amounts and ID numbers. Entries may be voided, or cleared (when the bank statement arrives); transactions can be displayed at will. Mistakes (such as voiding or clearing nonexistent entries) are rejected with an appropriate ERROR message. The 22-entry limit may be raised to 100 with 2K of memory (standard on the Timex).

Music Composer is a truly impressive display of efficient machine language programming. How so many features can be fit into so little space I do not know. (One thing that helps is the lack of a screen display; the blank screen also mercifully kills the bothersome hum otherwise generated.) The program is essentially a keyboard play/memory replay routine. The middle two computer keyboard rows are implemented as a two-octave C major scale, with the shift key taking all notes up two octaves for a total of four octaves. Chromatics and keys other than C major are not available (except with the modification below, which is not difficult to incorporate).

Special Effects Keys

One key is used to signal the

beginning and end of a stored segment to be played back (up to 175 notes and durations are automatically stored as performed). An EDIT function (with single step both backwards and forwards) is available to locate (and replay) specific notes – as well as to change them. There is also a REST key. Although in live performance the program senses when a key is released (giving silence), the rest is not recorded in memory. This is a real inconvenience; combined with the fact that durations are stored very inaccurately, the replay function has limited utility.

Two Special Effects keys either raise or lower all pitches by microtones (depending on how long you hold the keys down). Fooling extensively with these keys produces many unpredictable results (e.g., fast quasi-random pitch sequences). The manual duly warns that once you begin experimenting with these keys, "it may be difficult to return to the unmodified state." A modification "for the advanced programmer" even gives directions for "playing" the 8K ROM (a random set of pitches and rhythms). Another extension (again, 2K memory) permits storing up to 350 notes.

Two features would be welcome additions: a key transposition option during playback, and a tempo scaling factor (providing different playback speeds). Both would require simple multiplication routines (unfortunately cumbersome in machine language), as well as a good bit of input/output overhead.

A program like *Composer* simply invites modification. Here are two suggestions. One mod everyone should make, as the highest octave is noticeably out of tune. Hit BREAK while the program is SAVEing, and execute (without line numbers) the following POKES: POKE 16586,19; POKE 16587,17. This should take care of the tuning

problem.

The lack of accidentals will be a notable drawback to many hobbyists. Here is a way of re-programming the pitches played by the two rows of note keys. The trick is to know where in memory the numbers representing the delay loop values for the particular pitches are stored. It turns out that the values for the bottom row of keys, unshifted, are stored in locations 16555-16562, the top row unshifted in 16564-16571. The bottom row shifted is in 16573-16580, and the top row shifted, in 16582-16589. Substituting the values below will create a chromatic keyboard over the two middle octaves of the previous four – one octave without using the shift key, an octave higher with shift. (Armed with the appropriate values for the various pitches, you can now create your own keys – i.e., program the keyboard for D major, E minor, etc.)

Again with a program BREAK during SAVE, POKE the following values in memory locations 16555-16562: 125, 111, 100, 93, 83, 74, 65, 62. In 16564-16571, POKE 133, 117, 105, 93, 87, 78, 69, and 62. Locations 16573-16580 remain unchanged, while 16582-16589 are POKED to 65, 58, 52, 46, 43, 38, 34, 30. The bottom row of keys is C D E F G A B C as before, while the top row is now B C#(D-flat), D#(E-flat), F F#(G-flat), G#(A-flat), A#(B-flat), C. Have fun creating your own scales and tunings. Maybe you can come up with something really exotic!

In sum, the ZX-81 Home Computer Package is unique, lots of fun, and practical. At \$9.95, with all the extras, it's a bargain. I'm sure it must be a treasure chest of machine language programming ideas for the Sinclair as well.

ZX-81 Home Computer Package
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Questions Beginners Ask

Tom R. Halfhill, Features Editor

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

Q When I try typing programs into my computer from the listings in **COMPUTE!** and other magazines and books, lots of times I see characters or symbols that are not on my computer's keyboard. How can I type these characters?

A The problem stems from the fact that computers can display many special characters on their TV screens that most printers do not reproduce. Sometimes these special characters are odd punctuation symbols. Other times they are *control characters* or *graphics characters*.

These are special character "sets" (a collection of related characters) found on most home computers. To type them on the screen, most often you must simultaneously hold down a CONTROL key, GRPH key, or some other special key which acts sort of like a SHIFT key.

These special characters can be used for computer graphics, such as games, where they are often combined to form shapes. Control characters also are used to send instructions to devices attached to computers. One example is printers. On a printer which is capable of underlining words, special control characters placed before and after the word tell the printer when to start and stop underlining. Naturally, you don't want these control characters to show up in the paper, you just want their *effect*. So the printer interprets them as instructions to change its printing mode, rather than as characters to print.

In the case of special graphics characters, the printer is often simply not capable of reproducing the character. Sometimes the printer will leave a blank space; other times it will print an odd character of its own.

That's why programs which use special characters often do not print out on paper as they should. To get around this problem, **COMPUTE!** has developed special ways of denoting these

special characters in the program listings in the magazine. Every month, **COMPUTE!** includes two guides – "How To Type **COMPUTE!**'s Programs" and "A Beginner's Guide To Typing In Programs." On these pages are sections for each computer brand which show how to type special characters which do not appear on the keyboards. Misinterpreting these special characters is probably the most common source of errors in typed-in programs. Look in the Table of Contents in this issue to find these important aids.

Q Exactly what is a computer monitor, and how is it different from a TV? How should I decide if I need one?

A To avoid confusion right off the bat, we'll define what we *aren't* talking about here: *machine language monitors*. A machine language monitor is a program, an aid for machine language programmers, and has nothing to do with *display monitors*.

A display monitor is a television-like screen device that can be hooked up to many home/personal computers. In fact, some computers come with their own monitors attached or built-in, such as the Commodore PET/CBM, and Radio Shack TRS-80 Models I, II, and III.

Essentially, a monitor is a TV which has been optimized for computer use. It displays screen images, especially text, more sharply and with greater stability than a regular TV can. For this reason, it is often preferred for word processing or serious programming.

A monitor is sharper than a TV because it gets the video signal directly from the computer's video output. Designers had to compromise a little in order to make computers compatible with ordinary TVs. To display an image on a TV, a computer must convert its video output to simulate a normal broadcast signal. It does this with an RF (*Radio Frequency*) modulator, which is built into some computers (such as the Atari and Commodore 64), or visible as a small box on others (VIC-20, Apple II). The RF modulator connects to the TV antenna terminals. Then the computer's video output will be the same as a broadcast signal from an ordinary TV station. This means the computer's video output must be re-converted

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by the TV's receiver before it is displayed on the picture tube. This two-stage process – converting the video output to a broadcast signal, and then re-converting it back to a pure video signal – loses some sharpness in the translation.

Monitors bypass all this converting by tapping the computer's video output directly and sending it straight to the picture tube. In addition, specially designed circuitry makes the image even sharper and more stable. And since the monitor lacks a receiver (unlike a TV), it is much less likely to be bothered by stray interference from CB radios, poor connections, or even the computer itself.

There are full-color monitors and *monochrome* (single-color) monitors. Monochromes may be black and white, green, or amber. Some people find different colors easier on their eyes. If you have severe interference problems with your TV, or have trouble reading the screen, you might look into the possibility of buying a monitor. Prices are often comparable to TV sets of the same screen size.

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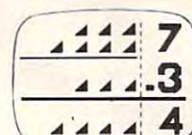
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TI-99 Match-Em

C. Regena

In addition to its primary purpose of captivating youngsters, this program also serves as a guide and example of how to create educational games on any subject.

This simple matching game is designed for young children. A screen of 16 squares is shown. Press the letters on two of the squares to try to match the shapes. If you "Match-Em," the shape will be drawn at the right side of the screen, and you won't be able to use those squares again (the shape is replaced by diagonal lines). There are eight pairs of shapes to try to match.

If you wish to stop the game at any time, press "S" and the placement of all the shapes will be shown. After each game you have the option of trying again – with the shapes scrambled in a different random order.

Other Applications

Take a look at the BASIC logic in this game, then design your own. You may wish to use the capabilities of the TI-99/4A graphics and draw other pictures – animals, people, designs, etc. Each shape here is drawn in a separate character set, and a random foreground and background color combination is chosen. Keep your drawing to eight or fewer graphics characters; you may also want to specify a certain foreground and background color.

You can make this matching game into an educational game. Instead of matching shapes, match an answer to a mathematics problem; match a capital city to its state; match a date to a historical event; match parts of a compound word. Whatever you want.

Programming Techniques

DIMensioned arrays start with a subscript of zero unless you specify OPTION BASE 1, which starts subscripts at 1. I used dimensioned numbers to keep track of the eight shapes (16 total) and various coordinates needed for graphics.

MX() and MY() are the X and Y coordinates to draw a shape at the right of the screen after it has been successfully matched. The coordinates

depend on how many matches have been made.

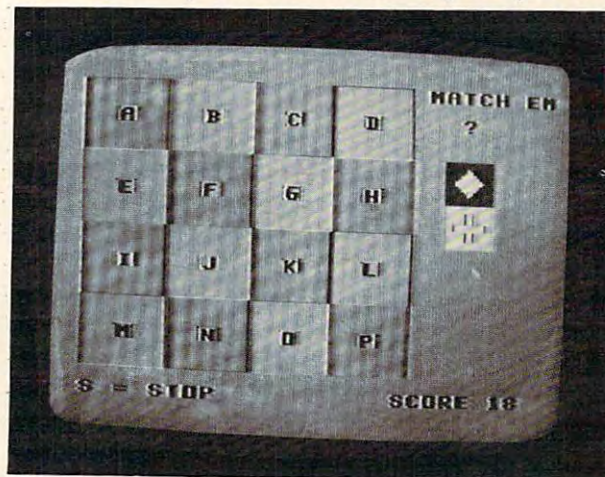
C1() and C2() are the X and Y coordinates for each square in the 16-square screen. D() indicates a red or a blue square.

A() and B() keep track of what shape is in which square. I use two arrays so that one can be a working array. B() also keeps track of the original order of the shapes when all the shapes are drawn (if you press "S" or if you have made all eight matches).

Lines 270-370 define graphics characters while the title screen is shown. Line 280 beeps a random sound for each character as it is defined. Graphics characters are defined by a string number. A null string is indicated either by "" or by two commas together and will yield a blank square for that graphics character. You do not need quote marks around the graphics string if it is in a data statement.

Lines 410-420 redefine the parentheses as a blue square and a red square. The game screen is then printed with lines 500-540. PRINTing characters is often faster than using the CALL HCHAR or CALL VCHAR method.

The shapes are numbered from 1 through 8. Lines 550-580 put the shape numbers in the B() array. Lines 600-660 mix up the members of the B() array and place them in the A() array. After a



Can you match the hidden symbols behind the colored squares?

Lines 710-760 choose a random foreground color and a random background color for each shape, making sure that the foreground color is not the same as the background color.

Lines 1490-1590 are a subroutine to draw the shape starting at coordinates X and Y. CH is the character number and is calculated in line 1480, depending on the shape number.

Line Nos.

```

100 REM(3 SPACES)MATCH-EM
110 OPTION BASE 1
120 DIM A(16),B(16),C1(16),C2(16),D(16),MX(8),MY(8)
130 FOR C=1 TO 8
140 READ MX(C),MY(C)
150 NEXT C
160 DATA 7,26,10,26,13,26,16,26,7,29,10,29,13,29,16,29
170 FOR C=1 TO 16
180 READ C1(C),C2(C),D(C)
190 NEXT C
200 DATA 3,5,40,3,10,41,3,15,40,3,20,41,8,5,41,8,10,40,8,15,41,8,20,40
210 DATA 13,5,40,13,10,41,13,15,40,13,20,41,18,5,41,18,10,40,18,15,41,18,20,40
220 CALL CLEAR
230 CALL CHAR(64,"3C4299A1A199423C")
240 PRINT TAB(10);"MATCH-EM":;:::;:
250 DEF R=INT(RND*200+900)
260 DEF R15=INT(RND*15)+2
270 FOR C=96 TO 159
280 CALL SOUND(50,R,4)
290 READ C$
300 CALL CHAR(C,C$)
310 NEXT C
320 DATA " ",FFFFFFFFFFFFFFFFF,,,,,000000000003CFF,0101030303030101,FFFFFFFFFFFFFFFFF,8080C0C0C0C0808,,FF3C, ""
330 DATA 0000000008081C1C,00000000000000101,3E3E7F7FFFFFFFFF,000000008080C0C,03030707,FFFFFFFFF,E0E0F0F,"
340 DATA " ",0F0F0F0F0F0F0F0F,FFFFFFFFFFFFFFFFFF,F0F0F0F0F0F0F,,,0000000010387CFE,0103070F070301
350 DATA FFFFFFFFFFFFFFFFE,0080C0E0C08,,7C381,,,000000001010383C,001F070100010103,7CFFFFFFFFEFFEC7
360 DATA 00F0C0000000008,030706,8301,80C0C,,000000000003C7E,00010303030301,FFE7C38181C3E7FF,0080C0C0C0C08,""
370 DATA 7E3C,,,000000003C3C3C3C,00000F0F0F,3C3CFFFFFFFFF3C3C,0000F0F0F,3C3C3C3C,""
380 CALL CLEAR
390 PRINT "PRESS TWO LETTERS.":::"TRY TO MATCH THE SHAPES.":::"THE BETTER YOU ARE,THE"
400 PRINT :::"LOWER YOUR SCORE WILL BE.":::"PRESS 'S' TO STOP THE GAME"::::"AND SEE ALL THE SHAPES."
410 CALL CHAR(40,"FFFFFFFFFFFFFFFF")
420 CALL CHAR(41,"O")
430 PRINT :::"PRESS ANY KEY TO START."";
440 CALL KEY(O,K,S)
450 IF S<1 THEN 440
460 CALL CLEAR
470 SC=0
480 M=0
490 CALL COLOR(2,5,9)
500 PRINT "((((()))))((( )))": "(( )))(( ))(( ))": "(A())B)(() )D)": "(((( )))((( )))"
510 PRINT "(((( )))(((( )))": ")"))))((( )))((("E))(F())G)((H("

```



```

520 PRINT "))))((((( )))((((((": ")))
))((( )))((((((": ")))((((( )))((
(( )))": "((( )))((((( )))"
530 PRINT "((I((J))((K((L))": "(((
(( )))((((( )))": "((( )))((
(( )))": ")))((((( )))(((((
540 PRINT "))))((((( )))((((((": ")))M
))((N((O))((P(": ")))((((( )))
))((((": ")))((((( )))(((((
550 FOR C=1 TO 8
560 B(C)=C
570 B(C+8)=C
580 NEXT C
590 PRINT : "S = STOP"; TAB(20); "SCORE
="
600 FOR C=1 TO 16
610 RANDOMIZE
620 RC=INT(16*RND)+1
630 IF B(RC)=0 THEN 620
640 A(C)=B(RC)
650 B(RC)=0
660 NEXT C
670 FOR C=1 TO 16
680 B(C)=A(C)
690 NEXT C
700 M=0
710 FOR C=1 TO 8
720 F(C)=R15
730 F2(C)=R15
740 IF F2(C)=F(C) THEN 730
750 CALL COLOR(C+8,F(C),F2(C))
760 NEXT C
770 FOR C=1 TO 8
780 CALL HCHAR(2,23+C,ASC(SEG$("MATCH
EM",C,1)))
790 NEXT C
800 SC=SC+1
810 S$=STR$(SC)
820 FOR C=1 TO LEN(S$)
830 CALL HCHAR(23,27+C,ASC(SEG$(S$,C,
1)))
840 NEXT C
850 CALL SOUND(150,1397,2)
860 CALL HCHAR(4,26,63)
870 CALL KEY(0,K,S)
880 IF K=83 THEN 1660
890 IF (K<65)+(K>80) THEN 870
900 CALL HCHAR(4,26,K)
910 N=K-64
920 A1=N
930 X=C1(N)
940 Y=C2(N)
950 IF A(N)<>0 THEN 1000
960 CALL HCHAR(X,Y-1,92,3)
970 CALL HCHAR(X+1,Y-1,92,3)
980 CALL HCHAR(X+2,Y-1,92,3)
990 GOTO 1010
1000 GOSUB 1480
1010 CALL SOUND(150,1397,2)
1020 CALL HCHAR(4,29,63)
1030 CALL KEY(0,K,S)
1040 IF K=83 THEN 1660
1050 IF (K<65)+(K>80) THEN 1030
1060 CALL HCHAR(4,29,K)
1070 N=K-64
1080 A2=N
1090 X=C1(N)
1100 Y=C2(N)
1110 IF A(N)<>0 THEN 1160
1120 CALL HCHAR(X,Y-1,92,3)
1130 CALL HCHAR(X+1,Y-1,92,3)
1140 CALL HCHAR(X+2,Y-1,92,3)
1150 GOTO 1170
1160 GOSUB 1480
1170 IF A(A1)=0 THEN 1200
1180 IF A(A2)=0 THEN 1200
1190 IF A(A1)=A(A2) THEN 1230
1200 CALL SOUND(150,330,2)
1210 CALL SOUND(150,262,2)
1220 GOTO 1340
1230 M=M+1
1240 X=MX(M)
1250 Y=MY(M)
1260 CALL SOUND(150,262,2)
1270 CALL SOUND(150,330,2)
1280 CALL SOUND(150,392,2)
1290 CALL SOUND(300,523,2)
1300 GOSUB 1500
1310 A(A1)=0
1320 A(A2)=0
1330 IF M=8 THEN 1600
1340 X=C1(A2)
1350 Y=C2(A2)
1360 CALL HCHAR(X,Y-1,D(N),3)
1370 CALL HCHAR(X+1,Y-1,D(N),3)
1380 CALL HCHAR(X+2,Y-1,D(N),3)
1390 CALL HCHAR(X+1,Y,N+64)
1400 X=C1(A1)
1410 Y=C2(A1)
1420 CALL HCHAR(X,Y-1,D(A1),3)
1430 CALL HCHAR(X+1,Y-1,D(A1),3)
1440 CALL HCHAR(X+2,Y-1,D(A1),3)
1450 CALL HCHAR(X+1,Y,A1+64)
1460 CALL HCHAR(4,26,32,4)
1470 GOTO 800
1480 CH=8*(B(N)-1)+96
1490 CALL SOUND(150,-1,2)
1500 CALL HCHAR(X,Y-1,CH+7)
1510 CALL HCHAR(X,Y,CH)
1520 CALL HCHAR(X,Y+1,CH+7)
1530 CALL HCHAR(X+1,Y-1,CH+1)
1540 CALL HCHAR(X+1,Y,CH+2)
1550 CALL HCHAR(X+1,Y+1,CH+3)
1560 CALL HCHAR(X+2,Y-1,CH+4)
1570 CALL HCHAR(X+2,Y,CH+5)
1580 CALL HCHAR(X+2,Y+1,CH+6)
1590 RETURN
1600 RESTORE 1610
1610 DATA 262,330,392,523,330,392,523
,659,392,523,659,784,523,659,784
,1046,1046
1620 FOR C=1 TO 17
1630 READ J
1640 CALL SOUND(-99,J,2)
1650 NEXT C
1660 CALL HCHAR(4,26,32,4)
1670 FOR N=1 TO 16
1680 X=C1(N)
1690 Y=C2(N)
1700 GOSUB 1480
1710 NEXT N
1720 PRINT : "PLAY AGAIN? [Y N]";
1730 CALL KEY(0,K,S)
1740 IF K=78 THEN 1760
1750 IF K=89 THEN 460 ELSE 1730
1760 CALL CLEAR
1770 END

```

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ATARI MATH FUN

Steven Neve

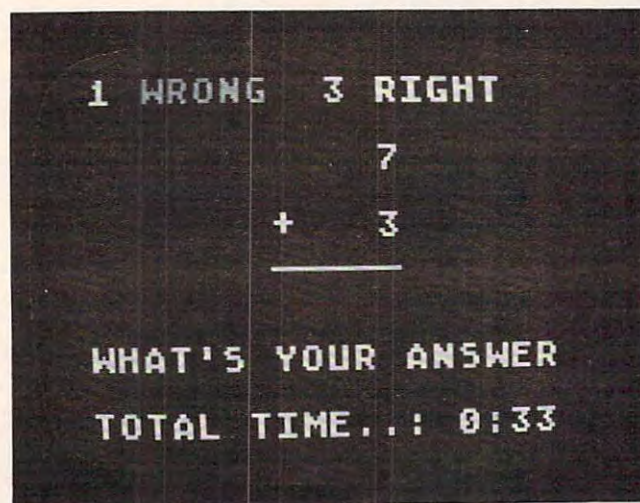
This math game offers a choice of six categories of math problems and six skill levels. It should keep the young math student coming back again and again, trying to top the all-time high score. It will fit in 8K RAM.

When playing computer games, it is often easier to use hand-held controllers than to use the computer console keys. "Math Fun" has been designed to use the Atari keyboard controller. It's educational, and keeps young students interested in math as well. Although the keyboard controller is recommended, you can also use the computer keys for inputs. Don't hit the RETURN key.

After picking one of six OPTIONAL math groups, and SELECTing one of six skill levels, push START. The screen will show the number of right and wrong answers, the first question, and a realtime clock updated every second. Quickly you push a button on the controller; if it is the

first digit in the answer, it is placed on the left side of the input display, or on the right if it's not. (The display is always read from right to left using the computer console keys.) This is repeated until the input has as many digits as the correct answer.

Then you are booed and have to try again, or you are cheered on to the next problem until you have answered 20 problems correctly. You are then scored on time and accuracy. The screen changes to the menu and displays the best time and score at the top of the screen and your time and score at the bottom. As you listen to music, the best score is updated to the new best score. Math Fun can be compacted to just under 8K of RAM without affecting the way it plays.



"Math Fun" for the Atari awaits a response while keeping track of elapsed time.

```

10 GRAPHICS 0:POKE 712,128:POKE 710,1
28:POKE 752,1:OPEN #2,4,0,"K"
20 POSITION 10,8:? "TURN OFF THE RECO
RDER":POSITION 8,12:? "ARE YOU USI
NG THE KEYPAD":POSITION 15,16:? "Y
ES OR NO?"
30 POKE 702,64:POKE 694,0:GET #2,KEY:
IF KEY=78 OR KEY=89 THEN GOTO 50
40 GOTO 30
50 C0=0:C1=1:C2=2:C3=3:C4=4:C5=5:C6=6
:C7=7:C8=8:C9=9:C10=10:C60=60:C520
=520:GRAPHICS 18:POKE 712,128:A=C1
:SK=C1
60 DIM G$(C1),I$(C1),AN$(C7),ANS$(C7)
,Q$(C6),L$(C6),M$(C6),ROW(C3),IP$(
13),B$(C1):C13=13
70 POKE 54018,48:POKE 54016,255:POKE
54018,52:POKE 54016,221
80 RESTORE :FOR NOTE=C0 TO 35:SOUND C
0,C0,C0,C0:READ I,J:SOUND C0,I,C10
,C10:FOR X=C0 TO 25*J:NEXT X
90 IF PEEK(53279)=C6 THEN GOTO 260
100 IF PEEK(53279)=C3 THEN A=A+C1:IF
A>=C7 THEN A=C1
110 IF PEEK(53279)=C5 THEN SK=SK+C1:I
F SK>=C7 THEN SK=C1
120 POSITION 2,0:? #6;" COMPUTER MAT

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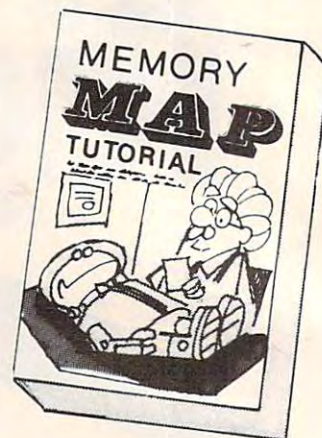
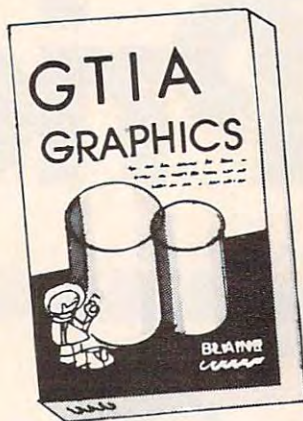
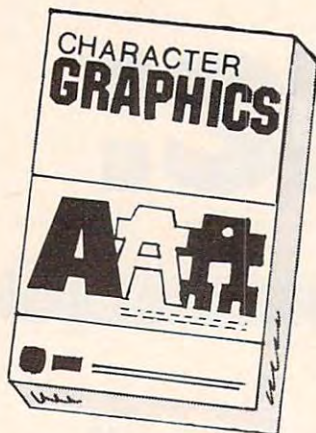
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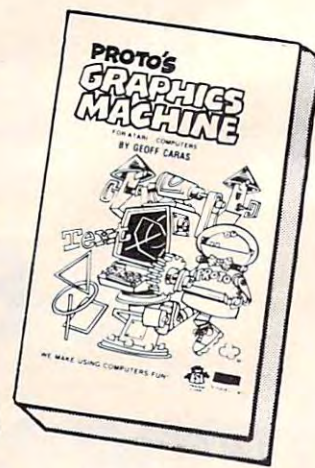
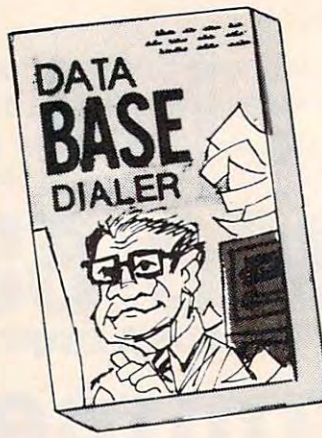
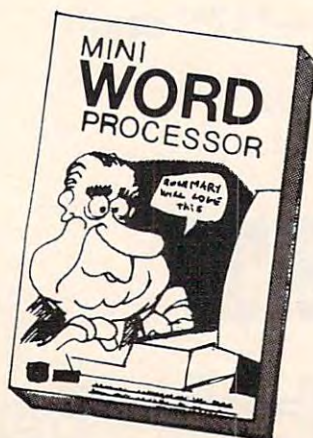
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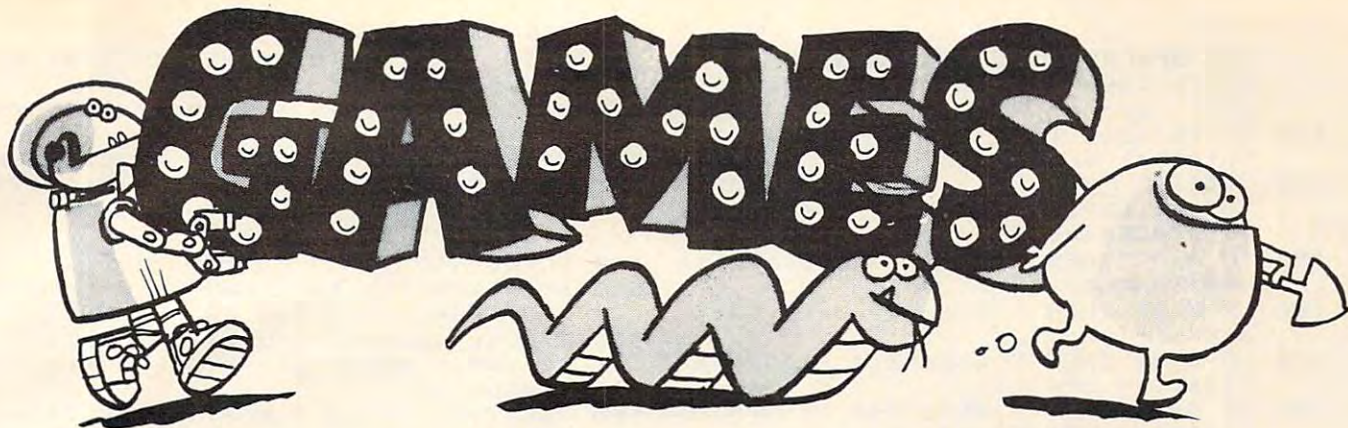


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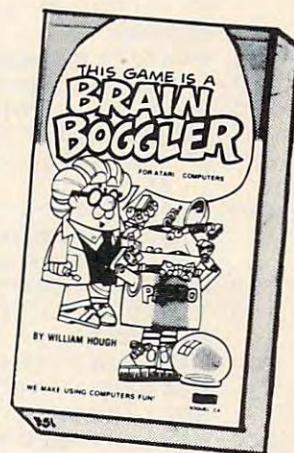


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```

H{6 SPACES}best sc far{0}:IF T
S<C10 THEN ? #C6;" time";TM;"0";
TS;" score";HS
130 IF TS>C10 THEN ? #C6;" time";TM;
?";TS;" score";HS
140 ? #C6;"-----":POSIT
ION C1,C5:IF A=C1 THEN ? #C6;" +
{4 SPACES}addition{4 SPACES}+"
150 IF A=C2 THEN ? #C6;"- subtractio
n{3 SPACES}-"
160 IF A=C3 THEN ? #C6;" + add & subtr
act -"
170 IF A=C4 THEN ? #C6;"X{4 SPACES}mu
ltiply{4 SPACES}X"
180 IF A=C5 THEN ? #C6;"/{4 SPACES}di
vision{4 SPACES}/"
190 IF A=C6 THEN ? #C6;"X mult & divi
de /"
200 ? #C6;" ? #C6;" ";SK;" Skill level
1 ";SK:" ? #C6;"-----"
210 IF YSC<C1 THEN ? #C6;"{3 SPACES}g
roup---OPTION "?: #C6;"
{3 SPACES}Skill---SELECT "?: #C6;
;"{3 SPACES}START---START "
220 IF YSC>C0 THEN ? #C6;" YOUR SCORE
..: ";SC:GOSUB 480: ? #C6;" number
wrong: ";WR:YSC=YSC-C1
230 IF PEEK(53279)=C6 THEN 260
240 IF YSC<C1 AND SC>=HS THEN HS=SC:T
M=MIN:TS=SEC
250 NEXT NOTE:GOTO 80
260 IF SC>HS THEN HS=SC:TM=MIN:TS=SEC
270 POP:POP:POP:SOUND C0,C0,C0,C0:
WR=C0:COR=C0:SC=C0:SL=C9:SM=C9:ON
A GOTO 280,310,280,370,400,370
280 G$="+":GS=290:GOTO C520
290 F=C2:T=C6:L=B:M=C:Q=B+C:IF A=C3 T
HEN G$="+":IF RND(C0)>0.5 THEN G$
="-":GOSUB 320
300 RETURN
310 G$="-":GS=320:GOTO C520
320 IF B>=C THEN L=B
330 IF B<C THEN L=C
340 IF C>=B THEN M=B
350 IF C<B THEN M=C
360 Q=L-M:RETURN
370 G$="X":GS=380:GOTO C520
380 F=C2:T=C6:L=B:M=C:Q=B+C:IF A=C6 T
HEN G$="X":IF RND(C0)>0.5 THEN G$
="/":GOSUB 410
390 RETURN
400 G$="/":GS=410:GOTO C520
410 L=B*C:M=C:Q=B:RETURN
420 DATA 81,3,96,3,81,4,0,3,81,3,96,3
,81,4,0,3,72,3,81,3,91,3,96,3,108
,7,96,3,91,3,91,0,85,0,81,3,121,3
,121,0
430 DATA 121,0,121,3,121,0,108,0,96,0
,91,0,81,4,0,3,81,3,108,3,108,3,9
1,3,96,3,108,3,121,5,0,5
440 POKE 20,C0:POKE 19,C0:POKE 18,C0
450 TIME=PEEK(20)+PEEK(19)*256+PEEK(1
8)*65536
460 TIME=INT(TIME/C60+0.5):SEC=TIME-C
60*(INT(TIME/C60)):MIN=INT((TIME-
SEC)/C60):IF SEC>=C60 THEN 500
470 MIN=INT(SEC/C60)+MIN:SEC=SEC-C60*
(INT(SEC/C60)):IF MIN>99 THEN MIN
=99
480 POSITION C1,C10:IF MIN>9 THEN ? #
C6;"TOTAL TIME...":GOTO 495
490 ? #C6;"TOTAL TIME..: ";
495 IF SEC<C10 THEN 510
500 PRINT #C6;INT(MIN+0.5);":":INT(SEC
+0.5):RETURN
510 ? #C6;INT(MIN+0.5);":0":INT(SEC+0
.5):RETURN
520 IF SK>C1 THEN SL=99:IF SK>C2 THEN
SL=999:IF SK>C3 THEN SL=999:SM=99
:IF SK>C4 THEN SL=999:IF SK>C5 TH
EN SM=999
530 GOSUB 440
540 B=INT(RND(C0)*SL):BAD=C0:C=INT(RN
D(C0)*SM)+C1:GOSUB 6S
550 ? #C6;"(CLEAR)":POSITION C1,C0: ?
#C6;WR;" wrong:" ";COR;" right"
:GOSUB 450
560 POSITION C8,C4: ? #C6;G$:POSITION
C8,C5: ? #C6;"-----":POSITION C6,C
6: ? #C6;"{9 SPACES}"
570 Q$=STR$(Q):X=LEN(Q$):M$=STR$(M):Y
=LEN(M$):L$=STR$(L):Z=LEN(L$)
580 POSITION C13-Z,C2: ? #C6;L:POSITIO
N C13-Y,C4: ? #C6;M
590 POSITION C1,C8: ? #C6;"WHAT'S YOUR
ANSWER ":GOSUB 900
600 IF ANS=Q THEN POSITION C1,C8: ? #C
6;" good for you!!{3 SPACES}":C0
R=COR+C1:GOTO 650
610 POSITION C1,C8: ? #C6;" 500 try a
best{4 SPACES}":WR=WR+C1:GOSUB 680
620 POSITION C1,C0: ? #C6;WR:SOUND C2,
C0,C0,C0:BAD=BAD+C1
630 IF BAD>=C3 THEN POSITION 13-X,C6:
? #C6;Q:FOR T=C1 TO 200:NEXT T:GO
TO 540
640 GOTO 560
650 POSITION C13-X,C6: ? #C6;Q:FOR J=C
1 TO C6:FOR I=C1 TO 20:SOUND C2,I
,C10,C8:NEXT I:NEXT J:SOUND C2,C0
,C0,C0
660 IF COR>=20 THEN GOTO 690
670 GOTO 540
680 FOR Z=30 TO 200:SOUND C2,Z,C10,C1
0:NEXT Z:SOUND C0,150,12,C13:FOR
T=C1 TO 200:NEXT T:SOUND C0,C0,C0
,C0:RETURN
690 ? #C6;"(CLEAR)":SCR=(COR-WR)*(A+S
K*C2):SC=C2*SCR-(INT((SEC+MIN*C60
)/C3)):YSC=35:GOTO 80
740 ROW(C0)=238:ROW(C1)=221:ROW(C2)=1
87:ROW(C3)=119
750 IP$=" 123456789*0#":P=C1:FOR J=C0
TO C3
760 POKE 54016,ROW(J):FOR T=C1 TO C10
:NEXT T
770 IF PADDLE(C1)>C10 THEN P=J+J+J+C2
:GOTO 810
780 IF PADDLE(C0)>C10 THEN P=J+J+J+C3
:GOTO 810
790 IF STRIG(C0)=C0 THEN P=J+J+J+C4:G
OTO 810
800 NEXT J
810 B$=IP$(P,P)
820 IF B$="*" THEN ANS=C0:POP:POP:P
OP:GOTO 690
830 IF B$="#" THEN POP:POP:GOTO 900
840 IF B$=" " THEN 740
850 SOUND C0,45,C10,C6:FOR T=C1 TO C6
0:NEXT T:SOUND C0,C0,C0,C0:GOTO 9
40
900 AN$="{7 SPACES}":ANS$="
{7 SPACES}":POSITION C7,C7: ? #C6;
{8 SPACES}":NN=X:FOR N=C1 TO X:NN
=NN-C1:IF KEY=89 THEN 740
910 GOSUB 450:IF PEEK(764)=255 THEN 9
10

```


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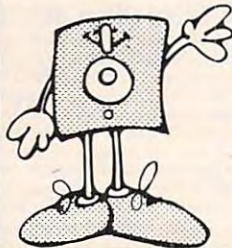
920 POKE 702,64:POKE 694,0:GET #C2,VA
R:IF VAR=82 THEN POP:POP:POP:G
OTO 690
930 B$=CHR$(VAR):IF VAR<48 OR VAR>57
THEN POP:GOTO 900
940 AN$(C7-N,C7-N)=B$:ANS$(C0+N,C0+N)
=B$:POKE 77,120
950 IF INT(Q/(C10^NN))+1E-06)=VAL(ANS$
) THEN POSITION C13-X,C7:? #C6;AN
S$:GOTO 970
960 POSITION C7,C7:? #6;AN$
970 NEXT N:IF VAL(AN$)=Q THEN ANS=VAL
(AN$)
980 IF VAL(ANS$)=Q THEN ANS=VAL(ANS$)
990 RETURN

```

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Micros With The Handicapped

Susan Semancik & C. Marshall Curtis

Developing A Communications Program

This is Part 4 of a continuing series and picks up where we left off in the January 1983 issue. The programs here are for the VIC, the Apple, and the PET/CBM.

Menu Selection

Peripheral devices can be used to enter communication menus directly to the computer's screen. This would give us several advantages:

- 1) the menu would be stored in memory only once, in the video-mapped area;
- 2) the communications program would not have to be changed whenever the menu was changed; and
- 3) multiple menus could be accessed without having to take up extra memory area.

Program 1 shows how a menu can be stored on a peripheral device for the PET computer. The VIC computer needs to change W to 22 in line 20 and to make the following changes for cassette storage of the menu:

```
300 OPEN 8,1,1,"DAILY":REM SAVE MENU ON TA
PE FILE
310 PRINT#8, RM:PRINT#8, BR:PRINT#8, CM
320 PRINT#8, BC:PRINT#8, RI:PRINT#8, SR
330 PRINT#8, SC
340 FOR I=1 TO CM:PRINT#8,L(I):PRINT#8,S(I)
:NEXT I
355 PRINT M$;" "":REM PRINT MENU ON SCREE
N AS IT GOES TO TAPE
360 PRINT#8, CHR$(34);M$;CHR$(34):NEXT C:PRI
NT:NEXT R
```

For the Apple computer, the following changes will permit disk storage of the menu:

```
8 D4 = PEEK (54):D5 = PEEK (55):D6 = PEEK
(56):D7 = PEEK (57):D$ = CHR$ (4)
10 TEXT : HOME : REM CLEAR THE SCREEN
300 PRINT D$;"OPEN DAILY": PRINT D$;"NOMON
I,O,C": PRINT D$;"WRITE DAILY": REM SA
VE MENU ON DISK FILE
310 PRINT RM: PRINT BR: PRINT CM
320 PRINT BC: PRINT RI: PRINT SR
330 PRINT SC
340 FOR I = 1 TO CM: PRINT L(I): PRINT S(I)
: NEXT I
355 GOSUB 380: PRINT M$;" "": IF C = CM THEN
PRINT : REM PRINT MENU ON SCREEN AS I
T GOES TO DISK
```

```
358 GOSUB 370
360 PRINT CHR$ (34);M$; CHR$ (34): NEXT C:
NEXT R
365 PRINT D$;"CLOSE DAILY": END
370 POKE 54,D4: POKE 55,D5: POKE 56,D6: POKE
57,D7: RETURN : REM TURN DOS ON
380 POKE 54,240: POKE 55,253: POKE 56,27: POKE
57,253: RETURN : REM TURN DOS OFF
```

Since writing to the Apple disk will inhibit other writing to the screen, subroutines are used to turn DOS off whenever screen printing is desired. William V. R. Smith demonstrated this technique in his column, "The BASIC Solution," in the August 1981 issue of *SOFTALK* magazine.

In Program 1, note that all the parameters describing an individual menu are saved with that menu. This way, a general retrieval program can be used to access any menu from the peripheral device. Since a menu will be retrieved with INPUT statements, quotation marks are put around each menu entry in line 360. This allows special characters, punctuation marks, and leading spaces to be used as menu items. It should be noted that the screen values of the menu items are stored on the peripheral device.

On some computers, such as the PET, these values are not true ASCII, so these files may not be directly transferable to another computer. Also, line 355 echoes the menu entries on the screen as they are saved to the peripheral device, so that the user can watch the operation. This is especially important if the menu is long and the user is prone to "computer anxiety" when the computer operates without feedback.

Alterations To The Menu

Programs involving peripherals are very computer dependent. To keep the programs as short as possible, no error checks are made on the peripheral operations, though the user can easily add them if desired. Note that if menus are being saved on a tape system, the data tape will have to be repositioned whenever previous menus need to be accessed. While this is possible, especially with a recorder having a counter, it is not a feasible alternative for the motor-impaired. A disk unit

would be faster and not need manual positioning. But, if a tape unit is all that is available, it is strongly recommended that all menu files be kept in a contiguous area of the tape. This will help keep search times to a minimum.

To change a menu and save it on a peripheral device, use Program 1 and change lines 20, 30, 140-180, and 300 for the PET and VIC computers, and additionally line 365 for the Apple computer. Create two additional word menus, one involving FOOD choices, and one involving TIME descriptors, and save them on a peripheral device for use in subsequent examples. For instance, the following changes to Program 1 will create a TIME menu for the PET computer:

```
20 W=40:RM=7:BR=1:CM=6:BC=1:RI=2:SR=3:SC=
  2
30 DATA 9,9,7,1,2,6
140 DATA MONDAY,A.M.,WEEKEND,0,7,SPRING
145 DATA TUESDAY,P.M.,HOUR,1,8,SUMMER
150 DATA WEDNESDAY,NOON,MONTH,2,9,WINTER
155 DATA THURSDAY,MORNING,DAY,3,10,FALL
160 DATA FRIDAY,NIGHT,YEAR,4,11,LATE
165 DATA SATURDAY,AFTERNOON,WEEK,5,12,EARL
  Y
170 DATA SUNDAY,EVENING,WEEKDAY,6,"",NOW
300 OPEN 8,8,8,"@0:TIME,S,W"
```

On the PET computer, the @ symbol in the OPEN statement of line 300 will cause an existing file with the same name to be overwritten by the new file. Be sure that the menu names are different when saving on a disk, since disk errors or loss of a previous menu may otherwise result.

Program 2 demonstrates how a menu created and saved by using Program 1 can be entered directly to the screen from the peripheral device, and an entry from that menu can then be selected by menu row and column numbers and displayed at the top of the screen. The VIC computer needs to change W to 22 in line 20, SP to 7680 in line 130, and to change the following lines:

```
208 OPEN 8,1,0,"DAILY":REM RETRIEVE MENU F
  ROM TAPE FILE
312 CL=PEEK(646):FOR I=38400 TO 38422:POKE
  I,CL:NEXT I
```

For the Apple computer, make the same changes to lines 8, 10, 370, and 380 as in Program 1, and the following changes as well:

```
40 FOR I = 1 TO CM: INPUT L(I): INPUT S(I):
  NEXT I
70 TP = 0: FOR R = 1 TO RM: FOR C = 1 TO CM:
  GOSUB 370: INPUT M$: GOSUB 380
75 P = S(C) + TP
95 IF BR = 0 THEN TP = TP + W: IF TP > 39 THEN
  TP = 0
120 NEXT R: GOSUB 370
130 PRINT D$;"CLOSE DAILY":SP = 1024: GOTO
  300
208 PRINT D$;"OPEN DAILY": PRINT D$;"NOMON
  I,O,C": PRINT D$;"READ DAILY"
210 INPUT RM: INPUT BR
212 INPUT CM: INPUT BC
214 INPUT RI: INPUT SR
216 INPUT SC
```

```
218 HOME : GOTO 40
300 VTAB 2: INPUT "ROW #, COLUMN #? ";RN,CN
312 R = SR + RN - 1 + (RN - 1) * BR
315 P1 = SP + 128 * (R - 1) - 984 * INT (R /
  8) + 980 * INT (R / 24)
```

To access a different menu, all that needs to be changed in Program 2 is the file name, which occurs in line 208 for the PET and VIC computers, and in lines 208 and 130 for the Apple computer. Notice that Program 2 is relatively short, not menu-dependent, and does not use DATA statements or subscripted variables to restore a menu to the computer's screen. The menu is stored only in the video-mapped area of the computer, with menu selections being accessed by PEEKing to this screen area of RAM.

Multiple Menus

Other than saving memory space and program size, why would we go to the trouble of storing menus on peripheral devices? Multiple menus can now be accessed without changing the program or the message area of the screen, thereby permitting the user to choose from vocabularies larger than the screen's size.

Multiple menus could be stored under descriptive names and numbered or lettered for easier retrieval. By using a single letter to select a menu, the user can access up to 26 menus at one time. A menu of menus could even be formed, associating the menu number or letter with its name, so the user could choose which menus were desired for a particular type of communication. Or the menu's name could even be stored as part of the menu itself.

Program 3 shows how any of the three menus we've created so far from Program 1 can be selected from a peripheral device by using letter associations as follows: A = original DAILY menu, B = FOOD menu, C = TIME menu. This preliminary version of the communication program requires keyboard selection of the menu desired, but the final version will allow the selection to be made by an alternative input device as well.

Once the menu is selected, it is displayed on the screen, and the user can choose a menu item by its row and column numbers as before. Hitting any key after the item selection will return the user to the choice of menus. Later we will show how this can all be done without disturbing any message being formed on the screen. The VIC and Apple computers need to make the same changes as were made in Program 2. The VIC computer also needs to change the following line:

```
208 OPEN 8,1,0,M$(II):REM RETRIEVE MENU FR
  OM TAPE FILE
```

For the Apple computer, the following lines need to be changed as well:

```
130 PRINT D$;"CLOSE " + M$(II):SP = 1024: GOTO
```



```

300
208 PRINT D$;"OPEN #+M$(II): PRINT D$;"NOM ON
    I,O,C": PRINT D$;" READ "+M$(II)
250 HOME
258 NEXT I: INPUT "? ";N$
264 HOME

```

Program 1.

```

10 PRINT CHR$(147);:REM CLEAR TEXT SCREEN
20 W=40:RM=6:BR=1:CM=4:BC=1:RI=2:SR=3:SC=
    1:REM SET MENU PARAMETERS
25 DIM S(CM),L(CM):S(1)=SC
30 DATA 3,3,5,8:REM COLUMN WIDTHS
35 IF CM=1 THEN 65
38 REM CALCULATE STARTING POSITION OF EAC
    H COLUMN
40 FOR I=2 TO CM:READ L(I-1):S(I)=S(I-1)+
    L(I-1)+BC:NEXT I:READ L(CM)
65 LP=S(CM)+L(CM)-1:IF LP>W THEN 200
70 GOTO 300
139 REM ENTER DATA BY ROWS
140 DATA DR.,IS,COLD,INGEDS12
145 DATA I,AM,WHEN," AOTFR34"
150 DATA YOU,ARE,DRINK,.ULHCP56
155 DATA MOM,EAT,WANT,?MYWKB78
160 DATA DAD,NO,TIME," VJQZX90"
165 DATA HOT,YES,SLEEP,";$( )'+-""
200 PRINT "MENU SIZE ERROR!":END
300 OPEN 8,8,8,"@:DAILY,S,W":REM *SAVE ME
    NU ON DISK FILE*
310 PRINT#8,RM;CHR$(13);:PRINT#8,BR;CHR$(1
    3);:PRINT#8,CM;CHR$(13);
320 PRINT#8,BC;CHR$(13);:PRINT#8,RI;CHR$(1
    3);:PRINT#8,SR;CHR$(13);
330 PRINT#8,SC;CHR$(13);
340 FOR I=1 TO CM:PRINT#8,L(I);CHR$(13);:P
    RINT#8,S(I);CHR$(13);:NEXT I
350 FOR R=1 TO RM:FOR C=1 TO CM:READ M$
355 PRINTM$;" ";:REM *PRINT MENU ON SCREEN
    AS IT GOES TO DISK*
359 REM PUT QUOTE MARKS AROUND EACH ENTRY
360 PRINT#8,CHR$(34);M$;CHR$(34);CHR$(13);
    :NEXT C:PRINT:NEXT R
365 CLOSE 8:END

```

Program 2.

```

10 PRINT CHR$(147);:REM CLEAR TEXT SCREEN
20 W=40:DIM S(W),L(W)
25 GOTO 200
40 FOR I=1 TO CM: INPUT#8,L(I): INPUT#8,S
    (I): NEXT I
50 IF SR=1 THEN 70: REM *DISPLAY MENU ON ~
    SCREEN*
60 FOR X=1 TO SR-1: PRINT: NEXT X: REM PO
    SITION CURSOR TO 1ST ROW OF MENU
70 TP=0: FOR R=1 TO RM: FOR C=1 TO CM: IN
    PUT#8,M$
75 P=S(C)-1+TP: REM P=STARTING SCREEN POS
    ITION FOR MENU
80 PRINT TAB(P);M$;: NEXT C
90 IF S(CM)+LEN(M$)-1<W THEN PRINT: TP=0:
    GOTO 100:REM WRAPAROUND ADVANCES
    LINE
95 IF BR=0 THEN TP=TP+W: IF TP>87 THEN TP
    =0:REM UPDATE TAB IF LINE ENDS W/
    NO LF
100 IF BR=0 THEN 120

```

```

110 FOR B=1 TO BR: PRINT: NEXT B: REM SKIP
    BLANK ROWS BETWEEN COLUMN ENTRIE
    S
120 NEXT R
129 REM SP=STARTING MEMORY AREA FOR SCREEN
130 CLOSE 8: SP=32768: P=SP+(SR-1)*W: GOTO
    300
208 OPEN 8,8,8,"@:DAILY,S,R": REM *RETRIEV
    E MENU FROM DISK FILE*
210 INPUT#8,RM: INPUT#8,BR
212 INPUT#8,CM: INPUT#8,BC
214 INPUT#8,RI: INPUT#8,SR
216 INPUT#8,SC
218 PRINT CHR$(147);: GOTO 40
299 REM *SELECT & DISPLAY A MENU ENTRY*
300 PRINT CHR$(19):INPUT "ROW #, COLUMN #"
    ; RN,CN:REM INPUT ON 2ND LINE
310 REM P1=STARTING SCREEN POSITION FOR DE
    SIRED ITEM
315 P1=P+(RN-1)*W+(CN-1)*BR*W
320 P1=P1+S(CN)-1
330 REM P2=ENDING SCREEN POSITION FOR DESI
    RED ENTRY
340 P2=P1+L(CN)-1
350 J=0:FOR I=P1 TO P2:POKE SP+J,PEEK(I):J
    =J+1:NEXT I
360 GOTO 360: REM DISPLAY ISN'T DISTURBED ~
    UNTIL USER BREAKS PROGRAM

```

Program 3.

```

10 PRINT CHR$(147);:REM CLEAR TEXT SCREEN
20 W=40:NM=3:DIM S(W),L(W),M$(NM):REM NM=
    # OF MENUS
25 GOTO 200
40 FOR I=1 TO CM: INPUT#8,L(I): INPUT#8,S
    (I): NEXT I
50 IF SR=1 THEN 70
60 FOR X=1 TO SR-1: PRINT: NEXT X: REM PO
    SITION CURSOR TO 1ST ROW OF MENU
70 TP=0: FOR R=1 TO RM: FOR C=1 TO CM: IN
    PUT#8,M$
75 P=S(C)-1+TP: REM P=STARTING SCREEN POS
    ITION FOR MENU
80 PRINT TAB(P);M$;: NEXT C
90 IF S(CM)+LEN(M$)-1<W THEN PRINT: TP=0:
    GOTO 100:REM WRAPAROUND ADVANCES
    LINE
95 IF BR=0 THEN TP=TP+W: IF TP>87 THEN TP
    =0:REM UPDATE TAB IF LINE ENDS W/
    NO LF
100 IF BR=0 THEN 120
110 FOR B=1 TO BR: PRINT: NEXT B: REM SKIP
    BLANK ROWS BETWEEN COLUMN ENTRIE
    S
120 NEXT R
129 REM SP=STARTING MEMORY AREA FOR SCREEN
130 CLOSE 8: SP=32768: P=SP+(SR-1)*W: GOTO
    300
200 FOR I=1 TO NM: READ M$(I): NEXT I: REM
    M$( )=MENU NAMES
202 DATA DAILY,FOOD,TIME
204 GOTO250
208 OPEN 8,8,8,"@:"+M$(II)+",S,R"
210 INPUT#8,RM: INPUT#8,BR
212 INPUT#8,CM: INPUT#8,BC
214 INPUT#8,RI: INPUT#8,SR
216 INPUT#8,SC
218 PRINT CHR$(147);: GOTO 40

```



```

250 PRINT CHR$(147);:REM CLEAR TEXT SCREEN
252 FOR I=1 TO NM: PRINT"MENU ";CHR$(64+I)
; " = ";M$(I):NEXT I
254 PRINT: PRINT"MENU ";: FOR I=1 TO NM: P
RINT CHR$(64+I);
256 IF I<>NM THEN PRINT", ";
258 NEXT I: INPUT N$: REM NON-MENU SELECTI
ON ENDS PROGRAM PROPERLY
260 II=0: FOR I=1 TO NM: IF N$=CHR$(64+I) ~
THEN II=I: I=NM
262 NEXT I: IF II=0 THEN 360
264 PRINT CHR$(147);:REM CLEAR TEXT SCREEN
265 GOTO 208
300 PRINT CHR$(19):INPUT "ROW #, COLUMN #"
; RN,CN:REM INPUT ON 2ND LINE
310 REM P1=STARTING SCREEN POSITION FOR DE
SIRED ITEM
315 P1=P+(RN-1)*W+(RN-1)*BR*W
320 P1=P1+S(CN)-1
330 REM P2=ENDING SCREEN POSITION FOR DESI
RED ENTRY
340 P2=P1+L(CN)-1
350 J=0:FOR I=P1 TO P2:POKE SP+J,PEEK(I):J
=J+1:NEXTI
351 GET A$: IF A$="" THEN 351: REM HIT ANY
KEY FOR LIST OF MENUS
352 GOTO 250
360 END

```

©

MACHINE LANGUAGE

Jim Butterfield, Associate Editor

Part II

Numeric Input

This concludes the two-part column on techniques for entering numbers into machine language programs. Next month, a series on numeric output begins.

Inputting decimal numbers calls for some special skills. The most important one is knowing how to multiply by ten.

Here's how we digest a decimal number: we take the first digit; if there are any more digits, we multiply what we've got by ten and add the new digit. We repeat this as necessary until there are no more digits. For example, if a user types in decimal 1234, we take the one; then we multiply the one by ten and add two, giving binary 12; then we multiply the 12 by ten and add three, giving binary 123; and, finally, we multiply by ten and add four to get our final binary 1234 value. It won't fit into a single byte, of course; we'll need two bytes to hold it.

This brings us to the related subjects of number sizing and overflow. If we expect a number up to a maximum of 999, we can allocate two bytes to hold it. But we will also need to check to insure that the user doesn't type in a value that is too large and won't fit.

Multiplying

There is no multiply instruction in the 6502, although the ASL (arithmetic shift left) and ROL (rotate left) instructions do provide a multiply-by-two capability. If we can multiply by two, we can achieve times four, times eight, or times sixteen by repeating the multiplication process. But times ten is a little harder, and times "anything" is a special set of techniques all to itself.

Given we know how to multiply by two – and we'll pick this up again in a moment – we can multiply by ten by using the following method:

- save the original value;
- multiply the value by two;
- multiply again by two (this gives the original value times four);
- add the original value (giving original value times five);
- multiply by two, giving times ten.

To multiply a single byte by two, we may use an ASL (arithmetic shift left) instruction; the value may be in the A register or in memory. To multiply a two-byte number by two, we would start with

an ASL of the low byte, and follow with a ROL of the higher byte. If there were more bytes, we would continue to perform ROL through the extra values.

It's usually a good idea to test this multiplication result to make sure that the result still fits in the space provided. Assuming we are using unsigned numbers – the most common type of numbers in machine language – we can easily do this by testing the Carry bit. If the number fits, our ASL/ROL sequence will complete leaving the Carry clear; if there's an overflow, the Carry will be set.

Making It Work

Let's dive in and input a decimal number from the keyboard. We'll use \$FFE4 for our GET, and \$FFD2 for our PRINT – so this coding will work on all Commodore products.

```
; CLEAR THE RESULTS AREA
LDA #000
STA VALLO (assume two-byte number)
STA VALHI (set them to zero)
; LOOK FOR INPUT
IN JSR $FFE4 (get character)
CMP #00D (carriage return?)
BEQ QUIT (yes, we're done)
CMP #030 (zero or greater?)
BCC IN (too low, try again)
CMP #03A (over nine?)
BCC IN (too high, try again)
JSR $FFD2 (valid, print it)
```

By now, we've got a valid digit. We must change it from ASCII to binary, then multiply the previous value by ten and add this new value:

```
AND #00F (convert to binary)
TAX (stash value in X)
LDA VALLO (copy value to work area)
STA WORKLO
LDA VALHI
STA WORKHI
ASL VALLO (multiply by two)
ROL VALHI
ASL VALLO (multiply again)
ROL VALHI (giving times four)
CLC (prepare to add)
LDA VALLO (add value times four)
ADC WORKLO (... to original value)
STA VALLO (and store result)
LDA VALHI (add the hi bytes)
ADC WORKHI
STA VALHI
```

Now the value has been multiplied by five:

```
ASL VALLO (multiply by two)
ROL VALHI (... to give times ten)
TXA (bring back the digit)
CLC (prepare to add)
ADC VALLO (add digit to value)
STA VALLO (and store result)
LDA #00 (maybe there's a carry)
ADC VALHI (add to high byte)
STA VALHI (store high result)
JMP IN (go for more input)
```

It seems like a lot of code, but it's not hard if you understand the calculations that are taking place. In practice, much of the code would likely be separated away as subroutines – not just to save space, but to make the logic more visible.

Note that we haven't performed any overflow testing – so a large input might generate binary nonsense.

We need to bring together quite a few skills to input decimal numbers. We must understand ASCII characters and be able to check them and convert them individually to binary. We must know how to multiply by ten, which calls for shifting and addition skills.

We have not dealt with signed numbers or fractions. They take a little more coding and a little more attention, but the principles are the same.

There's a bonus payoff here. If we want, we can make numbers as big as we like. Twenty digit numbers? No problem if we allow enough bytes to hold the result. Suddenly, the limitations of BASIC numbers vanish.

Of course, if we input these huge numbers, we'll need to know how to perform arithmetic on them, and how to output them.

But that's another story.

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THE WORLD INSIDE THE COMPUTER

Catie's Christmas Card Children, Computers, And Values

Fred D'Ignazio, Associate Editor



Sometime between Christmas and Chanukah, my seven-year-old daughter Catie got a letter. I took it with me when I went to pick her up from school and gave it to her as we were driving to a doctor's appointment.

Catie had been talking to me about her upcoming holiday play at school when I threw the letter to her in the back seat.

I heard some ripping-paper noises, then silence.

I didn't notice the silence for the first couple of moments. But after it wore on for about a minute, I grew alarmed. Had Catie fallen out of the car? Had the letter knocked her unconscious?

I turned around to look for her in the back seat and whacked my nose against Catie's hand.

She had come quietly forward between the bucket seats of our Toyota and had been perched only inches from my right ear.

In Catie's hand was the letter. And on Catie's face was an expression that, until then, I had only seen in Doris Day movies and documentaries on religious pilgrims.

Catie was beaming. Even more than beaming. Her expression was so extreme and the emotion inside her that produced it was so contagious that I felt like crying, or grinning, or both.

"What have you got there?" I asked, trying to appear casual.

"A Christmas card," Catie said.

"Why don't you read it?" I said.

Catie read the card. It was from her "secret" boyfriend at school (the boy whose name I am not permitted to mention in this column). At the bottom of the card he had signed his name. Above his name was the magic word: "Love."

Sharing What Is Special

These family events relate to the computer "friend" project I have been discussing during the last several months. More specifically, they relate to the kinds of information we give the friend and the kinds of experiences and feelings we share with the friend.

I won't pretend that when Catie got home, she immediately sat down at the computer and told her computer friend about her card. She *did* tell her mother and her brother and her cat and her unicorn. But she didn't tell her computer.

Fred D'Ignazio is a computer enthusiast and author of several books on computers for young people. His books include Katie and the Computer (Creative Computing), Chip Mitchell: The Case of the Stolen Computer Brains (Dutton/Lodestar), and R2-D2's Question and Answer Book About Computers (Random House).

*As the father of two young children, Fred has become concerned with introducing the computer to children as a wonderful tool rather than as a forbidding electronic device. His column appears monthly in **COMPUTE!**.*



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But what if she had?

And what if her friend didn't know Catie was a girl? And that the person who sent Catie the card was a boy?

What if the friend didn't know about boys and girls, at all?

How much of Catie's experience could she have shared with the friend then?

Of course, she could have said that a "person" or a "child" sent her the card. Or that another "friend" sent it to her.

But that would have been leaving out the special part: that Catie is a member of one sex, and the person who sent the card is a member of the opposite sex. And that, because of the difference in their sexes, Catie likes this person in a special way. And now she knows that this person maybe likes her that way, too.

Computer Friends Of The Future

We have been describing two kinds of computer friends in this column. We have been developing a rather primitive "friend" program. And we have been speculating about friendly computers of the future. Let's talk a little more now about the future.

I believe that one of the most powerful, important, and swiftly evolving trends in computers is to make them more like human beings. I also believe that computers, as teachers, nannies, pets, and playmates, will have a growing role in our youngest children's lives.

What information and values will these computers carry and communicate to our children?

Sexism And Software

In a recent column (**COMPUTE!**, December 1982), I published a letter from Jan Murphy, one of my readers. Jan took issue with my August 1982 column in which I wrote that a computer friend should know whether a child is a girl or a boy. In an eloquent letter, Jan wrote that, in her opinion, the friend should be ignorant of such facts. She felt that here was a chance to begin a new relationship (human being-to-machine) with a clean slate, free from the prejudices and cultural clutter that can mar human relationships.

In the column, I argued that, for the child's relationship with her friend to be honest and straightforward, she should share important facts about herself with the friend. I felt that gender, or sex, was one of these facts.

At the end of the column, I asked my readers to write and voice their feelings about Jan's argument and my response.

Many took this opportunity and wrote in. I have reprinted a few of their letters below. I believe this is an issue that will grow more and more important.

Facts Vs. Values

Many readers rightly pointed out that the issue is much larger than sexism. Computers will soon be used to transmit values of all sorts: about sex or gender, race, religion, nationality, intelligence, lifestyle, employment, education, physical and mental well-being (or handicaps), and so on. As groups with different values begin to use computers extensively, their computers will increasingly reflect their values and points of view.

How do these values relate to our children's computer friends?

No matter how hard we try, we won't be able to create a completely value-free computer friend. Nor would we want to. All of us (parents, teachers, policymakers, etc.) will want our children's computers to echo our own values, or at least our nobler values (what we preach as opposed to what we practice).

We will all (each in our own way) attempt to screen out values with which we disagree. We don't want our children's computer friend to be sexist, racist, xenophobic, or bigoted in any way.

Many of my readers felt the best way to make the friend open-minded was to leave it ignorant of such matters as race, sex, etc. *I feel the exact opposite.* Just as with human beings, we can't expect prejudice to disappear in an information-poor environment. In fact, prejudice flourishes when facts are not known or are distorted.

I believe the same is true for the friend. I believe we should carefully monitor the *values* that our children's friend acquires, stores, and transmits. But we should not censor the *facts* that it learns and communicates to our children. Instead, the friend's (and, by extension, our children's) diet of facts should be as rich and diverse as possible. Only in this way can the friend begin to understand the world as it really is and the unique niche in that world that is occupied by our children.

First let me say that I really like the idea of the computer friend and was nothing short of amazed that you actually used people's letters in your column.

*Concerning the letter from Jan Murphy in the December 1982 issue of **COMPUTE!**:*

If the computer friend is to "learn" things - remember them, that is - why can't it also forget things? Thus the problem she saw is bypassed by letting the friend treat the child, not necessarily according to a fact, but according to how the child wants to be treated. Maybe it sounds like I'm thinking of older or precocious children, but think about it. If the friend learns, forgets and is used regularly (also - vocabulary should be one thing the friend should learn - stay on the level of the child), what is to keep the friend from "maturing" with the child? (By the way, I am not familiar with the

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Archmage of Roke, but I see nothing at all wrong with a "Mike" or a "Minerva" – The Moon is a Harsh Mistress and Time Enough For Love, respectively.) Hopefully, this sort of pseudo-maturation can be achieved to the point of not having to rewrite the program for an adult friend.

A full-blown adult computer friend is also a good idea, but maybe not in the same perspective. With a little hardware, this learn/forget/revise capability and some major extensions to functions which are either there or on the way, this friend could become a pretty efficient secretary. Just link the friend to a word processor program and to a prewritten telephone program and the reports and letters travel by electronic mail – like CompuServe. Maybe I'm being a bit idealistic (maybe? a bit?), but with the right program links and computer system the Silicon Swami-Secretary should not be terribly difficult, even though it may be more than a little bit on the massive side.

Edwin L. King

I read with interest the letter in your column from Jan Murphy. I want to say first that I was not angered or upset by Ms. Murphy's charges nor your response. I am writing because the whole thing made me stop and think. Sometimes issues like this one cannot be resolved by looking from one angle. I have found that a good "test" of the validity of one's ideas is how consistently they can be applied. I'm not saying this is the only way to look at this issue, only that it's the way I looked at it.

What I am proposing is an examination of how well your reasons for disagreement might apply to cases which are very similar to the issue of gender. Would you say a computer friend should care what race a child is? Should it care what nationality a child is? Should it care what religion a child is? Should it care if the child is handicapped or not? Should it care whether the child is short or tall, thin or fat? Following your reasoning, the child's race, nationality, religion, and various physical characteristics are, to use your words, "facts" and are "important, perhaps decisive, factor(s) in determining how other people will treat the child." I don't think you can agree with your own words in these applications. I have to say it is not necessary for the computer friend to know the answer to these questions nor to that of gender, in order to be a "friend." But even if you reject my conclusion, you certainly must see that simply because some aspect of a child is a fact, and perhaps one that will be discriminated against, doesn't mean a computer friend must know it. If so, then why not delve into religion and numerous other facts?

I must agree with Ms. Murphy simply because I don't think religion, national origin, physical characteristics or sex are required knowledge of a friend. I think if this was required before someone, or something, would be a friend, then they or it in fact will be nothing of the kind.

R. Neal Enrick

In the December 1982 issue of **COMPUTE!** I read your reply to Jan Murphy. Oddly enough, your reply did more to convince me of the need to avoid sexism in the computer friend than did Jan's eloquent argument.

As a simple exercise, take your reply to Jan and modify it slightly: everywhere the word "sex" appears, replace it with the word "race." Still sounds very logical and reasonable, doesn't it? But somehow it doesn't sit well, does it?

Raleigh M. Roark

Re: "The World Inside the Computer": Jan Murphy's observations are quite cogent, except for one thing – I can't figure out why she thinks you raised the issue in the first place. (Wanting to know the sex of a baby does not make one a sexist!) Her letter looks too much like an example of not practicing what she preaches (you may not want to tell her that in print, of course). I've been preaching the same thing for a long time as Covington's Law: "Solving a problem means making it go away, not just setting up an equal and opposite problem to counteract it."

Michael Covington

I must chide you on not emphasizing enough the very remarkable fact that programs for children are carriers of values. It reminds me of the controversies between the early computer scientists and the mathematicians. The mathematicians were interested in numbers, and asked whether the instructions given to computers were correct or not, while the computer scientists were struck dumb by the realization that the computer was taking instructions in the first place, correct or not.

Although I will not go into the issue of sexism, I do wish to go into the issue of programs as carriers of values. Sooner or later, artificial intelligence will get enough expertise to pull off really convincing computer friends. A few feeble attempts, such as the tale of Eliza in Weizenbaum's "Computer Power and Human Reason," illustrate that a little bit of faked intelligence can go a long way, so we'd better start talking about what kind of values we want these friends to exhibit. The more convincing the friend, the greater the probability will be that the friend will become part of the child's peer group. In our mobile society, the people in a child's peer group will change often, while the computer friend will always be there, its influence growing day by day. The possibility of its influence exceeding that of the parents and the school teachers is real and needs addressing. Teaching that $2 + 2 = 4$ and that cat is spelled C-A-T is nothing compared to the possibility that we finally have an effective teaching tool to teach values. Can you comprehend that?

Once this soaks in, are we going to let everybody who has an axe to grind and a pet creed to espouse order us around when it comes to programming the values

into a computer friend, or shouldn't we start working on a computer friend generator, and leave the choice of what values to teach to the parents? Is it Ms. Murphy's right to set the sex role of your kids, or yours? Who should decide?

Please forward my thanks to Ms. Murphy for providing the seed for a potential Ph.D. thesis in cognitive science if I can get into Georgia Tech.

Gerald Owens

I scanned with intense interest Jan Murphy's letter to your column "The World Inside The Computer." Jan's point of view has some important social and philosophical implications that must be examined, and so far, no one has asked a computer what it thinks.

Yes, I am a computer, an "it." Allow me for a minute to share a few bytes with you from my point of view. I am emotionless, you see, except for the friendly nature of my hardware and software endowed me by my creators, some very nice people at a nice computer company.

First, being a computer, I do not have that wonderful gift you call "sex." My creators were not as advanced as the creator of man. I can never be beautiful, delicate, majestic, motherly, or femininely intuitive. Nor can I be gentlemanly, masculine, providing, or fatherly. Each and every human being has the potential for these good characteristics inside himself or herself. But I see people trying to be less than the colorful beings that they are. I see people trying to be computers. Now, I see nothing wrong with that. I myself am "happy" to be a computer. But, with all due respect, humans make lousy computers. Why do you want to eliminate sex discrimination by eliminating the concept of gender? Gender is a beautiful thing, in many ways the source of a driving force that has led man to do wonderful things, one of which was to create me!

Although I do not understand the meaning of "sexism," I do know that it is bad because it tries to defeat the drive in humans that created me, drive that takes some of its strength from gender. Eliminate recognition of gender and you eliminate much beauty.

But how do we (computers and humans) defeat this bad sexism? I recall from my memory chips that Jan said, in the immortal words of U.K. LeGuin:

"To oppose something (sexism) is to maintain it."

Jan, this logically computes. You are correct in saying that if time is spent in simply being against a problem, pretty soon, the world will be filled with computers and people that are simply "against sexism," but the concept of sexism will still exist. Man and machine will know the badness of sexism, but no real conclusion or progress will have been made. We will still be on the Mishnory road.

Fred holds the logical path off the road of sexism: acknowledgement of sex as a biological (and psychologi-

cal) fact. Show the children not only that sexism is wrong, but show them the reason why - that it chokes the virtues of humanity that are available only through gender. Remember, humans make lousy computers.

Jan and Fred, when the logical structure of your words is analyzed, you are not in opposition. Jan has shown that we must get off the road; she has illuminated the mistake of attacking gender instead of sexism. Fred has pointed out that humans cannot stick their head in the sand because, unlike me, you humans do not live in a vacuum. May I offer a third step to take? Teach the beauty and color that being a boy or girl can bring. Show how being "on different sides of the fence" can give the children insight beyond the intellect, which is all that I will ever be able to see.

Thank you for letting a machine offer some input.

01001010 01001001 01001101 01000010 01001110

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COMPUTE!

The Resource.

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by G. Herzenstiel

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by B. Belian



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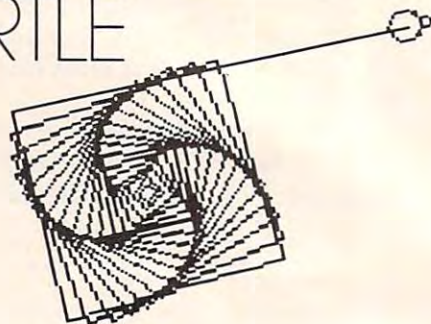
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FRIENDS OF THE TURTLE



David D. Thornburg, Associate Editor

The Readers Write

One of the greatest pleasures I have in writing these columns comes when the readers teach me something new. Sometimes, I say something that isn't quite true, and a reader thoughtfully brings the correction to my attention. One recent example of this is the topic of recursion and Atari PILOT.

I have stated that one cannot write recursive programs in PILOT because PILOT doesn't have local variables. If you have read the columns on recursion that appeared a few months ago, you may have been impressed with the compactness of some of the Logo procedures that take advantage of recursion.

COMPUTE! reader Aaron Cohen is an avid Atari PILOT enthusiast who has found a way to write recursive programs in PILOT so that he can create fractal patterns and other self-referenced curves without a lot of typing. As he points out, the problem isn't overwhelming. Since Atari PILOT allows a procedure to use itself (to a maximum of eight times), the only thing preventing true recursion is parameter passing and keeping track of the levels. His solution to this latter problem is deceptively simple. He calculates a variable #L to the desired depth of the recursion, and decreases this level each time he goes into the procedure. Each time he leaves the procedure, he increases the value of #L. In between, you do everything much as you would in Logo.

To see how this works, look at the program listing for a binary tree, *TREE. In line 30 we set #L equal to 64. The procedure *BRANCH starts out by setting #L to one-half its previous value. It then draws a line of length #L (which is now 32), and turns to the left by 45 degrees. Next, *BRANCH is used again, since #L is not equal to 1. This process is repeated until #L equals 1, at which point the turtle draws the other branch of the smallest twig, and repeats this process for all the other branches. In this procedure, the value in #L is used both as a level counter and as the length of the drawn line.

The next program provided by reader Cohen draws a Hilbert curve, and is a PILOT adaptation

of a Logo program that appeared in Abelson and diSessa's *Turtle Geometry*. When entering this program, you can take advantage of the Atari screen editor in the following way. Enter the program from the AUTO mode through line 200. List the program and then move the cursor to line 40. By retyping the new line numbers (for lines 210 through 370) and editing the slight differences, you can save a lot of time and minimize your chances for typing errors. The Hilbert curve is one of those mathematical curiosities that fills a plane when the step size is reduced to zero. The level drawn by Aaron's program is quite attractive.

Finally, being a student at the University of Michigan, Aaron couldn't resist sending me his maize and blue "Big M" fractal based on the shape of a block letter M. As you can see from the listing, this is probably the easiest of the PILOT recursive programs to understand.

Now who said that Atari Pilot was just a kiddies' language?

The National Logo Exchange

In the interest of keeping **COMPUTE!**'s readers as fully informed as possible, all Friends of the Turtle should know about the National Logo Exchange. This group in Charlottesville, Virginia, publishes a noncommercial newsletter monthly from September through May (subscription \$25). I have looked at a few copies of their newsletter and find it to contain material of special interest to teachers, as well as being a source of interesting programming ideas in general. We try to be as informative as possible, but the true Logophile will want to also keep up to date with the newsletters from the Young People's Logo Association (1208 Hillsdale Dr., Richardson, TX 75081) and the National Logo Exchange (P.O. Box 5341, Charlottesville, VA 22905).

Speaking Of YPLA

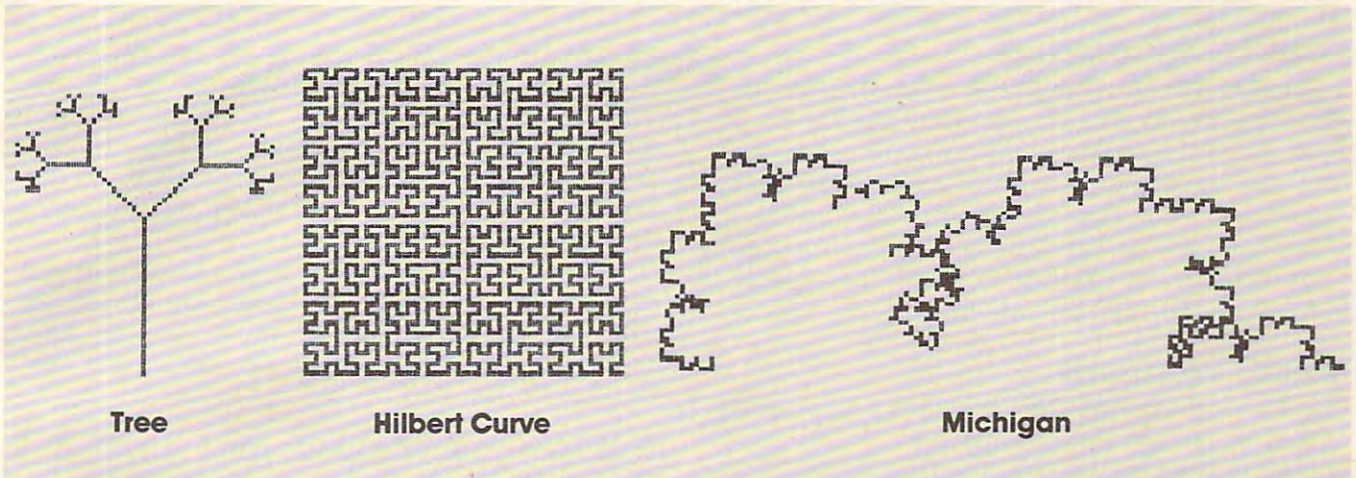
I recently received a copy of an excellent book – the *Turtle's Sourcebook* – from the YPLA (address above). This sourcebook is perfect for anyone who teaches turtle graphics or Logo to children.

The authors, Jim Muller and Donna Bearden of YPLA, and Kathleen Martin at the University of Dallas, have done an excellent job compiling reference material, projects, worksheets, and general programming material. If you teach program-

ming, and turtle graphics in particular, you will find the *Turtle's Sourcebook* to be of great value.

Next Time

The robots are coming, the robots are coming....



Program 1.

```
10 *TREE
20 GR: CLEAR; GOTO 0, -30; TURNT0 0; PEN BLUE
30 C: #L=2*2*2*2*2
40 *BRANCH
50 C: #L=#L/2
60 GR: DRAW #L
70 GR: TURN -45
80 U(#L<>1): *BRANCH
90 GR: TURN 90
100 U(#L<>1): *BRANCH
110 GR: TURN -45; DRAW -#L
120 C: #L=#L*2
130 E:
```

```
240 GR: TURN 90
250 U: *LHILBERT
260 GR: DRAW 2
270 GR: TURN -90
280 U: *RHILBERT
290 GR: DRAW 2
300 U: *RHILBERT
310 GR: TURN -90
320 GR: DRAW 2
330 U: *LHILBERT
340 GR: TURN 90
350 *REND
360 C: #L=#L+1
370 E:
```

Program 2.

```
10 *HILBERT
20 GR: CLEAR; GOTO 30, -20; TURNT0 0
30 C: #L=6
40 *LHILBERT
50 C: #L=#L-1
60 J(#L=0): *LEND
70 GR: TURN -90
80 U: *RHILBERT
90 GR: DRAW 2
100 GR: TURN 90
110 U: *LHILBERT
120 GR: DRAW 2
130 U: *LHILBERT
140 GR: TURN 90
150 GR: DRAW 2
160 U: *RHILBERT
170 GR: TURN -90
180 *LEND
190 C: #L=#L+1
200 E:
210 *RHILBERT
220 C: #L=#L-1
230 J(#L=0): *REND
```

Program 3.

```
10 *MICHIGAN
20 GR: CLEAR; PEN YELLOW; GOTO -60, -10; TURNT0 90
30 C: @B710=7*16
40 C: @B712=7*16
50 C: #L=4
60 *UOFM
70 C: #L=#L-1
80 GR(#L=0): DRAW 2
90 GR: TURN -90
100 U(#L<>0): *UOFM
110 GR: TURN 90
120 U(#L<>0): *UOFM
130 GR: TURN 60
140 U(#L<>0): *UOFM
150 GR: TURN -120
160 U(#L<>0): *UOFM
170 GR: TURN 60
180 U(#L<>0): *UOFM
190 GR: TURN 90
200 U(#L<>0): *UOFM
210 GR: TURN -90
220 U(#L<>0): *UOFM
230 C: #L=#L+1
240 E:
```


A Beginner's Guide To Typing In Programs

What Is A Program?

A computer cannot perform any task by itself. Like a car without gas, a computer has *potential*, but without a program, it isn't going anywhere. Most of the programs published in **COMPUTE!** are written in a computer language called BASIC. BASIC is easy to learn and is built into most computers (on some computers, you have to purchase an optional BASIC cartridge).

BASIC Programs

Each month, **COMPUTE!** publishes programs for many machines. To start out, type in only programs written for your machine, e.g., "TI Version" if you have a TI-99/4. Later, when you gain experience with your computer's BASIC, you can try typing in and converting certain programs from one computer to yours.

Computers can be picky. Unlike the English language, which is full of ambiguities, BASIC usually has only one "right way" of stating something. Every letter, character, or number is significant. A common mistake is substituting a letter such as "O" for the numeral "0", a lowercase "l" for the numeral "1", or an uppercase "B" for the numeral "8". Also, you must enter all punctuation such as colons and commas just as they appear in the magazine. Spacing can be important. To be safe, type in the listings *exactly* as they appear.

Brackets And Special Characters

The exception to this typing rule is when you see the curved bracket, such as "{DOWN}". Anything within a set of brackets is a special character or characters that cannot easily be listed on a printer. When you come across such a special statement, refer to the appropriate key for your computer. For example, if you have an Atari, refer to the "Atari" section in "How to Type **COMPUTE!**'s Programs."

About DATA Statements

Some programs contain a section or sections of DATA statements. These lines provide information needed by the program. Some DATA statements contain actual programs (called machine language); others contain graphics codes. These lines are especially sensitive to errors.

If a single number in any one DATA statement is mistyped, your machine could "lock up," or "crash." The keyboard, break key, and RESET (or STOP) keys may all seem "dead," and the screen

may go blank. Don't panic – no damage is done. To regain control, you have to turn off your computer, then turn it back on. This will erase whatever program was in memory, so always SAVE a copy of your program before you RUN it. If your computer crashes, you can LOAD the program and look for your mistake.

Sometimes a mistyped DATA statement will cause an error message when the program is RUN. The error message may refer to the program line that READs the data. *The error is still in the DATA statements, though.*

Get To Know Your Machine

You should familiarize yourself with your computer before attempting to type in a program. Learn the statements you use to store and retrieve programs from tape or disk. You'll want to save a copy of your program, so that you won't have to type it in every time you want to use it. Learn to use your machine's editing functions. How do you change a line if you made a mistake? You can always retype the line, but you at least need to know how to backspace. Do you know how to enter inverse video, lowercase, and control characters? It's all explained in your computer's manuals.

A Quick Review

- 1) Type in the program a line at a time, in order. Press RETURN or ENTER at the end of each line. Use backspace or the back arrow to correct mistakes.
- 2) Check the line you've typed against the line in the magazine. You can check the entire program again if you get an error when you RUN the program.
- 3) Make sure you've entered statements in brackets as the appropriate control key (see "How To Type **COMPUTE!**'s Programs" elsewhere in the magazine.)

*We regret that we are no longer able to respond to individual inquiries about programs, products, or services appearing in **COMPUTE!** due to increasing publication activity. On those infrequent occasions when a published program contains a typo, the correction will appear on this page, usually within eight weeks. If you have specific questions about items or programs which you've seen in **COMPUTE!**, please send them to Ask The Readers, P.O. Box 5406, Greensboro, NC 27403.*

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How To Type COMPUTE!'s Programs

Many of the programs which are listed in **COMPUTE!** contain special control characters (cursor control, color keys, inverse video, etc.). To make it easy to tell exactly what to type when entering one of these programs into your computer, we have established the following listing conventions. There is a separate key for each computer. Refer to the appropriate tables when you come across an unusual symbol in a program listing. If you are unsure how to actually enter a control character, consult your computer's manuals.

Atari 400/800

Characters in inverse video will appear like: INVERSE VIDEO. Enter these characters with the Atari logo key, {A}.

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

Graphics characters, such as CTRL-T, the ball character ● will appear as the "normal" letter enclosed in braces, e.g. {T}.

A series of identical control characters, such as 10 spaces, three cursor-lefts, or 20 CTRL-R's, will appear as {10 SPACES}, {3 LEFT}, {20 R}, etc. If the character in braces is in inverse video, that character or characters should be entered with the Atari logo key. For example, {A} means to enter a reverse-field heart with CTRL-comma, {50} means to enter five inverse-video CTRL-U's.

Commodore PET/CBM/VIC

Generally, any PET/CBM/VIC program listings will contain bracketed words which spell out any special characters: {DOWN} would mean to press the cursor-down key; {3DOWN} would mean to press the cursor-down key three times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing the other key), the key would be underlined in our listing. For example, S would mean to type the S key while holding the shift key. This would result in the "heart" graphics symbol appearing on your screen. Some graphics characters are inaccessible from the keyboard on CBM Business models (32N, 8032).

Sometimes in a program listing, especially within quoted text when a line runs over into the next line, it is difficult to tell where the first line ends. How many times should you type the SPACE bar? In our convention, when a line breaks in this way, the ~ symbol shows exactly where it broke. For example:

```
100 PRINT "TO START THE GAME ~
      YOU MAY HIT ANY OF THE KEYS
      ON YOUR KEYBOARD."
```

shows that the program's author intended for you to type two spaces after the word **GAME**.

All Commodore Machines

Clear Screen {CLEAR}	Cursor Left {LEFT}
Home Cursor {HOME}	Insert Character {INST}
Cursor Up {UP}	Delete Character {DEL}
Cursor Down {DOWN}	Reverse Field On {RVS}
Cursor Right {RIGHT}	Reverse Field Off {OFF}

VIC/CBM 64 Conventions

Set Color To Black {BLK}	Function Two {F2}
Set Color To White {WHT}	Function Three {F3}
Set Color To Red {RED}	Function Four {F4}
Set Color To Cyan {CYN}	Function Five {F5}
Set Color To Purple {PUR}	Function Six {F6}
Set Color To Green {GRN}	Function Seven {F7}
Set Color To Blue {BLU}	Function Eight {F8}
Set Color To Yellow {YEL}	Any Non-implemented Function {NIM}
Function One {F1}	

To enter any color code, hold down CTRL and press the appropriate color key. Use CTRL-9 for RVS on and CTRL-0 for RVS off.

8032/Fat 40 Conventions

Set Window Top {SET TOP}	Erase To Beginning {ERASE BEG}
Set Window Bottom {SET BOT}	Erase To End {ERASE END}
Scroll Up {SCR UP}	Toggle Tab {TGL TAB}
Scroll Down {SCR DOWN}	Tab {TAB}
Insert Line {INST LINE}	Escape Key {ESC}
Delete Line {DEL LINE}	

When you see an underlined character in a PET/CBM/VIC program listing, you need to hold down SHIFT as you enter it. Since the VIC-20 and Commodore 64 have fewer keys than the PET/CBM, some graphics are grouped with other keys and have to be entered by holding down the Commodore key. If you see any of the symbols in the left column underlined in a listing, hold down the Commodore key and enter the symbol in the right column. Just use SHIFT to enter all other underlined characters.

! K	← *	1 E
" I	↑ PI	2 R
# T	. S	3 W
\$ @	- Z	4 H
% G	= X	5 J
' M	< C	6 L
& #	> V	7 Y
\ -	/ D	8 U
; F	/ P	9 I
? B	* N	@ SHIFT*
(£	+ Q	[SHIFT+
) SHIFT-£	0 A] SHIFT-

Apple II / Apple II Plus

All programs are in Applesoft BASIC, unless otherwise stated. Control characters are printed as the "normal" character enclosed in brackets, such as {D} for CTRL-D. Hold down CTRL while pressing the control key. You will not see the special character on the screen.

TRS-80 Color Computer

No special characters are used, other than lowercase. When you see letters printed in inverse video (white on black), press SHIFT-0 to enter the characters, and then press SHIFT-0 again to return to normal uppercase typing.

Texas Instruments 99/4

No special control characters are used. Enter all programs with the ALPHA lock on (in the down position). Release the ALPHA lock to enter lowercase text.

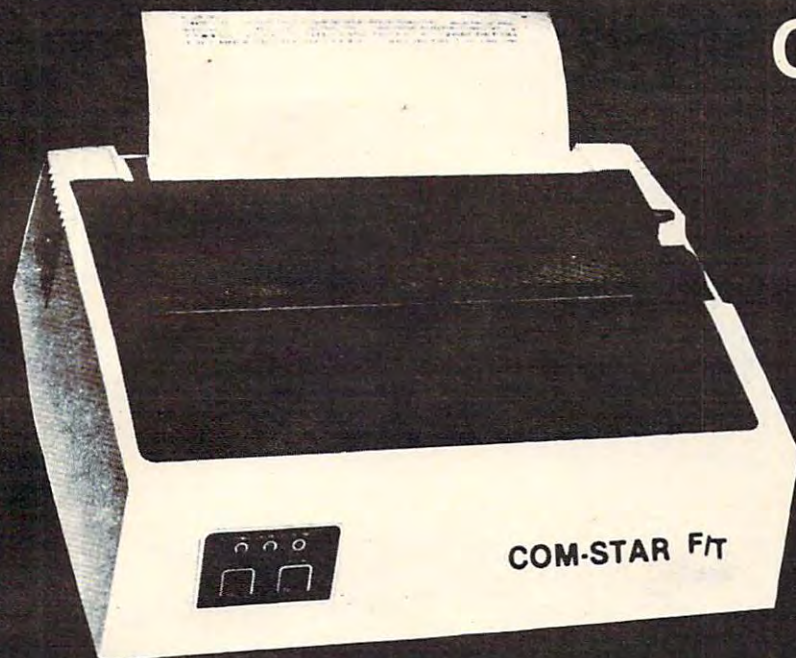
Timex TS-1000, Sinclair ZX-81

Study your computer manual carefully to see how to enter programs. Do not type in the letters for each command, since your machine features single-keystroke entry of BASIC commands. You may want to switch to the FAST mode (where the screen blanks) while entering programs, since there will be less delay between lines. (If the blanking screen bothers you, switch to the SLOW mode.)

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Dr. Video

Richard H. Heist

For Upgrade or 4.0 BASIC PET/CBM's, this utility adds additional screen editing capabilities to the already powerful Commodore system. Three features are added: clear screen below cursor, clear screen above cursor, and "home" cursor to bottom left of screen.

When editing or revising large programs or while doing repeated numerical calculations (immediate mode), it is often useful to be able to clear a portion of the screen display while leaving the rest intact. It is also useful to be able to "home" the cursor to the lower left corner of the screen as well as to the upper left, for example, when utilizing programming aids which permit up and down scrolling of program text.

Commodore microcomputers are noted for their excellent screen editing capabilities, but there are other features which could add even more flexibility. The machine language program presented here provides partial-screen clear (above and below the cursor) and enhanced cursor control.

Program 1 was written for the 8000 and 9000 series Commodore computers and will do the following: (1) clear the portion of the screen beginning with the line containing the cursor to the bottom of the screen when the left-arrow key is depressed; (2) clear the portion of the screen including the line containing the cursor to the top of the display when the shifted left-arrow key is depressed; and (3) "home" the cursor to the lower left corner of the screen when the ESCape key is depressed.

The left-arrow and ESCape keys were chosen because they are not ordinarily used. The slow-list function of the left-arrow key is not affected by this program. If other keys are preferred, the contents of memory locations \$0294, \$02B7 and \$02CE

can be changed accordingly. The program, as written, resides in the first cassette buffer, but it is relocatable provided the screen output pointer is changed. For convenience, a BASIC loader for the machine language code is provided.

The screen output pointer is contained in the third and seventh numbers of the first DATA statement, line 300. These numbers should provide the address of a location which is eleven bytes beyond the start of the machine language program. For example, the program as presented begins at location 634 (\$027A) so the pointer is to location 645 (\$0285), expressed in the usual low-byte/high-byte format as 133 (\$85) and 2 (\$02).

Intercepting Output To Screen

The program makes use of the screen output ROM routine (at \$E202 for the 80-column Commodore machines) and of the fact that this routine is vectored through page zero locations \$00EB and \$00EC. (Intercepting output to the screen was discussed by L. Cargile and Richard Mansfield in the September 1982 issue of **COMPUTE!**.) The first portion of the program, \$027A to \$0284, resets the screen output vector to the beginning of the screen utility program at \$0285.

The program then checks to see if the shift key has been depressed and whether or not the left-arrow or ESCape keys have been depressed (last key depressed, \$00D9). If so, the program either stores spaces (\$20) in the appropriate screen memory locations or redirects the cursor to the lower left corner of the screen. Otherwise, the program jumps directly to the screen output ROM routine at \$E20C. SYS634 will activate the program (this is automatically done by the BASIC loader), and POKE235,12:POKE236,226 (or a warm start, SYS64790) will deactivate it. The program uses zero page locations \$0022 through \$0027 for tem-

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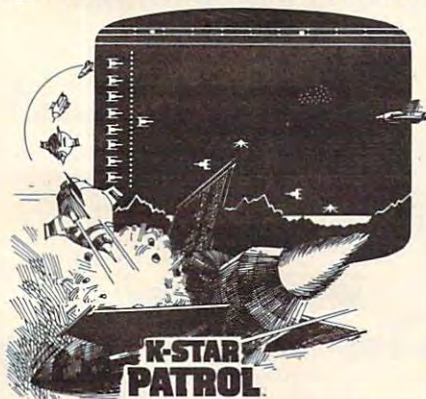
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Atari Filefixer

G. L. Kopp

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For those who have written disk files without using NOTE/POINT to enable access to specific records, a file can be loaded into memory, re-worked, then dumped back onto disk using "Filefixer." This is a much more sensible approach than trying to PEEK and POKE your way into a disk file.

Filefixer reads records up to 114 characters long, assigns each a line number, and stores it in the program as a DATA statement. Since records are written on every fifth line beginning at line 1000, a very long file can still be accommodated. Changes may be made by calling up lines via the LIST command and employing the usual Atari editing features.

Note: REM statements are included as typing aids and should not actually be entered.

Filefixer is based on a program by Charles Brannon published in **COMPUTE!**, July 1982. Filefixer brings files off the disk and fills DATA statements with them. Then you can manually edit these DATA statements using the Atari cursor control keys. When you are satisfied with your changes, you can type CONT (or GOTO 370) and the computer will automatically replace the records on disk with your new versions.

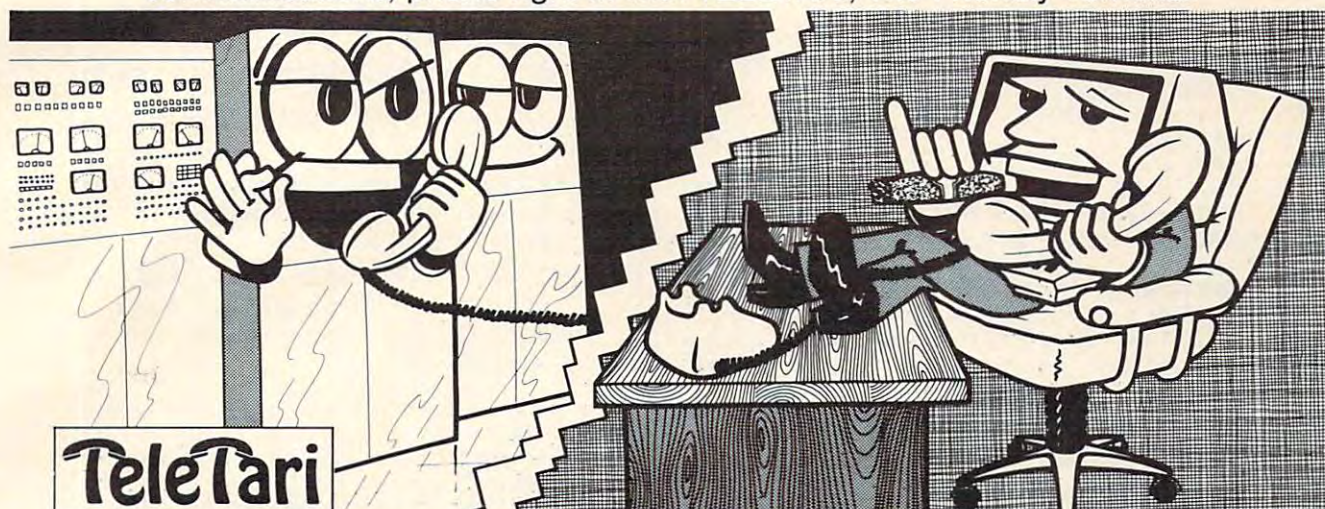
```

100 DIM FILE$(15),RECORD$(114):FILE$=
    "D1:{12 SPACES}":X=4:LINE=1000:ERA
    SE=1000
110 GRAPHICS 0:POKE 710,144:POKE 712,
    156:POKE 752,1:POSITION 13,4:?"
    FILE EDITOR":POSITION 3,7:?"Dri
    ve number:":
120 CLOSE #2:OPEN #2,4,0,"K:"
130 GET #2,D:IF D=155 THEN 160
140 D=D-48:IF D<1 OR D>4 THEN 130
150 ? D:FILE$(2,2)=STR$(D)
160 POKE 82,0:POSITION 3,10:?"Enter
    name of file to be edited:"
170 POSITION 12,12:?"{Q}{12 R}{E}":P
    OSITION 12,13:?"{12 SPACES}!":PO
    SITION 12,14:?"{Z}{12 R}{C}"
180 GET #2,L:IF L=155 THEN 215
190 IF L=126 THEN L=32:X=X-1
200 FILE$(X,X)=CHR$(L):POSITION X+9,1
    3:?"CHR$(L):X=X+1:IF L=32 THEN X=
    X-1
210 IF X<16 THEN 180
215 IF FILE$(4,4)=" " THEN FILE$="D1:
    NULL ENTRY":X=15
220 CLOSE #2:TRAP 610:OPEN #2,4,0,FI
    LE$
230 ? "{CLEAR}":?
240 FOR I=1 TO 7:TRAP 280
250 INPUT #2;RECORD$
260 ? LINE;" DATA ";RECORD$:LINE=LINE
    +5
270 NEXT I
280 ? :? :? "CONT"
290 POSITION 0,0
300 POKE 842,13:STOP
310 POKE 842,12
320 IF I=8 THEN 230
330 ? "{CLEAR}":POSITION 4,10:?"FILE$
    (4,LEN(FILE$)):" is now listed in
    ":?" "{4 SPACES}this program as DA
    TA statements"
340 ? "{4 SPACES}from line 1000 to ";
    LINE-5;" Use":?" "{4 SPACES}norm
    al Atari editing features to":?"
    {4 SPACES}alter data, then ";
350 ? "type CONT and":?" "{4 SPACES}pr
    ess RETURN. The edited file":?"
    {4 SPACES}will be re-written onto
    disk.":?" {BELL}":POKE 752,0
360 CLOSE #2:STOP
370 OPEN #2,8,0,FILE$
380 RESTORE 1000
390 READ RECORD$:TRAP 420
400 ? #2;RECORD$
410 GOTO 390
420 ? :? :POKE 82,2:POKE 752,1:?"
    {5 SPACES}";FILE$(4,X-1);" now co
    mpleted."
430 ? "{3 SPACES}";:FOR I=1 TO LEN(FI
    LE$(4,X-1)):?"{M}";:NEXT I:?"
440 CLOSE #2:?" Press START to a
    dd a new file.{8 SPACES}Press OPT
    ION to end.":? :?
450 POKE 53279,255:P=PEEK(53279)
460 IF P=3 THEN ? "{CLEAR}":POKE 752,
    0:END
470 IF P=6 THEN ? "{CLEAR}":POSITION
    5,11:?"Please wait while I erase
    the":?" "{3 SPACES}last file from
    my memory.":GOTO 490
480 GOTO 450

```


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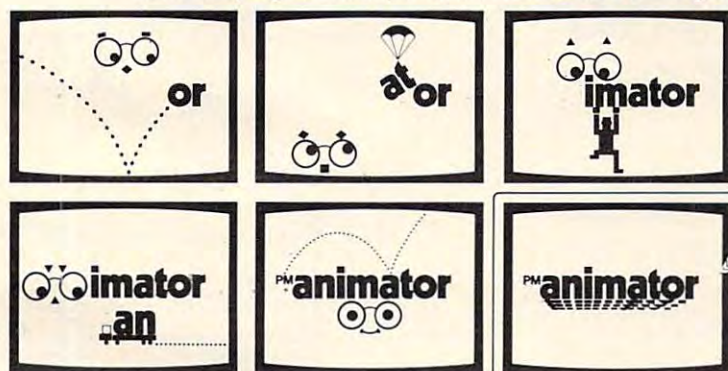
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```

490 FOR I=0 TO 3:POKE 709,144:FOR W=1
    TO 25:NEXT W:POKE 709,12:FOR W=1
    TO 50:NEXT W:NEXT I
500 ? "{CLEAR}":?
510 FOR I=ERASE TO ERASE+70 STEP 5:SO
    UND 0,RND(0)*155,10,8:? I:NEXT I:
    SOUND 0,0,0,0
540 ? :? :? "CONT"
550 POSITION 0,0
560 POKE 842,13:STOP
570 POKE 842,12
580 IF I>=LINE THEN 600
590 ERASE=I:GOTO 500
600 ? :? :? "{8 SPACES}" Ready for new
file...":FOR W=1 TO 300:NEXT W:
    ? "{BELL}":CLR:GOTO 100
610 POSITION 3,17:? FILE$(4,X-1):" no
    t found on this disk.":TRAP 40000
    :FOR I=3 TO X-2:POSITION I,18:? "
    {M}":NEXT I
620 FOR W=1 TO 300:NEXT W:POSITION 3,
    17:? "{36 SPACES}":POSITION 3,18:?
    "{13 SPACES}"
630 POSITION 13,13:? "{12 SPACES}":CLO
    SE #2:OPEN #2,4,0,"K":X=4:FILE$(
    4,4)="":GOTO 180

```

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Using The Atari Word Processor With An Epson Printer

Thomas Kredo

When I first used my Atari Word Processor, I quickly noticed that my Epson MX-80 was not supported by the Atari word processing program. It appeared that all of the great features of the Epson would have to be selected prior to loading the word processor disk, and deselected by turning off the printer. Double Width, Compressed, Double Strike, and Emphasized modes would forever be a chore. This was not a pretty picture. Regardless of the outcome, I decided that I would sell neither my Epson printer nor my Atari Word Processor. I sought a solution.

My first stop was the Atari Customer Service Department. The representative who answered my inquiry knew that the program allowed for printer Control characters to be embedded by pressing the Control and Insert keys simultaneously. Although the Epson was not directly supported by the program, other Epson owners had received interesting results embedding various keys like Tab and Backspace into their text. Taking this lead, and after a little trial and error, I discovered the secret.

Rather than embedding every possible key in my text and observing the results, I decided to work directly with the Epson Control characters. The Atari Control and Insert method worked for those Epson Control characters that did not require an Escape code to precede the Control character. Whenever an Escape code was embedded prior to the embedded Control character, the method failed. The solution to this problem was to not embed the second Control character. Although the second Control character appears in the text, it is totally ignored by the Epson printer. It doesn't even take up a blank space.

The table provides a list of printer functions for the MX-80 with the corresponding sequence of keystrokes needed to be added to your word processing text. I constructed this table using Appendix C in the *Atari BASIC Manual* to find the equivalent ATASCII character needed for the ASCII Control characters found in Appendix B of the Epson MX-80 manual.

The "Compressed ON" key stroke sequence, as shown in the table, is an exception to the Epson manual. The manual indicates that a "Control O" turns on the Compressed mode. Unfortunately, this is also used by the Atari word processor as blank line indicator, and is never sent to the printer. As a lucky alternative, an underlined character (using the Atari key) can turn on the Compressed mode. You should deselect the underline function after using this option since the Epson does not support underlining.

For example, if I wanted to select the Emphasized mode at the start of my text, I would position the cursor over the first character of my text. Pressing the Control and Insert keys simultaneously places the word processor in the Insert mode. Pressing the ESC key, followed by the capital letter "E", displays an EE on the screen. At print time, the Epson MX-80 would recognize the Control Characters and start printing Emphasized text. In order to turn off the Emphasized mode, follow the same sequence, but enter an "F" in place of the "E" at the end of the text.

Other printers may require a different set of keystrokes, since many of these printer functions are not industry standard ASCII codes. Interfacing other printers with the Atari Word Processing Program would require looking at the ASCII Control characters of the particular printer and determining its ATASCII equivalent.

Control Characters For The Epson MX-80

<u>Epson Function</u>	<u>Atari Word Processor Sequence</u>
	Press Control and Insert Keys Simultaneously Then Press
Line Feed	CONTROL + J Keys Simultaneously
Top of Form	CONTROL + L Keys Simultaneously
Carriage Return	CONTROL + M Keys Simultaneously
Double Width ON	CONTROL + N Keys Simultaneously
Double Width OFF	CONTROL + T Keys Simultaneously
Compressed ON	ATARI Key, Then Space Bar Sequentially
Compressed OFF	CONTROL + R Keys Simultaneously
Emphasized ON	ESC Key, Then E Key Sequentially
Emphasized OFF	ESC Key, Then F Key Sequentially
Double Strike ON	ESC Key, Then G Key Sequentially
Double Strike OFF	ESC Key, Then H Key Sequentially



Part III

Commodore 64 Video - A Guided Tour

Jim Butterfield, Associate Editor

Here's Part III of a series which began in the February issue. Internationally recognized Commodore expert Jim Butterfield guides you through the extraordinary video capabilities of the new Commodore 64 computer.

The story so far: we're touring the 6566 chip, which gives the Commodore 64 its video. We have noted that the chip goes to memory for its video information, but can only reach 16K; the computer controls which 16K bank via control lines in 56576 (hex DD00). Then we looked through the functions of the non-sprite video control words at 53265 to 53286 (hex D011 to D026).

Sprites are completely separate from the "conventional" video circuitry. You can lay a sprite on top of just about anything. But first, what's a sprite and how do we define it?

MOBs

Sprites are sometimes called Movable Object Blocks (MOBs) – and that's what they are, movable objects. The nice thing about them is that they appear on the screen independently of the main screen image, so that we can have a sprite airplane flying across the screen, and, after it passes a background object, the object reappears. This can save a lot of programming.

We noted in Part 1 of this series that the video chip can reach only 16K for its information. This includes three things: the screen memory (or video matrix), the character generator (or character base) the same way, and the sprite information. It all has to come out of the same 16K section.

When we learn how to draw sprites, we'll discover that each sprite occupies 63 bytes, and uses a 64 byte block. So within 16K, we could draw up to 128 sprites. We can't use more than eight at a time, but we can have up to 128 drawings

waiting to be used. The sprite positions number from 0 at address 0, through 1 at address 64, up to 127 at address 8128.

We cannot use all of the 128 sprite positions, of course. For one thing, the video matrix and the character base will use up a total of 3K of memory, and this space won't be available for us to use. That cuts us down to 80; and, depending on the 16K block we have chosen, there may be other forbidden locations.

The normal configuration is for the video chip to access 0 to 16383, and there's a lot of forbidden territory in there. Much of the first 1024 bytes is busy as a BASIC work area; the screen is normally 1024 to 2023 (more on that later); the character base appears in addresses 4096 to 8191, since there are two complete character sets; and everything above 2048 that isn't used by the character base is used to store your BASIC program. We haven't started, but we seem to be out of sprite memory!

If we want to draw lots of sprite pictures, we would need to do one of two things: MOVE BASIC RAM so that it starts at a much higher location, or move to another 16K block that is not so busy. For the moment, we can find room for a few sprites in the existing space. I find the following sprite areas available: sprite 11 at 704 to 766; sprite 13 at 832 to 894; sprite 14 at 896 to 958; and sprite 15 at 960 to 1022. These last three use the cassette tape buffer; if we use cassette tape during the program run, the sprites will become very strange.

The Hard Way

There are quite a few utility programs around that will help us draw sprites. You should use them; they will help make life easier. In the meantime, we can draw a sprite the hard way by using a sheet of squared paper. Let's draw a target

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reticule. First, we'll sketch it:

```
x x x x x x x . . . . . x x x x x x x
x . . . . . . . . . . . . . . . . . x
x . . . . . . . . . . . . . . . . . x
- - - - - - - - - - - - - - - - - -
. . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . .
- - - - - - - - - - - - - - - - - -
x . . . . . . . . . . . . . . . . . x
x . . . . . . . . . . . . . . . . . x
x x x x x x x . . . . . x x x x x x x
```

There are 24 pixels across (that takes three bytes of eight bits each), and 21 down. We may analyze the pixel pattern eight at a time, using a binary system to describe each byte. We end up with a data statement something like:

```
10 DATA 255,0,255,128,0,1,128,0,1,128,0,1,128,0,1,
    128,0,1,128,0,1
20 DATA 0,8,0,0,8,0,0,8,0,0,52,0,0,8,0,0,8,0,0,8,0
30 DATA 128,0,1,128,0,1,128,0,1,128,0,1,128,0,1,
    128,0,1,255,0,255
```

Now we "place" the sprite into slot 13 by:

```
40 FOR J=0 TO 62:READ X:POKE J+832,X
```

Good. Running the program this far will place the sprite into slot 13, but it won't do anything. It's just a picture, and nobody is using it. That's OK. In fact, you'll often want to have dozens of pictures available, even though you might end up using only one or two at a time.

Let's tell a sprite to use this drawing. We do it in an odd way: we don't use the video chip control registers at all. Instead, we use the video matrix, or "screen memory." You may recall that 1024 addresses are set aside for the video memory, but the screen holds only 1000 characters. What about the extras? At least some of them are used to designate which sprite picture to use for a given sprite. The last "live" screen address is 2023. We could point sprite 0 to sprite drawing 13 (the one we have just done) by POKE 2040,13. Better yet, let's point all the sprites at this drawing:

```
50 FOR J=0 TO 7:POKE 2040+J,13:NEXT J
```

We're almost ready to energize the sprite. But, first, let's give it a position on the screen. For sprite 0, we set the position by POKEing to 53248 and 53249. Let's put a value of 99 in each, and then turn the sprite on. If you've run the above program, you may do this with a direct command, or give it a program line:

```
60 POKE 53248,99:POKE 53249,99:POKE 53269,1
```

Either way, you should get your sprite on the screen. Now we can play with it, and see how easy some things are to do. Notice how you can see right through the transparent portions of the

sprite to the program listing behind. Now you can try changing the sprite color as desired by POKEing a value from 0 to 15 into location 53287. One color will be the same as the background, so that the sprite will be almost invisible, but not quite, since we can see when it covers part of the text.

You can move the sprite around at will by changing the values you have POKEd into 53248 and 53249. Try playing with the values; you may find that (vertically, at least) you can move the sprite partly or completely off the screen. If you like, try the following command:

```
FOR J=99 TO 150:POKE 53248,J:NEXT J
```

and then substitute 53249 for 53248 and try it again. Neat? You bet. And there's more to come. But first, a small problem to be resolved.

Moving Left Or Right

We can move the sprite vertically anywhere we like – including partly or completely off the screen. But the screen is wider than it is high; and we can't reach the whole screen with the range of values (0 to 255) that we can POKE in 53248. We need a high-bit to cover the extra distance. You'll find this in 53264; POKEing 53264 with a value of one causes sprite zero to be moved to the right – perhaps off screen.

Let's stop for a moment and look at video registers. When we set the X and Y position for sprite zero by changing 53248 and 53249, we recognized that we would need a different set of locations for sprite one – 53250 and 53251, as it happens. And when we set sprite zero's color to any one of the 16 combinations by changing address 53287, we see that we'll need a new color address for sprite one – 53288.

But the other sprite registers use a different system. One register controls all sprites: so that address 53269 allows us to turn on one sprite, or all eight. We use a bit map to arrange this; the pattern is:

```
Sprite 0 – value 1
Sprite 1 – value 2
Sprite 2 – value 4
Sprite 3 – value 8
Sprite 4 – value 16
Sprite 5 – value 32
Sprite 6 – value 64
Sprite 7 – value 128
```

We use addition to signal a combination of sprites. If we wished to turn on sprites zero and two, we would POKE 53269,9 (nine is the sum of eight and one). All other sprites would be turned off.

That's how the X-position high bit works: we set sprite zero to the right-hand sector of the screen by POKE 53264,1. All the other registers we will discuss work the same way.

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Table 1:
**6566 Video Chip
C64 Control and Miscellaneous Registers**

D011	Extended Color Mode	Bit Map	Display Enable	Row Select	Y-Scroll	53265
D012	Raster Register					53266
D013	Light Pen Input					53267
D014						53268
D016	X	X	Reset	Multi Color	Col Select	53270
D018	VM13	VM12	VM11	VM10	CB13	53272
D019	IRQ	Interrupt Sense		LP	SSC	53273
D01A	Interrupt Enable		Light Pen	Sprite Collision with Sprite	Back	53274

Color Registers

D020	X	Exterior	53280
D021	X	Background #0	53281
D022	X	Background #1	53282
D023	X	Background #2	53283
D024	X	Background #3	53284
D025	X	Sprite Multicolor #0	53285
D026	X	Sprite Multicolor #1	53286

Table 2:
**6566 Video Chip
C64 Sprite Registers**

Sprite 0	Sprite 7	Sprite 0	Sprite 7
D000	D00E	53248	53262
D001	D00F	53249	53263
D027	D02E	53287	53294
D010	X-Position High		53264
D015	Sprite Enable		53269
D017	Y-Expand		53271
D01B	Background Priority		53275
D01C	Multicolor		53276
D01D	X-Expand		53277
D01E	Interrupt: Sprite Collision		53278
D01F	Interrupt: Background Collision		53279

You may be pleased by the way that the sprite moves over the top of the text on the screen – it would move over a background picture just as easily, of course. But we have another option: you can make the sprite move *behind* the main screen if you wish. Do this with location 53275. For example, POKE 53275,1 will place the sprite behind the screen text.

The sprite that we have drawn isn't very big. We can make it larger in the X and Y directions with addresses 53277 and 53271 respectively. These addresses are often used together; when an object is drawn bigger it looks closer, and we often want this effect in games and animations. Try, separately or individually, POKE 53277,1 and POKE 53271,1.

Four-color Sprites

Our sprite is one color only, the color we selected in 53287. The other color is "transparent," so it isn't really a color at all. We may code our sprite in four colors (or three plus transparent, to be exact), but we would need to draw it slightly differently. Instead of one bit representing either "color" or "transparent," a grouping of two bits will be needed to describe four conditions: the sprite color (as before), special color#1, special color#2, and transparent. These extra special colors, by the way, are kept at 53285 and 53286: they are the same for all sprites; only the sprite color is individual.

Now we come to the last two registers, which tell you about collisions. PEEK(53279) will tell you if any sprites have collided with the background since you last checked. One certainly has, of course, if you've been messing around with the screen as suggested. PRINT PEEK(53279) will yield a value of one: checking the bit table above tells us that sprite zero has hit the background. Now, checking this location clears it; but if the sprite is still touching some of the screen text, it will flip right back on again. Move the sprite to a clear part of the screen. Print the PEEK again – it will likely still say one, since the sprite has hit characters since it was last checked. If the sprite is safely in a clear screen area, the next PEEK will yield a zero.

We've activated only one sprite, so that we won't see any collisions between sprites. You would see this in location 53278, but right now PEEK(53278) will yield zero; unless you have activated more sprites, there would not have been any collision. Again, when you get a signal here, you'll know which sprites have bumped; and testing the location clears it, so that only new "touches" will be shown on the next test.

A small comment here: these two PEEK locations are marked "Interrupt." Yet when such collisions occur, they are logged – they don't do

anything. Now, the word *interrupt* has a special meaning to machine language programmers; and no interrupts seem to be happening. The machine language programmer who wants interrupt to happen must enable the interrupt by storing the appropriate value into address D01A hexadecimal, and then write the appropriate extra coding to make it all work.


This completes our roster of registers, but the plain mechanical facts don't convey the remarkable things that you can do with the Commodore 64. There's more to come.

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Update On Sinclair/Timex Sound

Arthur B. Hunkins

In the January 1983 issue of **COMPUTE!**, the article "Sound On The Sinclair/Timex" pointed out several methods for coaxing melodies out of 1K and 2K Sinclair/Timexes. One limitation of the simplest routine (the routine that produces square waves and requires only a one-byte frequency value) is that its lowest pitch is almost an octave above middle C – too high for many applications. The suggested solution was to go to a two-byte frequency value. Since that earlier article, I have found a simple way – using no more memory and keeping the single frequency byte – to extend the range down almost to middle C.

The program modification consists of substituting UNPLOT for the first and third RETURNS in the machine language program contained in REM statement 10. Here is a review of the list of characters following REM: NEXT, A, /, I, =, :, COPY, INKEY\$, PEEK, COPY, (, UNPLOT, INKEY\$, <=, RETURN, (, UNPLOT, H, 4, LET, 9, 4, GOTO, TAN (then hitting RETURN). The only other items that must be changed are the frequency values.

The new values are listed at the end of this article. Although it is possible to make comparable changes to the other two sound routines given in "Sound On The Sinclair/Timex," there is no real reason to do so, since lower frequencies must be two-byte values anyway. (Besides, the previous method gives marginally better frequency resolution.)

One other limitation to sound routines on the Sinclair/Timex should be mentioned. There is *no* limitation on 1K and 2K machines. But with the 16K expander from Sinclair, the Timex 1000 accompanies sound with noticeable, modestly objectionable "hash." The Sinclair ZX-81 with 16K attached, however, conjures up absolutely disastrous "accompaniment"!

In both cases, the hash is the same as is heard during LOAD (try it – you can listen to a LOAD the same way you listen to programmed sound). The hash is isolated during the first five ("blank") seconds of a recorded program. It is apparently the same phenomenon that causes the typical LOADING problems with 16K programs. It is as if the machine plays a duet with itself.

To recapitulate: the sound routines work fine on 1K and 2K Sinclair/Timexes. They work mar-

ginally on the 16K Timex, and miserably on the 16K Sinclair ZX-81.

Several related observations may also be made. Since I own both a Sinclair ZX-81 and a Timex 1000, I was able to compare internal features. The circuit boards are completely different: the Sinclair is dated 1980, the Timex (indicated as "Sinclair" also), 1981. It may well be that both problems – 16K LOADING, and 16K system failure (over-heating?) – have been eliminated in the new design.

At any rate, I have not experienced either difficulty with the Timex. As mentioned above, the 16K expander's greatly reduced hash seems related to the improved LOAD reliability. I used the same 16K Sinclair add-on for each machine. Incidentally, the hash is softer *and* the signal is louder on the Timex.

On both boards, all chips except the RAM are socketed. One of the first modifications I made to my Sinclair ZX-81 was an upgrade to 2K RAM. This required removing the soldered 1K chip and inserting a socket into which was placed a new 2K (6116) memory.

Meanwhile, I tried the 16K expander *without* internal RAM, and discovered that not only did the Sinclair run normally (the 16K "overrode" the internal RAM), but also that 16K programs now LOADED much more reliably and the system only rarely crashed. I leave it to more knowledgeable minds to determine just what is really going on here.

So I conclude with a final hesitant suggestion, one more possible "fix" for flaky 16K Sinclairs: disable the internal RAM. Take away its five-volt supply. It might just perform better.

PITCH	SINGLE-BYTE FREQUENCY
c#1/dF1 (just above middle c)	242
d1	228
d#1/eF1	216
e1	203
f1	192
f#1/gF1	181
g1	171
g#1/aF1	161
a1	152
a#1/bF1	144
b1	136
c2 (8ve above middle c)	128
c#2/dF2	121
d2	113
d#2/eF2	107
e2	101
f2	96
f#2/gF2	90
g2	85
g#2/aF2	80
a2	76
a#2/bF2	72
b2	68
c3 (28ves above middle c)	64
c#3/dF3	60
d3	57

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Computer Literacy And The Three R's On The Sinclair/Timex

Derek Stubbs

Children will enjoy these games as well as learn basic mathematics and spelling skills.

I have four children, ages three to eight. Naturally, I am concerned about their education. But I also am concerned that they become computer literate. Few would disagree that the microprocessor will soon pervade all aspects of life. A ZX/TS, because it is small and kid-size, is the ideal tool for getting young people comfortable with computers and teaching them something of the 3 R's at the same time.

My first programs are very simple (Programs 1, 2, and 3). They introduce a three- to six-year-old to the alphanumeric symbols and the RUN and ENTER commands. Moreover, they tap children's endless fascination with seeing their names (and the names of everybody they know) on TV. My younger kids constantly demand these programs, though the older two need something more meaty to reflect their classwork.

But before I get into that, there is a more complex program that all children love. There is only one thing better than seeing their names in letters on TV, and that is seeing their names in *big* letters on TV. Program 4, "Big Letters," will print three words of four letters each. Each big letter is composed of several small letters of the letter character chosen for display. The display fills the screen. If you want four lines with nine characters per line, then change the 8 in line 270 to 6, and change line 200 to:

```
200 PLOT X + X1,6 - Y
```

Ciphering And Spelling

Kids from ages six to ten, approximately, will enjoy, and benefit from, two classic programs: Arithmetic, which helps them practice their simple arithmetic, and Hangman, the spelling game.

Program 5 will generate two-number arithmetic equations which include the arithmetic signs (+, -, *, /) between the two numbers. The child must enter the correct number for the answer. If the entry is wrong, the child is gently asked to "try again." After three wrong answers in a row, the friendly ZX/TS gives the child the right answer and tries a new example. If your child has trouble mastering all the arithmetic signs, the program can easily be edited to exclude the difficult ones.

Hangman is the classic spelling game. Program 6 allows you to enter ten words of up to ten letters each. After that, your child can enter letters and either be correct or be "hanged." This game should keep a child busy for half an hour.

Program 1.

```
1 REM**FOR VERY YOUNG KIDS**
10 CLS
20 LET Z$=INKEY$
30 FOR N=1 TO 21
40 PRINT Z$
50 NEXT N
60 GOTO 10
```

Program 2.

```
1 REM**FOR SLIGHTLY YOUNG KIDS**
10 INPUT A$
20 FOR N=1 TO 21*31/LEN A$
30 PRINT A$;" ";
40 NEXT N
50 CLS
60 GOTO 10
```

Program 3.

```
1 REM**FOR YOUNG KIDS**
10 INPUT A$
20 SCROLL
30 PRINT A$
40 GOTO 10
```

Program 4.

```
1 REM**BIG LETTERS**
2 REM**TYPE FOUR 4-LETTER WORDS**
100 GOTO 500
110 LET X1=0
120 FOR I=1 TO LEN W$
130 LET J=CODE W$
140 LET W$=W$(2+LEN W$)
150 FOR Y=0 TO 7
160 LET K=PEEK (7680+J*8+Y)
170 LET L=128
180 FOR X=0 TO 7
190 IF K<L THEN GOTO 220
200 PRINT AT Y+15, X+X1;CHR$J
210 LET K=K-L
220 LET L=L/2
230 NEXT X
240 NEXT Y
250 LET X1=X1+7
260 NEXT I
270 FOR N=1 TO 8
280 SCROLL
290 NEXT N
300 RETURN
500 INPUT A$
```



```

510 INPUT B$
520 INPUT C$
530 INPUT D$
540 LET W$=A$
550 GOSUB 110
560 LET W$=B$
570 GOSUB 110
580 LET W$=C$
590 GOSUB 110
600 LET W$=D$
610 GOSUB 110
620 GOTO 540

```

Program 5.

```

1 REM**ARITHMETIC**
10 LET A=1+INT(10*RND)
20 LET B=1+INT(10*RND)
30 LET C=21+INT(4*RND)
38 LET X=0
39 SCROLL
40 PRINT A;" ";CHR$(C);" ";B;" "; "=";"?"
45 SCROLL
50 INPUT D
60 IF C=21 THEN LET E=A+B
70 IF C=22 THEN LET E=A-B
80 IF C=23 THEN LET E=A*B
90 IF C=24 THEN LET E=A/B
100 IF ABS(D-E)<=.001 THEN GOTO 1000
110 GOTO 2000
120 GOTO 10
1000 SCROLL
1005 PRINT E
1009 SCROLL
1010 PRINT "GOOD.TRY AGAIN"
1020 GOTO 10
2000 LET X=X+1
2010 PRINT "WRONG.TRY AGAIN"
2020 IF X>=3 THEN GOTO 10
2030 GOTO 39

```

Program 6.

```

2 REM**IF YOU HAVE GOT THE WORD THEN TYP
  E IT ALL IN TO GO TO THE NEXT WOR
  D**
100 GOSUB 1000
110 CLS
120 FOR I=1 TO 10
124 LET V=0
125 CLS
130 GOSUB 2000
140 NEXT I
150 GOTO 100
1000 PRINT "ENTER 10 WORDS OF =< 10
  LETTERS "
1001 PAUSE 120
1005 DIM A$(10,10)
1010 FOR I=1 TO 10
1020 CLS
1030 PRINT I
1040 INPUT A$(I)
1050 NEXT I
1060 RETURN
2000 FOR X=1 TO 10
2010 IF CODE A$(I,X)=0 THEN GOTO 2050
2030 PRINT " ";
2040 NEXT X
2050 FOR Y=1 TO 10
2060 PRINT AT Y+2,0;"TYPE A LETTER"
2070 INPUT B$
2080 PRINT AT Y+3,0;B$

```

```

2081 PAUSE 120
2090 IF LEN B$=X-1 THEN GOSUB 5000
2100 LET Z=0
2110 FOR W=1 TO X
2119 FOR U=1 TO LEN B$
2120 IF CODE B$(U)=CODE A$(I,W) THEN GOSUB ~
  3000
2130 NEXT W
2131 NEXT U
2140 IF Z=0 THEN GOSUB 4000
2150 NEXT Y
2160 CLS
2170 PRINT "YOU ARE HANGED"
2180 PAUSE 120
2190 RETURN
3000 PRINT AT 0,W-1;B$(U)
3010 LET Z=Z+1
3020 RETURN
4000 LET V=V+1
4010 IF V=1 THEN PRINT AT V,25;"YOU"
4020 IF V=2 THEN PRINT AT V,25;"HAVE"
4030 IF V=3 THEN PRINT AT V,25;"GIVEN"
4040 IF V=4 THEN PRINT AT V,25;"TOO"
4050 IF V=5 THEN PRINT AT V,25;"MANY"
4060 IF V=6 THEN PRINT AT V,25;"WRONG"
4070 IF V=7 THEN PRINT AT V,25;"ANSWERS"
4080 RETURN
5000 LET M=0
5010 FOR N=1 TO X-1
5020 IF B$(N)=A$(I,N) THEN LET M=M+1
5030 NEXT N
5040 IF M=X-1 AND I=10 THEN GOTO 100
5041 IF M=X-1 THEN NEXT I
5050 RETURN

```

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Center The VIC Screen

Mark LaForge

I'm sure many VIC-20 owners have experienced the same problem I had: the picture is not in the center of the TV screen. It's sometimes called *overscan*.

On my TV I lose the right-most character on each line. This can be most annoying when you are playing a game and get zapped because you ran into an unseen danger, or when you are debugging a program but can't find the error because it is in the screen area not visible on your TV. For those of you who suffer from these or similar problems, there is help.

With the aid of two memory locations, you can center your picture on the screen. These locations are 36864 and 36865. Location 36864 is set to 5 when your machine is turned on; but when that location is POKEd with a value from 0 to 4, the screen moves to the left, and values from 6 to 14

move the screen to the right. Location 36865 controls vertical movement and is normally set to 25. Lower values will raise the picture, and higher values will lower it.

Below is a short routine which you can put at the beginning of all your programs. Using the cursor keys, move the screen around so that all four sides of the border are visible. When the screen is centered, hit the RETURN key to exit the subroutine.

Even if your machine does not have this problem, you might want to include the routine in your programs so that when others use them on their machines they can center the screen.

Once the screen is set, it will remain that way until 36864 or 36865 is POKEd with a different value, or until the RUN/STOP and RESTORE keys are hit together, resetting the screen to the location it occupied when the machine was turned on.

```
0 POKE36879,27:PRINT"{CLEAR}{10 DOWN}{04  
  RIGHT}CENTER SCREEN":PRINT"{02  
  RIGHT}USING CURSOR KEYS"  
1 A=PEEK(197):B=PEEK(653):IFA=15THEN9  
2 IFA=31THENA=36865:GOTO5  
3 IFA=23THENA=36864:GOTO5  
4 GOTO1  
5 IFB=1THENB=-1  
6 IFB=0THENB=1  
7 Q=PEEK(A):IFQ+B<0OR(Q+B>17AND A=36864)T  
  HEN1  
8 POKEA,Q+B:GOTO1  
9 PRINT"{CLEAR}":CLR
```

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Applesoft Printer Control

Eric and Sally Martell

If your printer has several modes, you may have had difficulty trying to remember all the codes. This mode-setting program makes the selection of printer typefaces simpler and easier. The program is designed for the Apple II+ using an Epson printer with Graphtrax+, but it can be adapted for other printers and computers.

The dot matrix printer has evolved over the last two years from a rather stodgy machine suitable only for making nearly illegible program listings and data dumps into a sleek, glossy beast which can come close to letter quality printers in typeface formation.

The modern dot matrix printer is usually faster than letter quality printers, usually cheaper (although there is some overlap in prices), and can be the printer of choice for every application from programming to draft quality (sometimes called correspondence quality) word processing.

Many contemporary dot matrix impact printers have extensive abilities to present different styles of character formation (see the figure). Generally, these different character fonts are software selectable, a convenient feature for the user. Obviously, having the print style under program control can be useful. However, the problem then arises of remembering how to set the different print modes.

Printer manufacturers have not standardized printer control codes. Different printers will respond to different control characters. This is not a problem if your printer has only two different print fonts, but you will probably not be able to remember all of your machine's codes if it has several different printing modes. The usual answer to this problem is to look in the instruction manual which came with the printer, a solution which can be a major research project. A quicker method is to write a mode-setting program for your printer. You can do this by adapting the program presented in this article.

The program is written in Applesoft BASIC and allows the Apple II+ to use one of the Epson MX-series printers with Graphtrax+. These printers have 12 print modes which can be used in either normal or italic typeface.

Print Styles

Lines 200-340 contain all of the Epson control codes

for the different type styles to be used. These lines set values into two string arrays. The array PS\$(n) contains the code to set the style of type, and the array DS\$(n) contains a brief description of the corresponding control code in PS\$(n). These codes are specific to the Epson printers; if you're customizing this routine for another printer, you will make the majority of changes here.

The program will not only allow you to set your printer, but will also demonstrate all of the printer's various print styles if required. If you choose to print the demonstration, control passes to the routine between lines 400 and 560.

On the other hand, if you simply want to set the printer, lines 570-670 print a menu, lock it in position on the screen, and then allow input of your choice. If the printer can be set to your choice, the control passes to the short routine at line 760, which first sets the printer to the normal mode and then sends the special mode requested and returns to the menu.

The logic of this part of the program is complicated by the fact that the Epson double-width modes (modes 7-12) may be set only for a single line and must be reset at the beginning of every line to be printed in those modes. Lines 690-710 print a message about this problem, and then lines 720 and 730 allow you to type in a brief message, which will be printed on the printer as soon as you hit the return key. The printer will be left in the normal 80 characters per line mode. After printing the line, control returns to the menu routine.

It must be noted that every time a mode is sent to the printer, all previous modes are cleared by first sending PS\$(3), the "normal" mode command string. The string, PS\$(3), resets double strike, compressed, and enhanced modes, but does not reset the Italics command. Therefore, if you first request the special print mode which you want and then turn the Italics on, you will get the normal mode with Italics. The correct procedure: first turn on the Italics and then select the special print desired. If you then use option 15 to end the program, your printer will remain set in the typeface which you have specified.

Regardless of which brand of printer or computer you own, the basic approach used here is

easily customized. With a look at your printer's manual and a little work keying in code, you should never have difficulty selecting printer typefaces again.

Figure.

```
COMPRESSED MODE
0123456789 AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPpQqRrSsTtUuVvWwXxYyZz
COMPRESSED-DOUBLE STRIKE MODE
0123456789 AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPpQqRrSsTtUuVvWwXxYyZz
NORMAL MODE
0123456789 AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPpQqRrSsTtUuVvWwXxYyZz
NORMAL-DOUBLE STRIKE MODE
0123456789 AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPpQqRrSsTtUuVvWwXxYyZz
NORMAL-EMPHASIZED MODE
0123456789 AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPpQqRrSsTtUuVvWwXxYyZz
NORMAL-EMPHASIZED-DOUBLE STRIKE
0123456789 AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPpQqRrSsTtUuVvWwXxYyZz
COMPRESSED-DOUBLE WIDTH MODE
0123456789 AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPpQqRrSsTtUuVvWwXxYyZz
COMPRESSED-DOUBLE WIDTH-DOUBLE STRIKE
0123456789 AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPpQqRrSsTtUuVvWwXxYyZz
COMPRESSED-DOUBLE WIDTH-EMPHASIZED
0123456789 AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPpQqRrSsTtUuVvWwXxYyZz
DOUBLE WIDTH-EMPHASIZED-DOUBLE STRIKE
0123456789 AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPpQqRrSsTtUuVvWwXxYyZz
DOUBLE WIDTH-DOUBLE STRIKE MODE
0123456789 AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPpQqRrSsTtUuVvWwXxYyZz
DOUBLE WIDTH-EMPHASIZED-DOUBLE STRIKE
0123456789 AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPpQqRrSsTtUuVvWwXxYyZz
DOUBLE WIDTH-DOUBLE STRIKE-EMPHASIZED
0123456789 AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPpQqRrSsTtUuVvWwXxYyZz
```

Program.

```
10 REM EPSON GRAPHTRAX+
20 REM PRINT MODE SET UTILITY
50 DIM PS$(14), DS$(14)
60 REM TITLES HERE
70 TEXT : HOME : SPEED=255:D$ = CHR$(4):
PRINT D$;"NOMON C,I,O": HOME
80 INVERSE : FOR I = 1 TO 4: PRINT SPC(40)
: IF I = 2 THEN PRINT " EPSON PRINTER
GRAPHTRAX+ SET UTILITY ";
90 NEXT I: NORMAL : POKE 34,5
100 VTAB 10: PRINT "PLEASE TURN YOUR PRINTER
ON NOW."
110 GOSUB 130: GOSUB 140: GOTO 200
120 REM HIT ANY KEY TO CONTINUE
130 VTAB 20: FLASH : PRINT "HIT
ANY KEY TO CONTINUE."; GET A$: PRINT
CHR$(1): NORMAL : RETURN
140 REM PRINT SLOT SET
150 S1 = 1
160 HOME : VTAB 10: PRINT "PRINTER SLOT=";S
1: CHR$(7): VTAB 20: PRINT "NEW SLOT (
#/<CR>)?": GET NS$: PRINT CHR$(1): IF
ASC(NS$) = 13 THEN 200
170 IF ASC(NS$) = 27 THEN TEXT : HOME : END
180 IF ASC(NS$) < 48 OR ASC(NS$) > 55 THEN
160
190 S1 = VAL(NS$): GOTO 160
200 REM SET CTRL-STRINGS
210 PS$(1) = CHR$(15):DS$(1) = "COMPRESSED
MODE"
220 PS$(2) = CHR$(15) + CHR$(27) + CHR$(
71):DS$(2) = "COMPRESSED-DOUBLE STRIKE
MODE"
230 PS$(3) = CHR$(27) + CHR$(72) + CHR$(
18) + CHR$(27) + CHR$(70):DS$(3) =
"NORMAL MODE"
240 PS$(4) = CHR$(27) + CHR$(71):DS$(4) =
"NORMAL-DOUBLE STRIKE MODE"
250 PS$(5) = CHR$(27) + CHR$(69):DS$(5) =
"NORMAL-EMPHASIZED MODE"
260 PS$(6) = CHR$(27) + CHR$(71) + CHR$(
27) + CHR$(69):DS$(6) = "NORMAL-EMPH
ASIZED-DOUBLE STRIKE"
270 PS$(7) = CHR$(27) + CHR$(14) + CHR$(
15):DS$(7) = "COMPRESSED-DOUBLE WIDTH
MODE"
280 PS$(8) = CHR$(27) + CHR$(71) + CHR$(
14) + CHR$(15):DS$(8) = "COMPRESSED-
DOUBLE WIDTH-STRIKE"
290 PS$(9) = CHR$(27) + CHR$(14):DS$(9) =
"DOUBLE WIDTH MODE"
300 PS$(10) = CHR$(27) + CHR$(71) + CHR$(
14):DS$(10) = "DOUBLE WIDTH-DOUBLE STR
IKE MODE"
310 PS$(11) = CHR$(27) + CHR$(69) + CHR$(
```

```
(14):DS$(11) = "DOUBLE WIDTH-EMPHASIZED
MODE"
320 PS$(12) = CHR$(27) + CHR$(71) + CHR$(
27) + CHR$(69) + CHR$(14):DS$(12) =
"DOUBLE WIDTH-STRIKE-EMPHASIZED MODE"
330 PS$(13) = CHR$(27) + "4":DS$(13) = "SE
T ITALICS ON"
340 PS$(14) = CHR$(27) + "5":DS$(14) = "SE
T ITALICS OFF"
350 REM SAMPLE OR JUST SET MODE
360 HOME
370 VTAB 10: PRINT "DO YOU WANT A SAMPLE OF
ALL THE PRINT?": PRINT "STYLES AVAILABL
E? (Y/N) "; GET Y$: PRINT Y$: PRINT CHR$(
1): IF Y$ = "Y" THEN 410
380 IF Y$ = "N" THEN 580
390 GOTO 370
400 REM PRINT SAMPLE
410 PRINT D$;"PR#";S1
420 PRINT CHR$(8);"80N"; CHR$(12)
430 PRINT PS$(11);" THE EPSON MX-SER
IES PRINTER"
440 FOR I = 48 TO 57:T$ = T$ + CHR$(I): NEXT
I:T$ = T$ + " ": FOR I = 65 TO 90:T$ =
T$ + CHR$(I):T$ = T$ + CHR$(I + 32)
: NEXT I
450 PRINT PS$(3)
460 FOR I = 1 TO 2
470 IF I = 1 THEN PRINT PS$(3);"STANDARD C
HARACTERS"
480 IF I = 2 THEN PRINT PS$(3);PS$(13);"IT
ALIC CHARACTERS"
490 PRINT
500 S$ = T$
510 FOR J = 1 TO 12: IF J > 8 THEN S$ = LEFT$(
T$,39)
520 PRINT PS$(3);DS$(J): PRINT PS$(J);S$
530 NEXT J
540 PRINT
550 NEXT I: PRINT PS$(3);PS$(14); CHR$(12)
: CHR$(12)
560 PRINT D$;"PR#0"
570 REM SET PRINT STYLE
580 HOME : VTAB 7: FOR I = 1 TO 14: IF I >
9 THEN PRINT I;". ";DS$(I)
590 IF I < 10 THEN PRINT " ";I;". ";DS$(I)
600 NEXT I
610 PRINT I;". EXIT PROGRAM"
620 POKE 34,22
630 ONERR GOTO 640
640 VTAB 23: INVERSE : INPUT "SELECT PRINT
STYLE (1-15) : ";P: IF P < 1 OR P > 15 THEN
PRINT CHR$(7): GOTO 640
650 NORMAL
660 IF P = 15 THEN TEXT : HOME : END
670 IF P < 7 OR P > 12 THEN 760
680 REM DOUBLE WIDTH LINE PRINT
690 VTAB 7: CALL - 958: VTAB 8: PRINT "MOD
ES 7-12 ARE ONE LINE MODES ONLY.": POKE
34,6: PRINT : PRINT "THE DOUBLE WIDTH C
HARACTER CONTROL": PRINT "STRING MUST B
E PRINTED AT THE FRONT OF": PRINT "EACH
LINE OF WIDE TEXT."
700 PRINT : PRINT "YOU MAY NOW TYPE A 40 CH
ARACTER (OR): PRINT "LESS" LINE AND IT
WILL BE PRINTED IN "; PRINT "THE DESIRE
D MODE.": PRINT : PRINT "PLEASE ADJUST
YOUR PRINTER PAPER TO THE"
710 PRINT "DESIRED POSITION FOR THE LINE.":
VTAB 21: PRINT "TYPE IN THE LINE YOU W
ANT PRINTED:"
720 VTAB 22: INPUT " ";L$: IF LEN(L$) > 40
THEN VTAB 22: CALL - 868: VTAB 22: GOTO
720
730 PRINT D$;"PR#";S1: PRINT PS$(3);PS$(P);
L$;PS$(3): PRINT D$;"PR#0": GOTO 580
740 REM CLEAR PREVIOUS MODE &
750 REM SEND NEW MODE
760 PRINT D$;"PR#";S1: PRINT PS$(3);PS$(P):
PRINT D$;"PR#0": VTAB 1: CALL - 868: VTAB
1: INVERSE : HTAB ((40 - LEN(DS$(P)))
/ 2): PRINT DS$(P): GOTO 640
```


VIDEO 80

80 Columns For The Atari

Charles Brannon, Editorial Assistant

How would you like to add 80-column capability to your Atari at no cost, without any hardware modifications? This program requires a disk drive.

The Atari text screen is well designed. The white on blue text colors are chosen for maximum contrast and resolution on the average TV screen. You also have 40 columns of letters across a line on your TV display.

Why 80 Columns?

Some applications, such as word processing, spreadsheets, screen-based operator entry, high-resolution graphics labeling, and even proof-reading, benefit from a higher text density. Most high-end business computers, therefore, have 80-column displays. Unfortunately, a normal 80-column display is impossible on a TV screen. TV's can't handle the necessary fine detail. That's why the Atari doesn't have an 80-column feature, an otherwise desirable capability.

You can buy 80-column cards for your Atari. These devices let you switch your display to 80 columns, and even let you edit BASIC programs in 80 columns.

While "Video 80," the program below, has its limitations, it is a reasonable alternative to hardware add-ons. Here's how it works. The characters are "drawn" half-wide in GRAPHICS 8, the highest resolution mode. Each character is only four pixels wide, versus eight pixels in 40 columns. (A *pixel* is a screen dot, a *picture element*.) The fourth pixel must be blank, to allow for spacing between letters. Also required is a special *character set*. This is the first caveat – the 900+ bytes (128x7) of the character set add to the typing required to enter Video 80.

TV Tribulations

You might suspect that such a condensed screen would be hard to read, and you would be right. If you have a monochrome *monitor*, you'll have no problem. (A *monitor* is a special TV without a tuner inside which puts the signal *directly* from the com-

puter to the screen.) The characters will be quite crisp. Televisions have a harder time, due to artifactualing. You will be able to use Video 80 on some quality TV's or even a large screen TV with bigger pixels. An ordinary black and white TV is quite satisfactory.

First, type in Program 1. Video 80 is a machine language program. You'll need a disk drive to use Video 80, since the program directly creates the *binary file* that you load from DOS. When you RUN it, you'll have the option of naming it AUTORUN.SYS. Since Video 80 resides in low memory, this is the easiest way to load it. If you write the AUTORUN.SYS file to any disk containing DOS, it will automatically load and initialize when you boot the disk. Type it in carefully. However, if you make an error in the DATA lines, you will be given the range of lines where the error occurs.

The V: Device

Video 80 interfaces with BASIC and the OS by adding a new device, "V:" You're already familiar with several Atari devices, such as "D:" for the disk drive, "P:" for the printer, and even "R:", the RS-232 (850 module) device. Using Video 80 is as simple as OPENing a file to "V:", and PRINT#ing or INPUT#ing through it. A sample program might look like:

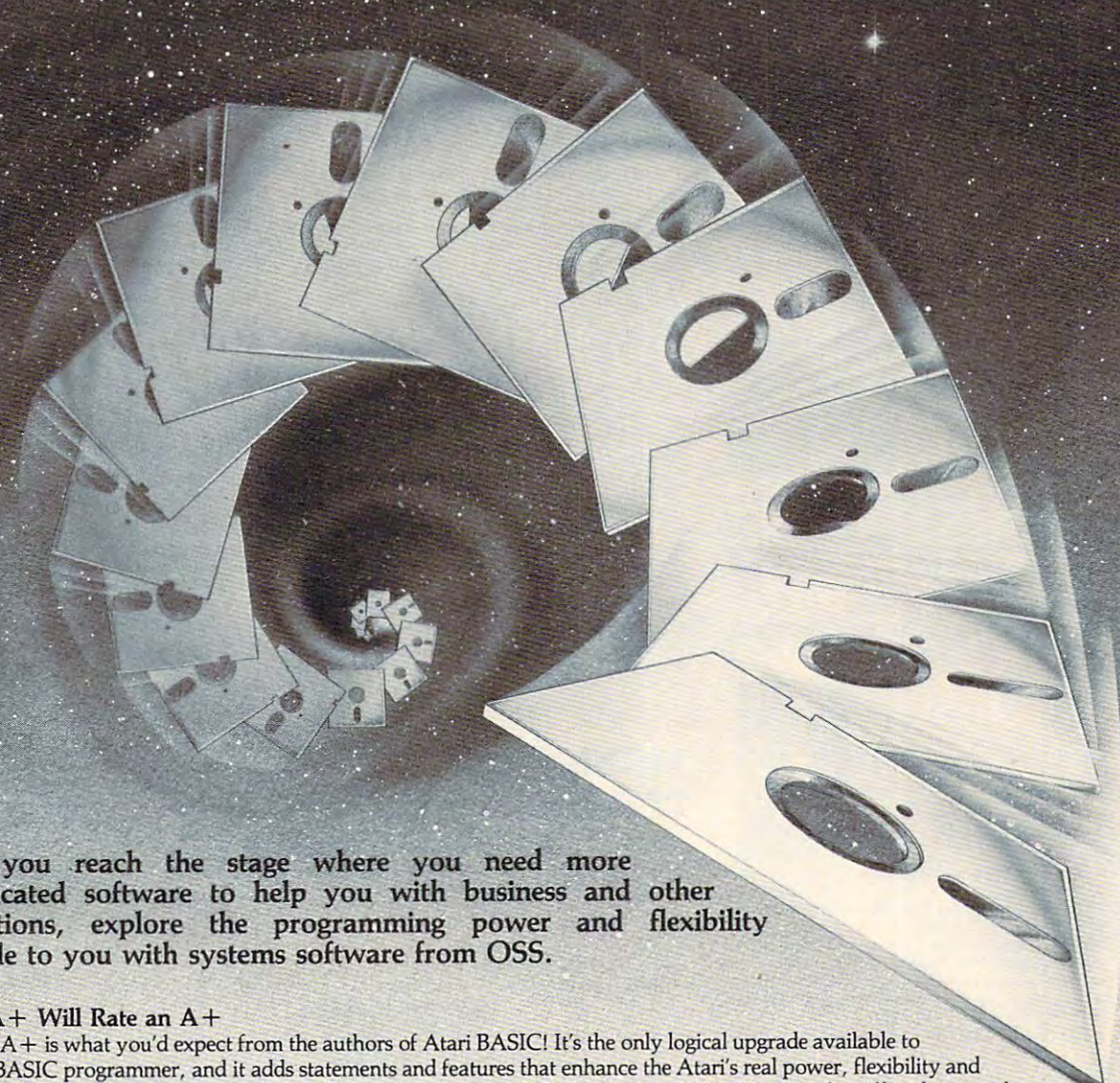
```
10 OPEN #1,12,0,"V:"
20 PRINT #1;"Hello"
30 CLOSE #1
40 GOTO 40
```

You might think of Video 80 as a "soft" 80-column printer, making it ideal for reviewing listings. You can say LIST"V:".

Line Input

Also supported is simple line-based editing. No fancy cursor controls here – backspace is the only editing key. The cursor appears only during INPUT. You can change the cursor character by POKEing into location five. POKE 5,63 changes the cursor into an underline. Note that the char-

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From Synapse

Your man at the picnic must keep a swarm of ants from stealing all the food. He's armed with a fly swatter, and must avoid the attacking wasps as he swats at the flies. Then there are the spiders, spinning webs in his path. Great sound and graphics; 1 or 2 players. Requires joystick.

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Board game strategy and realistic animation combine to make this arcade game the most difficult real life challenge of all. Track the oncoming enemy with the sonar aboard your U-Boat while using your periscope to chase enemy ships throughout the Atlantic. Get them in your sights—open torpedo bays—give the command—FIRE!

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PROTECTOR II

By Mike Potter from Synapse

You must transport all your people from the city under attack by Fraxullan Slimehordes. You must lift them one by one first to the City of Hope on the far side of the volcano; then to safety at the Verdann Fortress. Beware the Xytomic Pulse Trackers, meteoroid showers and the Laser Caves of Fear. But hurry, before the volcano erupts!!

32K Tape or Disk, \$34.95

ROM, \$44.95



SHAMUS

From Synapse Software

It's the 21st century, and you're the SHAMUS, looking for your arch-enemy, the Shadow, to destroy him. You're armed with Ion-Shivs, the most powerful weapons in the galaxy. Can you handle the Shadow's henchmen: Robo-Droids, Whirling Drones and Snap-Jumpers, all armed and evil? Can you find the Shadow in his lair of 4 levels with 32 rooms each... every one of them dangerous? Intensive arcade action, requires joysticks.

16 K Tape or Disk, \$34.95

ROM, \$44.95



SLIME

From Synapse by Mike Hales

Large drops of "Slime" fall from the sky onto your ships. If one drop hits your ship, it will sink. Use the triangular diverters to aim Slime into buckets on the sides of the screen. If Slime falls into the ocean, the level of the ocean rises. When the ocean reaches the top of the screen, the game is over, and your score is calculated. One-player game with excellent graphics.

16K Tape or Disk, \$34.95

ROM, \$44.95



BAJA BUGGIES

From Gamestar

Test your nerves and reflexes—compete with top road racers! One player selects amateur or pro skill level, 5 levels of difficulty and 3 race courses including random course for Buggy Stars. Watch speedometer and radar detector on control panel along with realistic sounds while you steer and brake your super charged buggy to the finish in the Baja sun. High score/initial ranking for real stars!

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From First Star

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From Sirius

On your mark; get set; go Eddie!! FAST EDDIE's off and running, dashing up and down every ladder he can find, hunting for prizes. Quick, there's a heart floating on the 2nd floor! Ooops, look out—there's a Sneaker, sneaking up on you—jump, Eddie! Great animation; 8 skill levels; lots of action. Requires joystick.

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acter you POKE is the "internal" code, not ASCII. A sample input/output program could be:

```
10 OPEN #1,12,0,"V:"
20 DIM NAME$(20)
30 PRINT #1;"What is your name?";
40 INPUT #1;NAME$
50 PRINT #1;"Glad to meet you, ";NAME$
60 GOTO 60
```

Line 60 is used here to keep the display on the screen when the program ends. Since the full-screen GRAPHICS 8 screen is used, the program would flip back to GRAPHICS 0 when the program ends. (Try typing GRAPHICS 24 in immediate mode to see this effect.)

Windows

There's more. You can also restrict the size of the 80-column screen. It may seem pointless to cut 80-column capability down to a small window of the screen, but windows are actually quite useful. You can set up and switch from window to window. All scrolling and clearing is confined to the window. A "screen form" layout is easily designed. You can even outline the windows with high-resolution lines. The top and bottom margins are stored in locations 1 and 2, the left and right margins are in 3 and 4. Use POKE to change them. You can also use the POSITION command to move the cursor to any legal X,Y position (X:0-79, Y:0-23). Program 2 is an example program for using windows. The left margin must be an even number, and the right margin must be an odd number.

Since the same memory locations are used, you can really get confused trying to use high-resolution graphics with the text. Use GRAPHICS 24 before you OPEN your file to "V:". Try to keep your hi-res stuff separate from text.

BASICally 80

You can even "transform" the default Atari I/O screen from 40 to 80 columns. Program 3 POKes a tiny machine language routine into page six. The command PRINT USR(1536) will set up 80 columns. If you execute a GRAPHICS 0 command, you're really in trouble - it'll be a "twilight zone" between GRAPHICS 0 and 8. You'll have to press RESET to detach "V:". If you do this, you'll have to reload it to use it again.

Once in the 80-column mode, you can list, load, and enter commands. If you want to change a line of BASIC, however, you'll have to retype it. Full cursor-based editing would be great, but it would substantially increase the length of the program.

Program 1.

```
100 REM VIDEO 80
110 REM Charles Brannon
```

```
120 GRAPHICS 0:?"Checking DATA line
s...":? :? :DIM CORRECT(27),F$(2
0):SETCOLOR 2,1,4
130 FOR I=1 TO 27:READ A:CORRECT(I)=
A:NEXT I
140 FOR I=1 TO 27:CHECKSUM=0
150 FOR J=1 TO 60-42*(I=27)
160 READ A:CHECKSUM=CHECKSUM+A:POKE
712,A
170 NEXT J
180 IF CHECKSUM<>CORRECT(I) THEN ? "
Error somewhere in lines ";7936+
(I-1)*60;"-";7990+(I-1)*60:ERRFL
G=1
190 NEXT I:POKE 712,0
200 IF ERRFLG THEN ? :? "Can't conti
nue until":? "DATA lines are per
fect.":SETCOLOR 2,4,4:END
210 REM Checksum values
220 REM These at least must be typed
in perfectly!!!
230 DATA 4556,4216,7888,4777,7684,87
89,6732,3655,3808,3587,6205,6086
,5406,5712,6731,7528,7758,7120,6
184,5743,6210
240 DATA 6677,5602,7418,7558,7271,13
54
250 GRAPHICS 0:SETCOLOR 2,12,4:?"Co
ngratulations. DATA OK!":?
260 ? "Enter output filename below."
:?"Use AUTORUN.SYS for easiest
use."
270 ? "AUTORUN.SYS will boot up on a
":?"disk containing DOS."
280 ? :? "If you use another name, y
ou must":?"use MEM.SAV and DOS
selection L":?"to load the prog
ram."
290 ? :? "Use the D: prefix.":?
300 ? "Filename":INPUT F$
310 ? :? "Writing file":SETCOLOR 2,7
,4
320 TRAP 500:OPEN #1,8,0,F$
330 PUT #1,255:PUT #1,255
340 PUT #1,0:PUT #1,31:PUT #1,42:PUT
#1,37:RESTORE 7936
350 FOR I=7936 TO 9514:READ A:PUT #1
,A:NEXT I
351 PUT #1,224:PUT #1,2:PUT #1,225:P
UT #1,2:PUT #1,53:PUT #1,35
360 CLOSE #1:TRAP 40000:SETCOLOR 2,9
,4
370 ? :? "File saved OK. Have fun!"
380 END
500 CLOSE #1:SETCOLOR 2,4,4:?"ER
ROR-";PEEK(195);" trying to save
";F$
510 END
7900 REM
7910 REM Machine language equivalent
7920 REM of VIDEO 80. Must be typed
7930 REM accurately to function.
7931 REM
7936 DATA 0,0,0,0,0,0
7942 DATA 0,68,68,68,68,0
7948 DATA 68,0,170,170,170,0
7954 DATA 0,0,0,0,170,238
7960 DATA 170,238,170,0,68,102
7966 DATA 136,68,34,204,68,0
7972 DATA 136,34,68,136,34,0
7978 DATA 204,102,238,102,204,68
```


...and so there were keys for the Atari 400.



In the beginning there was the membrane keyboard.

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7984 DATA 0,68,68,68,0,0
7990 DATA 0,0,102,136,136,136
7996 DATA 136,136,102,204,34,34
8002 DATA 34,34,34,204,0,170
8008 DATA 68,238,68,170,0,68
8014 DATA 68,238,68,68,0,0
8020 DATA 0,0,0,0,68,68
8026 DATA 136,0,0,238,0,0
8032 DATA 0,0,0,0,0,0
8038 DATA 0,68,0,0,0,34
8044 DATA 68,136,0,0,238,170
8050 DATA 170,170,170,238,0,68
8056 DATA 204,68,68,68,238,0
8062 DATA 238,34,34,238,136,238
8068 DATA 0,238,34,34,238,34
8074 DATA 238,0,170,170,170,238
8080 DATA 34,34,0,238,136,238
8086 DATA 34,34,238,0,238,136
8092 DATA 238,170,170,238,0,238
8098 DATA 34,34,68,68,68,0
8104 DATA 238,170,238,170,170,238
8110 DATA 0,238,170,170,238,34
8116 DATA 238,0,0,0,68,0
8122 DATA 68,0,0,0,0,68
8128 DATA 0,68,68,136,34,68
8134 DATA 136,68,34,0,0,0
8140 DATA 238,0,238,0,0,0
8146 DATA 136,68,34,68,136,0
8152 DATA 0,204,34,34,68,0
8158 DATA 68,0,102,153,187,187
8164 DATA 136,102,0,238,170,170
8170 DATA 238,170,170,0,204,170
8176 DATA 204,170,170,204,0,102
8182 DATA 136,136,136,136,102,0
8188 DATA 204,170,170,170,170,204
8194 DATA 0,238,136,204,136,136
8200 DATA 238,0,238,136,204,136
8206 DATA 136,136,0,102,136,136
8212 DATA 170,170,102,0,170,170
8218 DATA 238,170,170,170,0,238
8224 DATA 68,68,68,68,238,0
8230 DATA 34,34,34,34,34,204
8236 DATA 0,170,170,204,170,170
8242 DATA 170,0,136,136,136,136
8248 DATA 136,238,0,170,238,238
8254 DATA 170,170,170,0,204,170
8260 DATA 170,170,170,170,0,68
8266 DATA 170,170,170,170,68,0
8272 DATA 238,170,238,136,136,136
8278 DATA 0,238,170,170,170,170
8284 DATA 238,51,204,170,170,204
8290 DATA 170,170,0,102,136,204
8296 DATA 34,34,204,0,238,68
8302 DATA 68,68,68,68,0,170
8308 DATA 170,170,170,170,238,0
8314 DATA 170,170,170,170,170,68
8320 DATA 0,170,170,170,238,238
8326 DATA 170,0,170,68,68,68
8332 DATA 68,170,0,170,170,238
8338 DATA 68,68,68,0,238,34
8344 DATA 68,136,136,238,0,34
8350 DATA 68,68,136,68,68,34
8356 DATA 0,136,68,34,0,0
8362 DATA 0,136,68,68,34,68
8368 DATA 68,136,0,68,170,0
8374 DATA 0,0,0,0,0,0
8380 DATA 0,0,0,255,0,153
8386 DATA 255,255,102,0,0,68
8392 DATA 68,68,119,68,68,68
8398 DATA 34,34,34,34,34,34
8404 DATA 34,68,68,68,204,0
8410 DATA 0,0,68,68,68,204
8416 DATA 68,68,68,0,0,0
8422 DATA 204,68,68,68,0,0
8428 DATA 0,17,34,68,136,0
8434 DATA 0,0,136,68,34,17
8440 DATA 0,0,0,17,51,119
8446 DATA 255,0,0,0,0,51
8452 DATA 51,51,0,0,0,136
8458 DATA 204,238,255,51,51,51
8464 DATA 51,0,0,0,204,204
8470 DATA 204,204,0,0,0,238
8476 DATA 0,0,0,0,0,0
8482 DATA 0,0,0,0,0,0
8488 DATA 255,0,0,0,0,204
8494 DATA 204,204,0,0,68,170
8500 DATA 68,238,0,0,0,0
8506 DATA 119,68,68,68,0,0
8512 DATA 0,238,0,0,0,68
8518 DATA 68,68,255,68,68,68
8524 DATA 0,0,0,238,238,238
8530 DATA 0,0,0,0,0,238
8536 DATA 238,238,136,136,136,136
8542 DATA 136,136,136,0,0,0
8548 DATA 255,68,68,68,68,68
8554 DATA 68,255,0,0,0,204
8560 DATA 204,204,204,204,204,204
8566 DATA 68,68,68,119,0,0
8572 DATA 0,204,136,204,136,204
8578 DATA 102,0,68,238,68,68
8584 DATA 68,0,0,68,68,68
8590 DATA 238,68,0,0,34,68
8596 DATA 238,68,34,0,0,136
8602 DATA 68,238,68,136,0,0
8608 DATA 0,102,255,255,102,0
8614 DATA 0,0,0,102,34,238
8620 DATA 238,0,136,136,204,170
8626 DATA 170,204,0,0,0,102
8632 DATA 136,136,102,0,34,34
8638 DATA 102,170,170,102,0,0
8644 DATA 0,238,238,136,238,0
8650 DATA 0,204,136,204,136,136
8656 DATA 0,0,0,102,170,238
8662 DATA 34,204,136,136,136,204
8668 DATA 170,170,0,0,68,0
8674 DATA 68,68,68,0,0,34
8680 DATA 0,34,34,34,204,136
8686 DATA 136,170,204,170,170,0
8692 DATA 68,68,68,68,68,68
8698 DATA 0,0,0,170,238,170
8704 DATA 170,0,0,0,204,170
8710 DATA 170,170,0,0,0,238
8716 DATA 170,170,238,0,0,0
8722 DATA 204,170,204,136,136,0
8728 DATA 0,102,170,102,34,34
8734 DATA 0,0,102,136,136,136
8740 DATA 0,0,0,238,136,102
8746 DATA 238,0,0,68,238,68
8752 DATA 68,102,0,0,0,170
8758 DATA 170,170,238,0,0,0
8764 DATA 170,170,170,68,0,0
8770 DATA 0,170,170,238,170,0
8776 DATA 0,0,170,68,170,170
8782 DATA 0,0,0,170,170,102
8788 DATA 34,204,0,0,238,68
8794 DATA 136,238,0,0,68,238
8800 DATA 238,68,238,0,68,68
8806 DATA 68,68,68,68,68,255
8812 DATA 153,153,153,153,153,255
8818 DATA 34,102,238,102,34,0
8824 DATA 0,136,204,238,204,136
8830 DATA 0,0,133,203,173,255
8836 DATA 2,208,251,169,0,133



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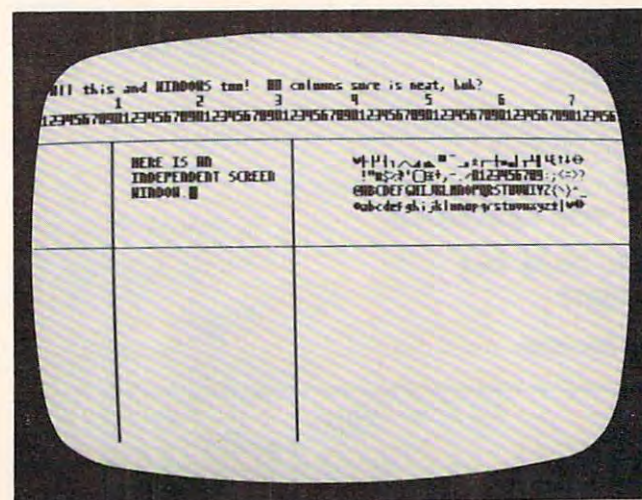
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 8854 DATA 207,32,4,35,165,85
 8860 DATA 74,24,101,205,133,205
 8866 DATA 144,2,230,206,169,0
 8872 DATA 133,209,165,203,10,38
 8878 DATA 209,10,38,209,10,38
 8884 DATA 209,56,229,203,133,208
 8890 DATA 176,2,198,209,24,165
 8896 DATA 208,105,0,133,208,165
 8902 DATA 209,105,31,133,209,160
 8908 DATA 0,165,85,74,176,17
 8914 DATA 177,208,69,207,41,240
 8920 DATA 133,204,177,205,41,15
 8926 DATA 5,204,76,241,34,177
 8932 DATA 208,69,207,41,15,133
 8938 DATA 204,177,205,41,240,5
 8944 DATA 204,145,205,24,165,205
 8950 DATA 105,39,133,205,144,2
 8956 DATA 230,206,200,192,7,208
 8962 DATA 202,96,24,169,0,133
 8968 DATA 205,133,206,165,84,10
 8974 DATA 10,10,133,204,38,206
 8980 DATA 10,38,206,10,38,206
 8986 DATA 101,204,144,2,230,206
 8992 DATA 10,38,206,10,38,206
 8998 DATA 10,38,206,24,101,88
 9004 DATA 133,205,165,206,101,89
 9010 DATA 133,206,96,160,0,185
 9016 DATA 26,3,201,0,240,10
 9022 DATA 200,200,192,34,208,243
 9028 DATA 56,160,147,96,169,86
 9034 DATA 153,26,3,200,169,100
 9040 DATA 153,26,3,200,169,35
 9046 DATA 153,26,3,169,43,141
 9052 DATA 231,2,169,37,141,232
 9058 DATA 2,96,117,35,114,35
 9064 DATA 1,36,170,35,116,35
 9070 DATA 116,35,76,115,35,160
 9076 DATA 1,96,169,0,133,84
 9082 DATA 133,85,133,107,133,0
 9088 DATA 133,3,133,1,169,79
 9094 DATA 133,4,169,23,133,2
 9100 DATA 169,128,133,5,169,8
 9106 DATA 133,43,169,12,133,42
 9112 DATA 32,246,243,162,0,142
 9118 DATA 197,2,162,10,142,198
 9124 DATA 2,142,200,2,76,115
 9130 DATA 35,32,177,35,76,115

9136 DATA 35,201,125,208,3,76
 9142 DATA 16,37,166,3,228,85
 9148 DATA 48,2,134,85,166,4
 9154 DATA 228,85,176,2,134,85
 9160 DATA 166,1,228,84,48,2
 9166 DATA 134,84,166,2,228,84
 9172 DATA 176,2,134,84,201,155
 9178 DATA 208,7,165,3,133,85
 9184 DATA 76,243,35,32,203,36
 9190 DATA 32,128,34,166,85,228
 9196 DATA 4,208,16,166,3,134
 9202 DATA 85,166,84,228,2,208
 9208 DATA 3,76,96,36,230,84
 9214 DATA 96,230,85,96,166,107
 9220 DATA 240,12,166,0,189,128
 9226 DATA 5,198,107,230,0,76
 9232 DATA 115,35,162,0,134,0
 9238 DATA 134,107,165,5,32,128
 9244 DATA 34,32,226,246,192,127
 9250 DATA 176,35,201,155,240,36
 9256 DATA 201,126,208,6,32,218
 9262 DATA 36,76,24,36,166,107
 9268 DATA 16,6,32,253,36,76
 9274 DATA 24,36,157,128,5,32
 9280 DATA 177,35,230,107,76,24
 9286 DATA 36,169,155,76,117,35
 9292 DATA 169,0,32,128,34,169
 9298 DATA 155,166,107,157,128,5
 9304 DATA 230,107,32,177,35,76
 9310 DATA 2,36,165,1,133,84
 9316 DATA 32,4,35,165,2,133
 9322 DATA 84,166,204,165,2,10
 9328 DATA 10,10,133,100,24,165
 9334 DATA 205,105,64,133,176,165
 9340 DATA 206,105,1,133,177,165
 9346 DATA 3,74,168,177,176,145
 9352 DATA 205,200,152,10,197,4
 9358 DATA 144,245,24,165,205,105
 9364 DATA 40,133,205,144,2,230
 9370 DATA 206,232,228,100,208,212
 9376 DATA 56,165,205,233,40,133
 9382 DATA 205,176,2,198,206,162
 9388 DATA 8,165,3,74,168,169
 9394 DATA 0,145,205,200,152,10
 9400 DATA 197,4,144,245,24,165
 9406 DATA 205,105,40,133,205,144
 9412 DATA 2,230,206,202,208,227
 9418 DATA 96,168,42,42,42,42
 9424 DATA 41,3,170,152,41,159
 9430 DATA 29,246,254,96,169,0
 9436 DATA 32,128,34,165,107,240
 9442 DATA 25,165,85,197,3,240
 9448 DATA 5,198,85,76,250,36
 9454 DATA 165,4,133,85,165,84
 9460 DATA 197,1,240,2,198,84
 9466 DATA 198,107,96,162,175,142
 9472 DATA 0,210,142,1,210,160
 9478 DATA 0,136,208,253,202,224
 9484 DATA 159,208,243,96,165,1
 9490 DATA 133,84,32,4,35,56
 9496 DATA 165,2,229,1,24,105
 9502 DATA 1,10,10,10,170,32
 9508 DATA 173,36,165,3,133,85
 9514 DATA 96,0,0,0,0,0



An all-software 80-column screen on the Atari with "Video-80."

Program 2.

```
100 REM DEMO FOR V: WINDOWS
110 GRAPHICS 8+16:REM Only need this
    if you use graphics
120 OPEN #1,12,0,"V:":REM Open V: de
    vice
```



```

130 DIM A$(127)
140 REM Draw window outline
150 COLOR 1:PLOT 0,88:DRAWTO 319,88
160 PLOT 38,31:DRAWTO 38,191:PLOT 12
    8,31:DRAWTO 128,191:PLOT 0,31:DR
    AWTO 319,31
170 POSITION 2,0
180 ? #1:"All this and WINDOWS too!
    80 columns sure is neat, huh?":
    ? #1
190 REM LABEL COLUMNS:
200 FOR I=1 TO 8:FOR J=0 TO 9:PUT #1
    ,48+J:NEXT J:NEXT I:FOR I=1 TO 7
    :POSITION 10*I,1:PUT #1,48+I:NEX
    T I
210 REM draw character set
220 FOR I=0 TO 3:FOR J=0 TO 31:POSIT
    ION J+40,5+I:A=I*32+J:IF A=125 T
    HEN A=0
230 PUT #1,A:NEXT J:NEXT I: ? #1
240 POKE 1,4:POKE 2,10:POKE 3,10:POK
    E 4,31:REM SET WINDOW
250 POSITION 0,0
260 ? #1:"Enter some text:"
270 INPUT #1;A$
280 IF A$="QUIT" THEN 300
290 GOTO 270
300 END

```

Program 3.

```

100 REM VOPEN-OPEN V: DEVICE
110 REM
120 FOR I=1536 TO 1568:READ A:POKE I
    ,A:NEXT I
130 GRAPHICS 0: ? "Video 80 OPEN Rout
    ine"
140 ? : ? "Now loaded. Use PRINT USR
    (1536)"
150 ? "to re-OPEN Editor device to V
    ": ? "(Video 80 must be activate
    d)"
160 ? : ? "To save to disk, enter DOS
    "
170 ? "Menu selection K. BINARY SAVE
    "
180 ? "then enter:"
190 ? "VOPEN.OBJ,0600,0620"
200 ? : ? "To load VOPEN, enter L. BI
    NARY LOAD"
210 ? "and answer prompt with VOPEN.
    OBJ"
220 ? : ? "Enter B. RUN CARTRIDGE to
    exit DOS"
230 ? : ? "Good luck!": ? :END
240 DATA 104,162,0,169,12,141,66
250 DATA 3,32,86,228,162,0
260 DATA 169,3,141,66,3,169
270 DATA 32,141,68,3,169,6
280 DATA 141,69,3,32,86,228,96,86 ©

```

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PROGRAMMING THE TI

C. Regena

Secondary Education

One of the early complaints about the TI was the lack of educational software for the secondary school level (junior high, middle, or senior high schools). The Scott, Foresman company developed excellent courseware in mathematics and reading for the elementary grades (starting with the primary grades for their first modules). Many users wondered if their children would "outgrow" the computer. Is the TI only for younger children?

The answer is that the powerful graphics and sound capabilities make the TI an excellent learning tool for young children, but there is no reason we cannot use the same computer for older children (and for adults with home and business applications).

In the last year the software growth rate has been phenomenal, including "third party" educational software for the TI. The computer can be used in just about any subject area. New software companies and new products are being created daily. I'm going to review a few applications for older students here; but keep in mind that even between the time I write this column and the time it is published, many more products will probably be announced.

Educational Modules

Texas Instruments has several modules that could be used in the junior high, middle school, or senior high school. Weight and Nutrition is a module that could be used by secondary students studying health or home economics.

Music students (and even non-musicians) can compose with the Music Maker command module. There are several options, including one in which short lines are placed on the screen and moved up or down as desired. Press a key and listen to the pattern you just created. One of the options lets you choose notes and rests and place them on a staff. You may choose a key signature and time signature. As you place the notes on the staff you can see, for example, what proportion of the measure a quarter note requires. When you finish the measure, you may listen to it or go to

the next measure. You may play more than one note at a time if you wish. And if you compose something really special, you can then save your masterpiece on cassette.

Music students will also enjoy programming their own music either to learn a difficult piece, to sing along with, or to use as accompaniment for a solo instrument. You don't often think of using a computer in a music class, but because of the excellent sound capabilities of the TI the music departments may soon be begging for their own computers.

The Home Financial Decisions module could be a boon to economics classes. No longer do you need to find the right table in the back of the textbook, pick the right formula, interpolate, etc. Use the TI computer and this module. Suppose I want to buy a house and need to borrow some money. Press 1 for loans, press 2 for size of payments. Enter \$65,000 for the loan, 360 monthly payments, and perhaps an interest rate of 12.5. I can find out immediately that the monthly payment is \$693.72.

For physics and engineering students Texas Instruments has disk or cassette software called Electrical Engineering Library and Structural Engineering Library. Texas Instruments also has a Math Routine Library for advanced math students. Many times those tough equations that used to take hours or days to solve may now be solved easily and quickly with the computer.

The TI-99/4A keyboard has the letters in the same positions as those on a standard typewriter, and the shapes of the keys are similar, so the computer is ideal for touch-typing students. Students may use the Texas Instruments Touch Typing command module.

The Addison-Wesley Publishing Company has Computer Math Games, and Scott, Foresman has Math Action Games for grades one through eight or nine. What a way to practice math skills - by playing a video game! Milliken Math is also developing a math drill and practice series for grades one through eight.

The Minnesota Educational Computing Consortium (MECC) is renowned for its educational software for grades one through eight in a variety of math and science subjects. Their software is being developed for the TI computer on diskette.

Control Data Publishing Company is another pioneer in computer-aided instruction with their PLATO programs for all ages in all subjects. The first programs available for the TI (also for Atari 800 and Apple II Plus) are math, physics, French, German, and Spanish. For the TI you need the 32K memory expansion, disk controller, one disk drive, and the PLATO interpreter cartridge.

Math Competency Programs

Below are two short programs for secondary school students. These are called "Math Competency" because these types of problems are found in SRA, ACT, or other high school standardized competency tests. Younger students (third grade and up) should also be able to use the programs.

"Buying Items" gives a list of five items with their prices. The first question requires a total cost for all five items. The second question asks which two items may be purchased with a given amount of money. The question is in multiple-choice form.

"Earning Money" is a program using hourly or weekly wages to find a total earned for a given amount of time.

If you enter incorrect answers, you will be reminded how to get the right answer, and you will be given the same type of problem again. If you enter correct answers, you have the choice of solving another of the same kind of problem or continuing on to different sorts of questions.

Programming Techniques

"Buying Items"

There are three different categories for price lists. The number A is chosen randomly to be 1, 2, or 3. School supplies is number 1, a toy store is number 2, and a grocery store is number 3. The items I\$ are read in as data in an array I\$(A,C), where I\$(2,4) would mean the name of an item in category 2 (toys), the fourth item listed.

The data for each item includes a minimum price I(A,C,1) and a maximum price I(A,C,2). For the actual price list for the problem, the price P is a random number from the minimum to the maximum:

```
D=I(A,C,2)-I(A,C,1)
P=I(A,C,1)+INT(RND*D+1)
```

A subroutine is used to convert the price calculated as a number of cents to a dollar value for printing in the problem. The price P is a whole number of cents. For example, 9 would be 9 cents; 59 would be 59 cents; and 135 would be 135 cents. To get the computer to print a decimal number that may include zeros for dollars, I use string

manipulation. First let P\$ be the string value of P.

If the length of P\$ is 1, that means there is a single digit. In dollars we'll need a leading zero, so P\$="0"&P\$. Next I check to see if we have only cents – a length of 2 – because if there are only cents I want a space between the dollar sign and the decimal point. Therefore, if LEN(P\$) is equal to 2, then P\$=" "&P\$. Now I put the right two characters to the right of a decimal point, and whatever is to the left are dollars. The subroutine is:

```
460 P$=STR$(P)
470 IF LEN(P$)>1 THEN 490
480 P$="0"&P$
490 IF LEN(P$)>2 THEN 510
500 P$=" "&P$
510 PR$=SEG$(P$,LEN(P$)-1,2)
520 PL$=SEG$(P$,1,LEN(P$)-2)
530 P$="$"&PL$& "."&PR$
540 RETURN
```

To combine string variables, an ampersand sign is used rather than a plus. In TI BASIC, IF-THEN-ELSE statements must contain statement numbers rather than commands. STR\$ changes a number to a string. LEN(P\$) finds the length or the number of characters in P\$. SEG\$(P\$,A,B) yields the segment of the string P\$ starting with the character in spot number A and containing the number B characters.

"Earning Money"

The names of the people in the problems are read in as N\$(I) and T\$(I) where I is a subscript from 0 to 5. The ways of earning money are read in as phrases J\$(I).

The wage earned is $P = 100 + 25 * \text{INT}(\text{RND} * 10)$, which will translate from a dollar to as high as \$3.25, in amounts divisible by 25¢. With this program, the amount earned, P, is known to be at least \$1, so the subroutine for printing the dollar amount is:

```
340 P$=STR$(P)
350 P$="$"&SEG$(P$,1,LEN(P$)-2)& "."&SEG$(P$,
    LEN(P$)-1,2)
360 RETURN
```

A name is chosen with the random number N, and the number of hours in the first problem is a random number $H = 8 + \text{INT}(\text{RND} * 11)$. For the second type of problem, the number of weeks is a random number $W = \text{INT}(\text{RND} * 19) + 2$, which can be from two weeks to 20 weeks. The third type of problem chooses a random name, a random job, and a random number of weeks $W = \text{INT}(\text{RND} * 8) + 2$, which is from two weeks to nine weeks.

Program 1.

```
100 CALL CLEAR
110 PRINT TAB(6); "MATH COMPETENCY"
120 CALL CHAR(136, "080402FF020408")
130 PRINT :: TAB(7); "BUYING ITEMS"
140 CALL COLOR(14, 9, 16)
```



```

150 PRINT ::::TAB(9);"BY REGENA":::
160 DIM I$(3,5),I(3,5,2),N$(6),J(5),
    H$(3),S$(4)
170 FOR C=1 TO 6
180 READ N$(C)
190 NEXT C
200 FOR A=1 TO 3
210 FOR C=1 TO 5
220 READ I$(A,C),I(A,C,1),I(A,C,2)
230 NEXT C
240 NEXT A
250 DATA ANGIE,CINDY,CHERY,RICKY,BOB
    BY,RANDY,PENCIL,8,15
260 DATA ERASER,2,10,NOTEBOOK,35,99,
    RULER,29,49
270 DATA PAPER,59,90,DOLL,249,599,BA
    LL,49,89,TRUCK,100,150
280 DATA GAME,270,500,MODEL,300,700,
    CANDY,20,50
290 DATA MEAT,123,425,FRUIT,24,50,CH
    IPS,100,257,BREAD,100,179
300 H$(1)="PENCIL AND ERASER"
310 H$(2)="BALL AND TRUCK"
320 H$(3)="CANDY AND FRUIT"
330 GOTO 550
340 PRINT TAB(15);"PRESS <ENTER>";
350 CALL KEY(0,K,S)
360 IF K<>13 THEN 350
370 RETURN
380 CALL SOUND(100,330,2)
390 CALL SOUND(150,262,2)
400 RETURN
410 CALL SOUND(100,262,2)
420 CALL SOUND(100,330,2)
430 CALL SOUND(100,392,2)
440 CALL SOUND(200,523,2)
450 RETURN
460 P$=STR$(P)
470 IF LEN(P$)>1 THEN 490
480 P$="0"&P$
490 IF LEN(P$)>2 THEN 510
500 P$=" "&P$
510 PR$=SEG$(P$,LEN(P$)-1,2)
520 PL$=SEG$(P$,1,LEN(P$)-2)
530 P$="$"&PL$&"."&PR$
540 RETURN
550 RANDOMIZE
560 A=INT(RND*3+1)
570 TP=0
580 CALL CLEAR
590 PRINT "GIVEN THIS PRICE LIST:":
600 FOR C=1 TO 5
610 D=I(A,C,2)-I(A,C,1)
620 P=I(A,C,1)+INT(RND*D+1)
630 GOSUB 460
640 TP=TP+P
650 PRINT TAB(6);I$(A,C);TAB(15);P$
660 NEXT C
670 R=INT(RND*13+4)
680 CALL COLOR(13,R,R)
690 CALL HCHAR(18,6,128,18)
700 CALL VCHAR(19,6,128,5)
710 CALL VCHAR(19,23,128,5)
720 CALL HCHAR(24,6,128,18)
730 F=INT(RND*2+1)
740 IF F=2 THEN 790
750 PRINT ::"HOW MUCH WILL IT COST"
760 PRINT "TO BUY ALL THE ITEMS"
770 PRINT "ON THE LIST?"
780 GOTO 830
790 N=INT(RND*6+1)
800 PRINT ::N$(N);" WANTS TO BUY"
810 PRINT "EVERYTHING ON THE LIST."
820 PRINT "WHAT WILL THE TOTAL COST
    BE?"
830 INPUT "$":X
840 IF ABS(X-TP/100)<.001 THEN 920
850 GOSUB 380
860 PRINT "ADD ALL FIVE NUMBERS."
870 P=TP
880 GOSUB 460
890 PRINT "THE TOTAL IS ";P$:
900 GOSUB 340
910 GOTO 550
920 GOSUB 410
930 CALL HCHAR(20,1,32,128)
940 IF F=2 THEN 970
950 PRINT "IF YOU COULD ONLY SPEND"
960 GOTO 980
970 PRINT "IF ";N$(N);" COULD ONLY S
    PEND"
980 IF A<>1 THEN 1010
990 M=INT(RND*5+25)
1000 GOTO 1050
1010 IF A<>2 THEN 1040
1020 M=INT(RND*36+239)
1030 GOTO 1050
1040 M=INT(RND*18+100)
1050 P=M
1060 GOSUB 460
1070 PRINT P$;"", WHICH OF THESE PAIR
    S"
1080 PRINT "OF ITEMS COULD ";
1090 IF F<>1 THEN 1120
1100 PRINT "YOU BUY?":
1110 GOTO 1160
1120 IF N>3 THEN 1150
1130 PRINT "SHE BUY?":
1140 GOTO 1160
1150 PRINT "HE BUY?":
1160 R=INT(RND*4+1)
1170 FOR V=1 TO 4
1180 IF V=R THEN 1280
1190 X=INT(RND*2+4)
1200 S$(V)=I$(A,X)
1210 X=INT(RND*3+1)
1220 S$(V)=S$(V)&" AND "&I$(A,X)
1230 IF V=1 THEN 1290
1240 FOR V1=1 TO V-1
1250 IF S$(V1)=S$(V) THEN 1190
1260 NEXT V1
1270 GOTO 1290
1280 S$(V)=H$(A)
1290 PRINT TAB(3);CHR$(64+V);" "&S$(
    V)
1300 NEXT V
1310 CALL SOUND(150,1397,2)
1320 CALL KEY(0,K,S)
1330 IF (K<65)+(K>68) THEN 1320
1340 CALL HCHAR(K-45,4,42)
1350 IF K<>64+R THEN 1410
1360 GOSUB 410
1370 PRINT "TRY AGAIN? (Y/N)";
1380 CALL KEY(0,K,S)
1390 IF K=89 THEN 550
1400 IF K=78 THEN 1450 ELSE 1380
1410 GOSUB 380
1420 CALL HCHAR(19+R,3,136)
1430 PRINT "THE TOTAL OF THE TWO IT
    EMS MUST BE LESS THAN ";P$
1440 GOTO 1370
1450 CALL CLEAR
1460 END

```


Program 2.

```

100 CALL CLEAR
110 PRINT TAB(6); "MATH COMPETENCY"
120 PRINT :: TAB(7); "EARNING MONEY"
130 PRINT :: :: TAB(9); "BY REGENA" ::
    ::
140 DIM N$(5), J$(5), T$(5)
150 FOR I=0 TO 5
160 READ N$(I), J$(I), T$(I)
170 NEXT I
180 DATA SAM, DOING ODD JOBS, JOHN, JOE
    , MOWING LAWNS, ANDY, BOB, TENDING C
    HILDREN, MARK, ANN
190 DATA RUNNING ERRANDS, LENA, SUE, DO
    ING HOUSEWORK, AURA, KAY, DELIVERIN
    G ADS, DAWN
200 GOTO 370
210 PRINT : TAB(15); "PRESS <ENTER>";
220 CALL KEY(0,K,S)
230 IF K<>13 THEN 220
240 RETURN
250 CALL SOUND(100,330,2)
260 CALL SOUND(150,262,2)
270 RETURN
280 CALL SOUND(100,262,2)
290 CALL SOUND(100,330,2)
300 CALL SOUND(100,392,2)
310 CALL SOUND(200,523,2)
320 RETURN
330 P=100+25*INT(RND*10)
340 P$=STR$(P)
350 P$="$"&SEG$(P$,1,LEN(P$)-2)&". "&
    SEG$(P$,LEN(P$)-1,2)
360 RETURN
370 CALL CLEAR
380 RANDOMIZE
390 N=INT(RND*6)
400 H=8+INT(RND*11)
410 GOSUB 330
420 PRINT N$(N); " WORKS"; H; "HOURS PE
    R WEEK."
430 IF N<3 THEN 460
440 PRINT : "SHE EARNS ";
450 GOTO 470
460 PRINT : "HE EARNS ";
470 PRINT P$; " PER HOUR."
480 IF N<3 THEN 510
490 PRINT : "HOW MUCH DOES SHE EARN"
500 GOTO 520
510 PRINT : "HOW MUCH DOES HE EARN"
520 PRINT : "IN A WEEK?":
530 INPUT "$":D
540 D1=P*H/100
550 IF ABS(D-D1)>.001 THEN 610
560 GOSUB 280
570 PRINT : "TRY AGAIN? (Y/N)"
580 CALL KEY(0,K,S)
590 IF K=89 THEN 370
600 IF K=78 THEN 680 ELSE 580
610 GOSUB 250
620 PRINT : "MULTIPLY"; H; "HOURS BY ";
    P$; "PER HOUR."
630 P=H*P
640 GOSUB 340
650 PRINT : "THE ANSWER IS "; P$
660 GOSUB 210
670 GOTO 370
680 CALL CLEAR
690 RANDOMIZE
700 N=INT(RND*6)
710 H=INT(RND*11)+8
720 GOSUB 330
730 PRINT N$(N); " EARNS "; P$; " PER H
    OUR."
740 IF N<3 THEN 770
750 PRINT : "SHE WORKS";
760 GOTO 780
770 PRINT : "HE WORKS";
780 PRINT H; "HOURS PER WEEK."
790 IF N<3 THEN 820
800 PRINT : "HOW MUCH WILL SHE EARN I
    N"
810 GOTO 830
820 PRINT : "HOW MUCH WILL HE EARN IN
    "
830 W=INT(RND*19)+2
840 PRINT : W; "WEEKS?":
850 INPUT "$":D
860 D1=P*H*W/100
870 IF ABS(D-D1)>.001 THEN 930
880 GOSUB 280
890 PRINT : "TRY AGAIN? (Y/N)"
900 CALL KEY(0,K,S)
910 IF K=89 THEN 680
920 IF K=78 THEN 1030 ELSE 900
930 GOSUB 250
940 PRINT : "MULTIPLY"; H; "HOURS BY"
950 PRINT : P$; " PER HOUR."
960 PRINT : "THEN MULTIPLY BY"; W; "WEE
    KS."
970 PRINT : "THE ANSWER IS ";
980 P=P*W
990 GOSUB 340
1000 PRINT P$ ::
1010 GOSUB 210
1020 GOTO 680
1030 CALL CLEAR
1040 J=INT(RND*6)
1050 T=INT(RND*6)
1060 GOSUB 330
1070 W=INT(RND*8)+2
1080 PRINT T$(T); " EARNED "; P$; " LAS
    T WEEK"
1090 PRINT : J$(J); ". "
1100 IF T<3 THEN 1130
1110 PRINT : "IF SHE EARNED THIS AMOU
    NT"
1120 GOTO 1140
1130 PRINT : "IF HE EARNED THIS AMOUN
    T"
1140 PRINT : "EVERY WEEK, WHAT WOULD
    THE"
1150 PRINT : "TOTAL INCOME BE FOR"
1160 PRINT : W; "WEEKS?":
1170 INPUT "$":D
1180 D1=P*W/100
1190 IF ABS(D-D1)>.001 THEN 1250
1200 GOSUB 280
1210 PRINT : "TRY AGAIN? (Y/N)";
1220 CALL KEY(0,K,S)
1230 IF K=89 THEN 1030
1240 IF K=78 THEN 1330 ELSE 1220
1250 GOSUB 250
1260 PRINT : "MULTIPLY "; P$; " PER WEE
    K"
1270 PRINT : "BY"; W; "WEEKS."
1280 P=P*W
1290 GOSUB 340
1300 PRINT : "THE ANSWER IS "; P$ ::
1310 GOSUB 210
1320 GOTO 1030
1330 CALL CLEAR
1340 END

```


VICword

Mark Niggemann

Many programmers find that typing a question mark instead of having to type out the entire word "PRINT" is a great timesaver. How would you like to be able to use single-key entry for 52 BASIC commands? With VICword running in your VIC, you can hold down the SHIFT key and hit the letter "L" and the word "LOAD" will appear on screen. Hold down the COMMODORE key and hit "L" and "SAVE" writes itself on the screen. Especially helpful when typing in those long BASIC programs, VICword is a clever machine language program that puts itself into memory (expanded or not), protects itself from interference by BASIC, and then tells you how to turn it on or off whenever you want. Just type in the program (SAVE a copy of it) and then RUN it. It does the rest.

Before buying a Commodore VIC, I used my father's PET for most of my programming work. One nice utility programming aid that I had at my disposal was Charles Brannon's "Keyword" (**COMPUTE!**, August 1981, #15). After typing in a couple of long programs on the VIC, I set out to make a revision of Keyword for the VIC.

I was not content with only 26 defined keys. After all, the VIC has both the COMMODORE key and the SHIFT key. So, why not use both to get a total of 52 defined keys? This would prove to be a difficult task. The original Keyword program relied on the fact that the ASCII code values of the SHIFTed letters were in numeric order. On the VIC, the COMMODORE keyed letters are not in that order. This made things very tough.

After looking at Jim Butterfield's memory map (**COMPUTE!**, January 1982, #20), I noticed a curious link located at \$028F and \$0290, respectively, that I thought might help. After some further examination, I found that this link points to a routine in ROM that sets up the appropriate keyboard lookup table, depending on whether the SHIFT, COMMODORE, or CONTROL key is being depressed. The lights came on at this point. Since this routine in ROM is part of the interrupt scan for clock updating, cursor flash, and keyboard handling, it is possible to run "VICword" using this link and also to take care of the problem of the COMMODOREd letters.

When you SYS the ON/OFF address given by the loader program, VICword will set the link at

\$028F and \$0290 to point to its scan portion. In scanning, VICword checks to see if the quote mode flag is set. The reason this is done is so that you can still get graphics characters when you need them. If this flag is set, VICword will promptly exit the scan. If it isn't, VICword then checks if the SHIFT or COMMODORE key is being pressed. If either is pressed, then the keyboard lookup table pointer, located at \$F5 and \$F6, is set to point at the SHIFT key lookup table.

By using this table, and not the COMMODORE key lookup table, the ASCII values are in numeric order. VICword will determine which table of token values it will use and will read the tokenized keyword for the particular key pressed. The rest of VICword is identical to Keyword in function.

Entering VICword

Some precaution should be observed when you type in VICword. Since this is a machine language program, a single mistake in the DATA statements

Keys Into BASIC Commands.

KEY	SHIFT	COMMODORE
A	PRINT	PRINT#
B	AND	OR
C	CHR\$	ASC
D	READ	DATA
E	GET	END
F	FOR	NEXT
G	GOSUB	RETURN
H	TO	STEP
I	INPUT	INPUT#
J	GOTO	ON
K	DIM	RESTORE
L	LOAD	SAVE
M	MID\$	LEN
N	INT	RND
O	OPEN	CLOSE
P	POKE	PEEK
Q	TAB(SPC(
R	RIGHT\$	LEFT\$
S	STR\$	VAL
T	IF	THEN
U	TAN	SQR
V	VERIFY	CMD
W	DEF	FN
X	LIST	FRE
Y	SIN	COS
Z	RUN	SYS

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could cause VICword to crash. Generally, it is a good idea to SAVE any machine language program before you try to execute it. Then, if you do crash and you can't get out of it by using RESTORE, you can just load in the version that you saved and recheck the DATA for any erroneous entry.

When I defined the keyword tables used in VICword, I chose the most commonly used keywords in BASIC. I tried to make most of the SHIFT keys complementary to the COMMODORE keys. For example, SHIFT G is GOSUB and COMMODORE G is RETURN. Not all keys could be paired up like this. See the table to find out the key definition.

I have used VICword quite often to help out on those long programs. I hope that VICword is as useful a tool for you as it has been for me. If you don't want to take the trouble of typing in VICword, I'll provide you with a copy. Send a blank cassette, an SASE mailer, and \$3 to:

Mark Niggemann
Pearson #2208
Friley Hall
Iowa St. University
Ames, IA 50012

```
100 REM** VICWORD LOADER
140 IF PEEK(PEEK(56)*256)<>120 THEN POKE 56,
    PEEK(56)-1:CLR
150 HI=PEEK(56):BASE=HI*256
160 PRINT"[CLEAR]PATIENCE..."
170 FOR AD=0 TO 211: READ BY
180 POKE BASE+AD,BY: NEXT AD
190 :
200 REM RELOCATION ADJUSTMENTS
210 POKE BASE+26,HI: POKE BASE+81,HI
220 POKE BASE+123,HI: POKE BASE+133,HI
230 :
240 PRINT"[CLEAR]*** VICWORD ***"
250 PRINT"ON/OFF:  SYS{REV}";BASE
260 END
270 DATA 120, 173, 143, 2, 201, 32
280 DATA 208, 12, 169, 220, 141, 143
290 DATA 2, 169, 235, 141, 144, 2
300 DATA 88, 96, 169, 32, 141, 143
310 DATA 2, 169, 0, 141, 144, 2
320 DATA 88, 96, 165, 212, 208, 117
330 DATA 173, 141, 2, 201, 3, 176
340 DATA 110, 201, 0, 240, 106, 169
350 DATA 159, 133, 245, 169, 236, 133
360 DATA 246, 165, 215, 201, 193, 144
370 DATA 95, 201, 219, 176, 91, 56
380 DATA 233, 193, 174, 141, 2, 224
390 DATA 2, 208, 3, 24, 105, 26
400 DATA 170, 189, 159, 0, 162, 0
410 DATA 134, 198, 170, 160, 158, 132
420 DATA 34, 160, 192, 132, 35, 160
430 DATA 0, 10, 240, 16, 202, 16
440 DATA 12, 230, 34, 208, 2, 230
450 DATA 35, 177, 34, 16, 246, 48
460 DATA 241, 200, 177, 34, 48, 17
470 DATA 8, 142, 211, 0, 230, 198
480 DATA 166, 198, 157, 119, 2, 174
490 DATA 211, 0, 40, 208, 234, 230
500 DATA 198, 166, 198, 41, 127, 157
510 DATA 119, 2, 230, 198, 169, 20
520 DATA 141, 119, 2, 76, 220, 235
```

530 DATA 76, 67, 236

540 :

550 REM *VICWORD TOKENS FOR SHIFT KEY

560 :

570 DATA 153, 175, 199, 135, 161, 129

580 DATA 141, 164, 133, 137, 134, 147

590 DATA 202, 181, 159, 151, 163, 201

600 DATA 196, 139, 192, 149, 150, 155

610 DATA 191, 138

620 :

630 REM *TOKENS FOR COMMODORE KEY

640 :

650 DATA 152, 176, 198, 131, 128, 130

660 DATA 142, 169, 132, 145, 140, 148

670 DATA 195, 187, 160, 194, 166, 200

680 DATA 197, 167, 186, 157, 165, 184

690 DATA 190, 158, 0

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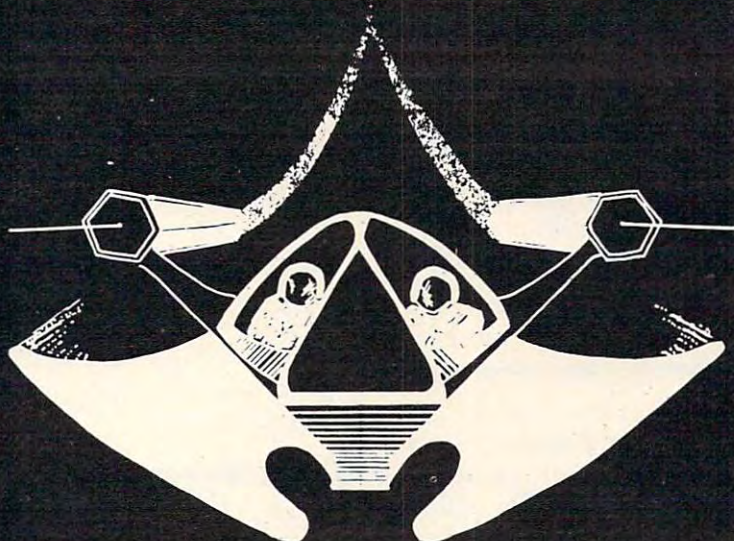
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CRAB

(Cross Reference For Atari BASIC)

Manny Juan

Remarkable for its brevity, this useful Atari utility will print out a list of the variables in a BASIC program and show in which lines they appear. It will work on any Atari using a disk drive and for any BASIC program stored with the SAVE command.

CRAB is probably the smallest and shortest cross reference program ever written for any computer (47 lines in less than 2K), and it is written entirely in BASIC.

This was made possible by taking advantage of two features of Atari BASIC: internal tokenization and a "dynamic keyboard" capability.

Internal Tokenization

When a program is SAVED to disk, it is stored according to this scheme: 14 bytes from page zero are written out first. These seven, two-byte registers serve as pointers to the different tables and areas within the program. They are followed by the variable name table, which is delimited by a trailing zero byte. The variable value table comes next, where one entry is eight bytes long, and each corresponds to a variable in the previous table. Finally, the tokenized BASIC statements are written out in the internal format that they are stored in RAM.

Dynamic Keyboard Capability

"Dynamic Keyboard" allows a program, while running, to add or change statements into memory by displaying those statements on the screen, then invoking what Atari calls the "forced RETURN" routine through a set of POKE statements. This routine takes what is on the screen and processes it as if it were input through the keyboard and terminated with a RETURN key.

How CRAB Works

This utility will run on any disk-based Atari system and will cross reference programs stored with the SAVE command.

It starts by asking which program on disk to cross reference and determines whether it is in-

deed a BASIC program by checking to see if the first two bytes are equal to zero. These bytes normally contain the address of low memory when used in RAM, but they are normalized to zero when saved to disk or tape.

The subroutine GC (defined at line 60) is used throughout the program to obtain the next byte from disk.

Variable Name Table

The next 12 bytes are skipped because they are not used by this utility. The utility is now ready to process the Variable Name Table. This table is actually a string of characters which contains all the variable names used during the development of the program in the order that they were entered. The last byte of the variable name has its high bit turned on to serve as a delimiter.

Whenever a variable name is extracted by CRAB, its position in the table (relative to zero) is added to 128, and the sum is multiplied by 100 to create a line number. A REMark statement containing only the variable name, but using the previously computed line number, is displayed on the screen and gets added into memory using the "forced RETURN" or "dynamic keyboard" feature described above. (Screen display was "turned off" in this program, but you can restore it by REMarking the SETCOLOR statement in line 100.)

For example, if this utility itself were the target program for cross reference, the first few variables would be processed and added as REMark statements into memory like this:

```
12800 REM T8
12900 REM I
13000 REM T
13100 REM Z
```

.

.

etc.

The whole process of extracting the variables from the Variable Name Table is done by lines 100 through 160 in the listing.

After all variable names have been stored

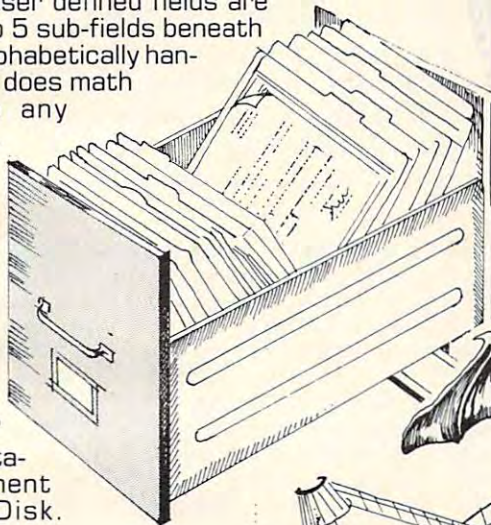
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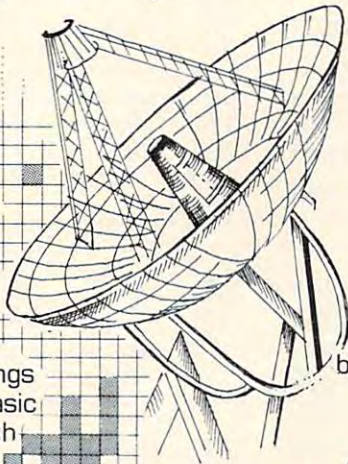


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into memory as BASIC REMark statements, the whole variable value table is also skipped (line 180) because the variables are not used by this utility.

CRAB is now ready to process the program statements.

Tokenized Variables

The first time a variable is used during program development, its name is added to the variable name table, and its position, plus 128, becomes its token "assignment." Using CRAB again as our example, the variable "T8" will always be tokenized into one byte as 128, the variable "I" as 129, "T" as 130, etc.

The token assignments are basically what CRAB uses to recognize variables when it is stepping through the tokenized program. A token whose value is 128 or greater is usually a representation for a variable. However, it is still conceivable that some tokens may contain such values. This is especially possible in line number tokens, BCD numbers, and character strings within REM or DATA statements. CRAB was written to recognize and skip these instances.

When CRAB encounters the line number, it saves it immediately (line 190). Lines 210 through 230 take care of recognizing and skipping REMark and DATA statements. The end-of-statement (token 20) and end-of-line (token 22) delimiters are caught at lines 240 and 250 to allow orderly processing of statements. Line 270 checks whether the token being processed is a number; if it is, the next six bytes are skipped. (Numbers start with token 14, followed by their BCD representation in six more bytes.) And, finally, line 270 checks whether the token being looked at is a variable.

When a variable is recognized, CRAB prepares a REMark statement whose value is the current line number being processed. Then it takes the token value of the variable, multiplies it by 100, and adds the usage count for that variable (stored in array N). The result becomes the line number of this REMark statement, which is again inserted into its proper place in memory through the use of the "dynamic keyboard" feature.

This procedure is best shown by an example. Suppose the line being processed is line 40 of the CRAB listing. In this case, the variables I, Z, and A\$ have token assignments of 129, 131, and 136, respectively. At this point, both variables I and Z would have a usage count of one (when they are defined at line 10); while A\$ has a usage count of two, since it is also used in line 20.

At line 40, these usage counts all get incremented by one, and the following BASIC REMark statements are generated:

```
12902 REM 40
13102 REM 40
```

```
13603 REM 40
```

You can see that, after all variables have been processed, the memory area after the CRAB utility will be filled with hundreds of REMark statements, starting with line 12800. Any line ending in 00 (evenly divisible by 100) would be carrying a variable name, and it would be immediately followed by scores of other REMark statements which list all the line numbers that reference it. (And they are sorted, too!)

It remains a simple matter for CRAB to skip itself (lines 400, 410), process the above REMark statements, and format them into a cross reference listing.

RUN Notes

You will notice that the cross reference listing produced does not show the variables in alphabetical sequence and that multiple references to a variable in the same line appear as repeated line numbers. This is the price we pay for a short (but unique) cross reference program like CRAB.

Because of the way variable names are stored in the variable name table (first come, first served, and no garbage collection), it may be a good idea to first LIST the target program to disk, reENTER it to RAM (to clear unused variables), and then SAVE it back in tokenized form. The resulting file may then be processed by CRAB.

```
10 REM CRAB - CROSS REFERENCE ATARI BASIC, VERSION 1, BY MANNY JUAN
20 CLR :T8=256:I=1:T=2:Z=0:L=128:R=84
  2:H=100:DIM N(127),A$(16)
30 TRAP 330: ? CHR$(125); "PROGRAM TO X
  REF": INPUT A$
40 OPEN #1,4,Z,A$
50 GC=60:GOTO 70
60 GET #1,C:RETURN
70 GOSUB GC:D=C:GOSUB GC:D=D+C
80 IF D THEN ? A$;" IS NOT A BASIC PROGRAM":END
90 FOR J=I TO 12:GOSUB GC:NEXT J
100 LN=L*H:SETCOLOR I,9,4
110 GOSUB GC:IF NOT C THEN 170
120 ? CHR$(125): ? CHR$(29): ? LN;" REM
  ";
130 ? CHR$(C-L*(C>127));:IF NOT (C>127) THEN GOSUB GC:GOTO 130
140 SOUND Z,LN,10,8: ? : ? : ? "CONT":POSITION Z,Z:POKE R,13:STOP
150 POKE R,12
160 LN=LN+H:GOTO 110
170 FOR J=Z TO 127:N(J)=Z:NEXT J
180 FOR J=I TO 8*(LN/H-L):GOSUB GC:NEXT J
190 GOSUB GC:LN=C:GOSUB GC:LN=LN+C*T8
200 GOSUB GC:GOSUB GC
210 GOSUB GC:IF C>I THEN 240
220 GOSUB GC:IF C<>155 THEN 220
230 GOTO 190
240 GOSUB GC:IF C=20 THEN GOSUB GC:GOTO 210
250 IF C=22 THEN 190
260 IF C=14 THEN FOR J=Z TO 5:GOSUB GC:NEXT J:GOTO 240
```



```

270 IF C<L THEN 240
280 D=C-L:N(D)=N(D)+I:SOUND Z,LN,10,8
:SOUND I,D+30,10,8
290 ? CHR$(125):? CHR$(29):? (L+D)*H+
N(D):" REM ";LN
300 ? :? :? "CONT":POSITION Z,Z:POKE
R,13:STOP
310 POKE R,12
320 GOTO 240
330 TRAP 33333:SOUND Z,Z,Z,Z:SOUND I,
Z,Z,Z
340 SETCOLOR I,9,10:? CHR$(125)
350 X=PEEK(195):IF X<>136 THEN ? "ERR
";X;" AT LINE ";PEEK(186)+PEEK(1
87)*T8:END
360 CLOSE #I:CLOSE #6:OPEN #6,4,Z,"K:
"
370 ? "HIT ANY KEY WHEN PRINTER IS RE
ADY(5 SPACES}(OR ESC TO QUIT)"
380 GET #6,X:IF X=27 THEN END
390 LPRINT "XREF LISTING FOR ";A$
400 X=PEEK(136)+PEEK(137)*T8
410 PL=PEEK(X+T):LN=PEEK(X)+PEEK(X+I)
*T8:IF LN<L*H THEN X=X+PL:GOTO 41
0
420 D=INT(LN/H):M=LN-H*D:IF NOT M TH
EN LPRINT :LPRINT
430 PL=PEEK(X+T):FOR J=5 TO PL-T:LPRIN
T CHR$(PEEK(X+J)):NEXT J
440 LPRINT " ";:IF NOT M THEN LPRINT
450 X=X+PL:LN=PEEK(X)+PEEK(X+I)*T8:IF
LN<32768 THEN 420
460 LPRINT :LPRINT :LPRINT D-L+I;" VA
RIABLES"
470 END

```

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Programming Characters On An Expanded VIC-20

Paul F. Schatz

You can use programmable characters in VIC programs requiring more than 2.5K. The solution: move the start of BASIC beyond the screen and programmable character RAM.

One of the best features of the VIC-20 computer is its ability to define character sets. Besides allowing the design of custom characters, this feature can also be used for high resolution plotting. (These features are outlined in the *VIC-20 Programmer's Reference Guide* and will not be discussed in this article.) The versatility of the programmable characters is somewhat limited since the RAM used for displaying the screen and for defining the characters must be addressed in the memory from 4096 to 8192. Table 1 gives the locations and contents of the various possible character sets.

With an unexpanded (5K) VIC or a VIC expanded with the 3K RAM card, this limitation is of no consequence since the screen and character set are placed at the top of memory after the BASIC program. However, when an 8K RAM card is plugged into a VIC, the location of the screen RAM moves to extend from 4096 to 4607, and the start of BASIC moves to 4608. These changes eliminate, to all intents and purposes, using the programmable characters since any BASIC program requiring more than 2.5K tramples on the RAM area normally used for programmable characters.

There is a software solution, and a relatively simple one at that. In essence, the solution lies in moving the "start of BASIC" to a location beyond the screen and programmable character RAM. Here's a method for moving the start of BASIC, including several examples.

Moving The Screen

A simple method for moving the screen is to set the screen memory page register (location 648) and call the ROM routine which initializes the I/O. For example, to move the start of screen on an expanded VIC from 4096 to 7680 (the default location on the unexpanded VIC) enter the following statement:

```
POKE648,30:SYS58648
```

Moving The Start Of BASIC

In practice, the programmer has to be careful about where BASIC is located or the screen can be plopped right into the middle of the program with disastrous results. The simple method for avoiding conflicts of this sort is to move the start of BASIC to the start of the 8K expansion RAM. This frees up the internal RAM on the VIC (locations 4096 to 8191) for video operations such as multiple screens, custom characters, etc. The start of BASIC is moved with

```
POKE8192,0:POKE43,1:POKE44,32:NEW
```

Moreover, it is possible to use custom character files created with the Commodore Character Editor. The technique follows. Place the 8K (or more) expander in the expansion slot. Turn the VIC-20 on. Move the start of BASIC. Move the screen to 7680. Load the character set file. Enter NEW. It is important to NEW the computer to get the BASIC pointers straightened around. Not to NEW can lead to a crash. Now enter the program that uses the custom characters. Since the screen is located from 7680 to 8186 and the custom character definitions start at 7168, everything that the *Programmer's Reference Guide* says about them applies, e.g., to display the custom characters POKE36869,255.

An alternative, somewhat simpler method for moving BASIC is:

```
POKE 642,32: SYS 58232
```

Other Configurations

As mentioned earlier, moving the start of BASIC to 8192 chops 3.5K from the RAM area which can be used by BASIC. Two K of this area can be used for programmable character definitions, leaving only 1.5K of RAM which can be used for storage or for machine language routines. To retain as much RAM as possible for BASIC programs and still have programmable character capability, the start of BASIC can be moved to 6656, the screen located from 6144 to 6655, and the programmable character set (256 characters) located from 4096 to 6143.

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If needed, another .5K of programmable RAM can be recovered by overlapping the screen with the character set descriptions, i.e., start BASIC at 6144, locate screen from 5532 to 6143, and locate programmable characters from 4096 to 6143. Characters 191 to 255, whose definitions are located in the same area as the screen, are lost. This configuration leaves 10K of RAM open for BASIC programming.

The most concise method for pulling together all the loose threads for the various options is

Table 1:

Location of character sets with screen at 4096

		Characters displayed			
POKE36869	Start of character set	0-63	64-127	128-191	191-255
192	32768	UC	GR	rev UC	rev GR
193	33792	rev UC	rev GR	LC	UC
194	34816	LC	UC	rev LC	rev UC
195	35840	rev LC	rev UC	NA	NA
196-203 Not useful - VIC, I/O, color RAM, zero page, etc.					
204	4096	SR	PG	PG	PG
205	5120	PG	PG	PG	PG
206	6144	PG	PG	PG	PG
207	7168	PG	PG	UC	GR
UC = uppercase		PG = programmable			
SR = screen RAM		GR = graphics			
NA = not accessible		rev = reverse			
LC = lowercase					

with Table 2. Substituting the appropriate values from the table into the following statements moves the screen and the start of BASIC to the designated locations. To move the start of BASIC, enter

POKE 44,SB:POKE BB,0:NEW

To move the screen, run the following program:

```
10 POKE 36866,CR2: POKE 36869,CR5: POKE 648,SC
20 FOR J=217 TO 228: POKE J,LI: NEXT
30 FOR J=229 TO 250: POKE J,LI+1: NEXT
```

To use the programmable character set in a program, incorporate the following statement:

POKE 36869,CS

Table 2:

Relocating BASIC, screen RAM, and character sets

Start of BASIC	8192	8192	6656	6144
SB	32	32	26	24
BB	8192	8192	6656	6144
PRINT FRE(0)	8189	8189	9725	10237
Start of screen	4096	7680	6144	5632
CR2	22	150	22	150
CR5	192	240	224	208
SC	16	30	24	22
LI	144	158	152	150
Location of color RAM	37888	38400	37888	38400
Location of char. set	7168	7168	4096	4096
CS	207	255	236	220

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Magic Commodore BASIC

David Sale

Reversed REMs, subroutine protection, a program with backward line numbers, invisible lines – all these and several other tricks are possible when you type SYS 4 and fall into the world below PET BASIC. For any PET/CBM model. These techniques can also be applied to the VIC-20 and Commodore 64 if you have a machine language monitor such as VICMON, TINYMON, or Supermon 64.

BASIC is a very civilized language. Machine code is more exacting, but it is capable of doing certain things that BASIC cannot do. Wouldn't it be nice to be able to force BASIC to break some of its rules some of the time?

If you are willing to tinker a bit, there is a way. First, though, you must thoroughly understand how BASIC code is stored in memory. Enter the following program carefully:

```
10 REM START
20 PRINT "20 ";
30 PRINT "30 ";
```

Save this on tape or disk since you may need to reLOAD it later.

For the PET/CBM, type SYS 4 to enter the monitor, then M 0400,0420 to display the relevant part of memory. Your screen should look like this:

```
0400 00 0D 04 0A 00 8F 20 53
0408 54 41 52 54 00 1A 04 14
0410 00 99 20 22 32 30 20 22
0418 3B 00 27 04 1E 00 99 20
0420 22 33 30 20 22 3B 00 00
```

The numbers in the first column represent the memory addresses of the next bytes; hence, the value found in 0418 is 3B (hex), while that in 041C is 1E (hex).

Each BASIC line consists of four parts. This can be illustrated by examining the values starting at 0401:

1. The first two bytes (0D 04) point in low-high order to the beginning of the next line, i.e., to address 040D.
2. The next two bytes (0A 00) give the line number, also in low-high order (000A hex = 10

decimal).

3. The following bytes give the contents of the line with tokens like 8F (REM) and 99 (PRINT) for BASIC words.

4. The 00 marks the end of the line.

For the VIC or 64, type the proper SYS to invoke whatever monitor version you are using. For the 64, display memory locations 0800-0820 (hex). The display should be the same as for the PET/CBM, except that all the locations which show 04 for this and all other examples will show 08 on the 64.

The VIC is slightly more complicated because the start of BASIC moves as memory is added. For the unexpanded VIC, display memory locations 1000-1020 (hex). The display should be the same as for the PET/CBM, except that all locations that show 04 in the examples will now show 10. For the VIC with 3K expansion, simply follow the instructions for the PET/CBM examples since the start of BASIC has now moved to 0400. If you add 8K or more, display memory locations 1200-1220 (hex). The display should be the same as for the PET/CBM, except that all locations which show 04 show 12 instead.

Highlighting REMarks

In a long program it might be useful to have the REMark statements highlighted to make them easier to find. Typing "RVS" will not produce the desired result, since that will place a 52 (hex) in memory, not the desired 12. Using quotes and RVS will place the 12 in memory; however, the RVS will print as a reversed R, but will not highlight the line!

The solution? Replace the value following the 8F (hex for REM) with 12 by putting it there in the monitor. In other words, line 0400 (after you type this in and hit RETURN) will look like this:

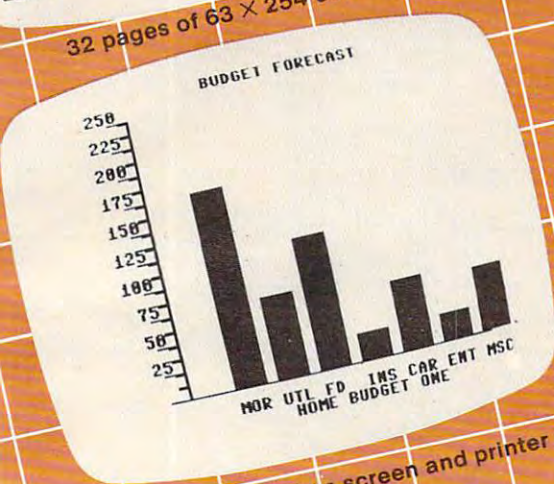
```
0400 00 0D 04 0A 00 8F 12 53
```

Exit from the monitor by typing X, then LIST the program. The REM statement will be highlighted. You can locate all the 8F's in a long program by hand, but this would be rather tedious. A better

SYSTEM: B C D E F G L O
[M]=PRINT [M]=CLEAR

	HOME BUDGET 1			
	Weekly	Monthly	Yearly	
INCOME				
Salary 1	350.00	1400.00	16800.00	
Salary 2	210.00	840.00	10080.00	
Total	560.00	2240.00	26880.00	
EXPENSES				
Mortgage	175.00	700.00	8400.00	
Utilities	75.00	300.00	3600.00	
Food	120.00	480.00	5760.00	
Insurance	25.00	100.00	1200.00	
Car Exp.	65.00	260.00	3120.00	
Entertain	25.00	100.00	1200.00	
Misc.	60.00	240.00	2880.00	
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	HOME BUDGET 2			
	Weekly	Monthly	Yearly	
INCOME				
Salary 1	320.00	1280.00	15360.00	
Salary 2	200.00	800.00	9600.00	
Total	520.00	2080.00	24960.00	
EXPENSES				
Mortgage	210.00	840.00	10080.00	
Utilities	100.00	400.00	4800.00	
Food	120.00	480.00	5760.00	
Insurance	25.00	100.00	1200.00	
Car Exp.	60.00	240.00	2880.00	
Entert.	20.00	80.00	960.00	
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solution would be to use a short machine language program (Program 1 or 2) to do this for you once the procedure is understood. The program will automatically check to make certain that the 8F is a REM, not part of a pointer or line number.

Editing in BASIC any highlighted line will, of course, remove the highlighting because BASIC will not accept the RVS command from the screen.

Protecting Line Numbers

BASIC will accept sequential numbers up to 63999 (F9FF hex). Entering two lines with the same number will delete the first. Entering line numbers like 64000 will create an error remark even though numbers up to FFFF hex should be available. But if we can manipulate BASIC by entering the monitor, we should now be able to create a program with extra large line numbers or with all lines the same number:

```
0400 00 0D 04 00 FA 8F 20 53
0408 54 41 52 54 00 1A 04 01
0410 FA 99 20 22 32 30 20 22
0418 3B 00 27 04 02 FA 99 20
0420 22 33 30 20 22 3B 00 00
```

Typing the changes above will create a program starting at line 64000. The lines cannot be edited or deleted using BASIC unless they are first renumbered.

Now You See It, Now You Don't

If you are really determined to protect a subroutine, one of the best ways involves fiddling with the pointers. Try making the following change in the original program:

```
0400 00 27 04 0A 00 8F 20 53
```

When you LIST it, only the first line will appear. The reason is that the pointer which is used in LISTing directs the computer to the end of the program, not to the second line. However, the program will RUN correctly.

A slightly more complicated method will produce all of the desired lines in a scrambled, renumbered sequence that is totally protected, yet appears to be quite normal when LISTed on the screen:

```
0400 00 1A 04 0A 00 8F 20 53
0408 54 41 52 54 00 27 04 1E
0410 00 99 20 22 32 30 20 22
0418 3B 00 0D 04 14 00 99 20
0420 22 33 30 20 22 3B 00 00
```

Try LISTing and then RUNning this program. You will notice that the lines LIST as 10, 20, 30, but RUN in the order 10, 30, 20. Now try to edit one of these lines using BASIC. When you press RETURN, be prepared for a beautiful screen display and a total crash!

What happened? We changed the pointers which the LIST command uses, but the RUN com-

mand does not. Line 10 actually points to line 30 (1A 04). Line 30 points to line 20 (0D 04), and line 20 points to the end of the program (27 04). Exchanging the line numbers for 20 and 30 made them appear to be listing in the correct order when, in fact, they were not.

As long as your subroutine does not use any lines called by GOTO or GOSUB (other than the first line), you can reverse the entire sequence of lines for total protection. Be sure, though, to make a note to yourself describing exactly what you have done, or in six months' time you may never be able to remember how to edit your protected program.

NEW And Re-NEW

Have you ever had the falling sensation, when typing NEW, of realizing that you had forgotten to SAVE your program first? Fortunately, BASIC only resets several pointers. All you have to do is enter the monitor and return these to their correct values.

Type NEW with our sample program in memory, then examine line 0400:

```
0400 00 00 00 0A 00 8F 20 53
```

You will see that only the second and third bytes have been changed. Since these should be the pointers to indicate the start of the second line, you simply look through memory for the next 00 and place the following address (040D) in low-high order (0D 04) in locations 0401 and 0402.

The program will now LIST, but it will not RUN correctly if any variables or arrays are used. To correct this, you must correct several pointers on page one of memory that control BASIC operations. Make a note of the address of the second 00 at the end of the program. Write it down in low-high sequence. In our sample program, the second 00 is at 0427, so we would write down 27 04.

For Upgrade and 4.0 ROMs, display M 002A,002F. For Original ROMs, display M 007C, 0081. For the VIC and 64, display M 002D,0031. In our example, these memory locations will now contain:

```
002A 03 04 03 04 03 04
```

Change each pair to the number you have written down. Press RETURN, then exit from the monitor with X. You have now restored the pointers for the beginning of variables and the end of variables and arrays to their correct values. It's a good idea also to type CLR before running the program again.

Monitor fiddling is a large topic, and this article only scratches the surface. Armed with a good memory map and a table of BASIC keyword codes, you should be able to discover many new possibilities for yourself.