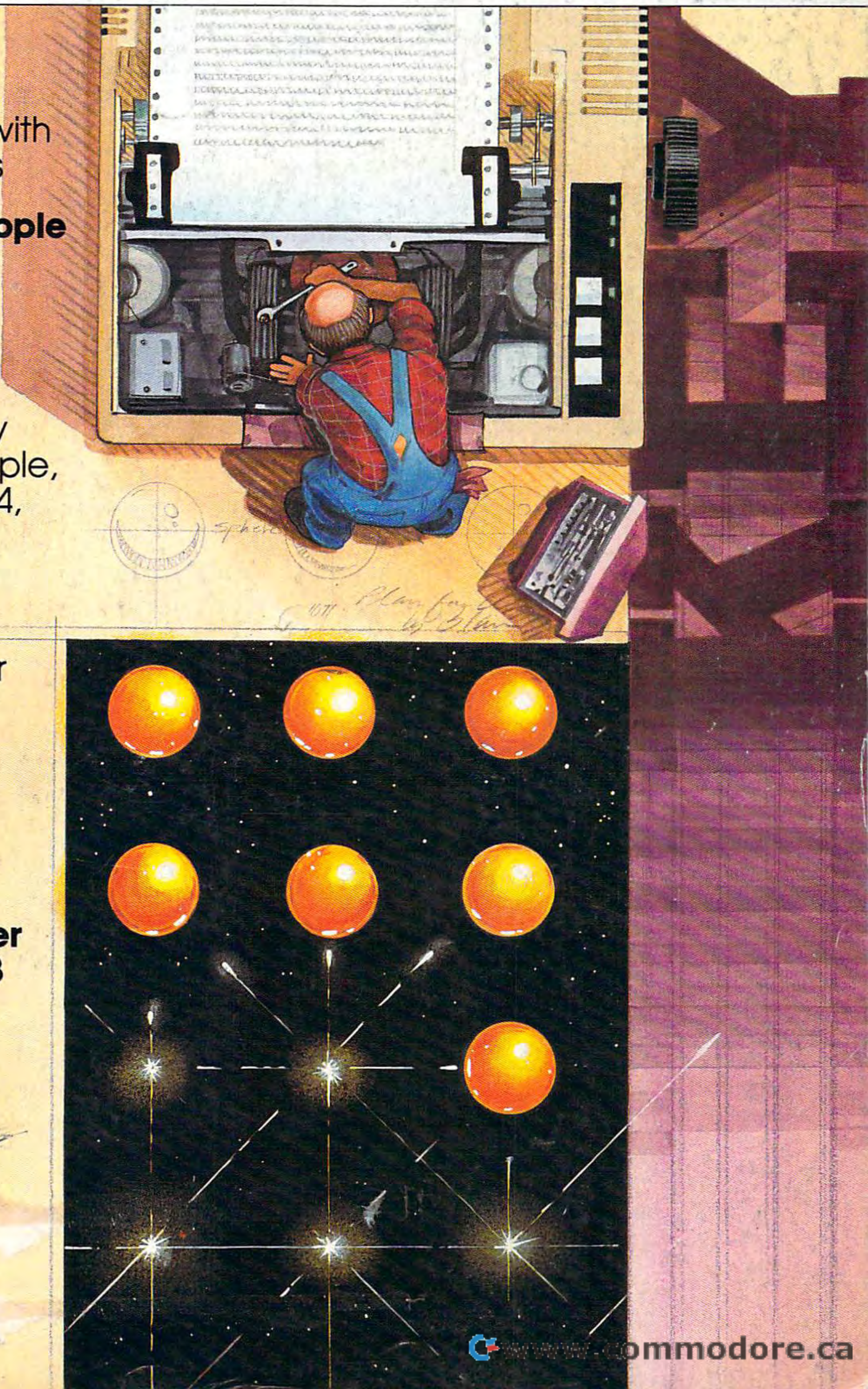
A Buyer's Guide To Computer Paint Programs

COMPUTE!

$3.00
January
1987
Issue 80
Vol. 9, No. 1
$4.25 Canada
02193
ISSN 0194-357X

The Leading Magazine Of Home, Educational, And Recreational Computing



FastKey For The Commodore 64
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Easily access and customize all your printer's features

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An explosive strategy game for Amiga, Apple, Atari, Commodore 64, IBM PC/PCjr, and ST

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Convert machine language into DATA statements

XMODEM File Transfer For Commodore 128 And 64

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Music Maker 64

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word processor
Pocket Planner 2
spreadsheet
Pocket Filer 2
database

New Features

Our new Pocket 2 series offers features usually found only in much more sophisticated applications software. Features that include: compatability with the new GEOS operating system†, ability to work with the Commodore RAM expander to allow a RAM disk, mouse support with pull down menus, 1571 burst mode for faster file loading, increased support for two single disk drives, automatic configuration for screen color, format and printer selection†.

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Now, when you upgrade your Commodore™ 64 to a 128, Pocket software helps make it a breeze. The new Pocket 2 software has both 128 and 64 applications on the same disk. So when you buy one you are actually buying two software packages. The cost only $59.95 (U.S.).

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**Pocket Writer 2 Word Processor
In addition to the new features above . . .**

- Spelling Checker incorporated in program (requires a dictionary disk)
- Spelling Checker now runs over 300% faster than in original Pocket software
- Word wrap is now fully automatic†
- Ability to move columns
- Go To page number for finding information in long texts†
- Fully automatic upper and lower case type conversion†
- Enhanced Delete process for word, line or paragraph
- Word Count feature for essays and assignments†
- Enhanced split memory mail merge option

**Pocket Planner 2 Spreadsheet
In additon to the new features above . . .**

- Individual column width selection now available†
- Multiple files in memory with cut and paste capability
- Able to print mathematical formulae as well as results of calculations†
- Global formatting option
- Enhanced row/column insert delete†
- Logarithmic and XY graphing capability
- Increased file compatability with other spreadsheets†
- Number of rows increased from 99 to 250†

**Pocket Filer 2 Database
In addition to the new features above . . .**

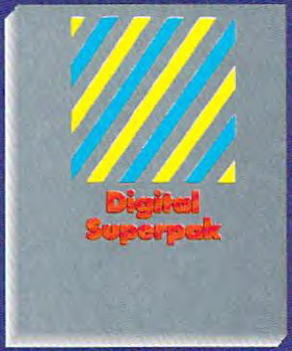
- Dynamic calculations during data entry
- Intelligent re entry to enter/edit mode
- Easier file conversion from other software†
- Automatic index updating for constantly sorted file†
- Enhanced mathematical language including loops and labels†
- High speed sort using dynamic buffering†
- Automatic entry of repetative data†

Serious Software That's Simple to Use

*Commodore's Microcomputers Magazine, independent reviewers, rated the original Pocket Writer 128/64 and Pocket Planner 128/64 software the "Annual Best of 1986" in the productivity category.

†Features available for Commodore 64™.

Superpak: The Solution That Saves Money!



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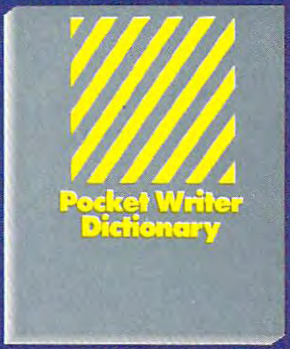
- Economical; $179.85 (U.S.) worth of software for only

$99.95 (U.S.)

Pocket Writer Dictionary



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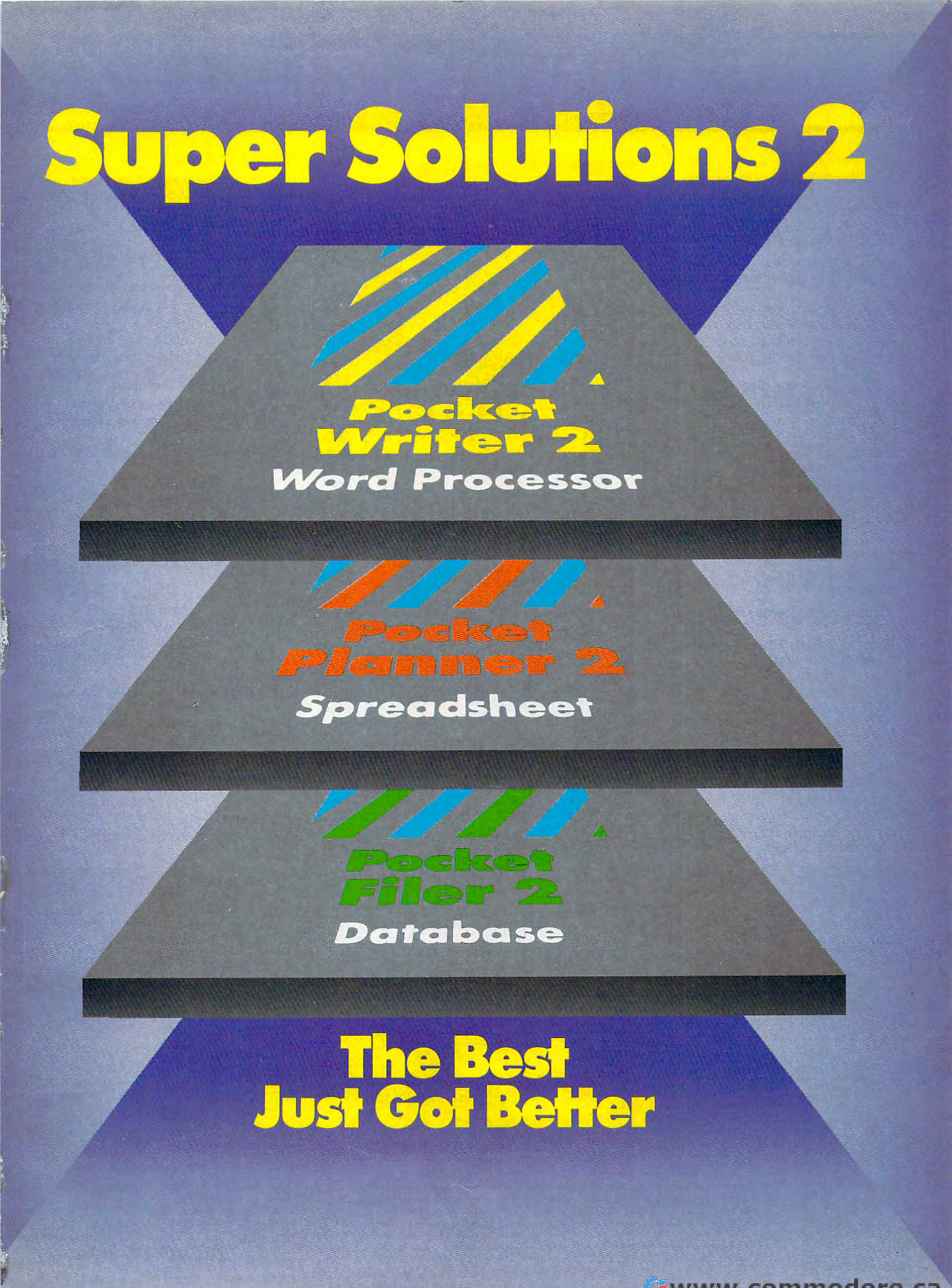
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Database
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Just Got Better

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– BILLBOARD'S computer software chart

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– INFOWORLD MAGAZINE

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2. HOMETEXT WORD-PROCESSOR

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- Natural English-language data entry/retrieval system for simplified electronic filing
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"The best professional word processor available."
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for the Commodore 64/128

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... one of the finest values on the market. Performance: excellent. Value: excellent."
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Three easy-to-use programs on one disk:

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- *Flexible data handling — save incoming text to disk, edit it, print it.*

2. HOMETEXT WORD-PROCESSOR
- *Over 20 full-screen editing and formatting features: move & copy, word-wrap, justification, automatic paging and many more.*

3. HOMEFIND DATABASE MANAGER
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JANUARY 1987
VOLUME 9
NUMBER 1
ISSUE 80

GUIDE TO ARTICLES AND PROGRAMS

FEATURES

REVIEWS

COLUMNS AND DEPARTMENTS

THE JOURNAL

NOTE: See page 98 before typing in programs.

AP Apple, **Mac** Macintosh, **AT** Atari, **ST,** Atari ST, **64** Commodore 64, **128** Commodore 128, **P** PET/CBM, **PC** IBM PC, **PCjr** IBM PCjr, **AM** Amiga. *General interest.

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COMPUTE! The Journal for Progressive Computing (USPS: 537250) is published monthly by COMPUTE! Publications, Inc., 825 7th Ave., New York, NY 10019 USA. Phone: (212) 265-8360. Editorial Offices are located at 324 West Wendover Avenue, Greensboro, NC 27408. Domestic Subscriptions: 12 issues, $24. POSTMASTER: Send address changes to: **COMPUTE!** Magazine, P.O. Box 10955, Des Moines, IA 50950. Second class postage paid at Greensboro, NC 27403 and additional mailing offices. ISSN 0194-357X.

Editor's Notes

As you read this, we're preparing to make our annual trek to that greatest of trade shows, the Winter Consumer Electronics Show, held in Las Vegas, Nevada, in early January each year. At the risk of seeming ungrateful, we've always wondered why anyone would spend the latter portion of the first week in January in the middle of the Nevada desert, but we make the journey, year after year, finding very little element of choice in the matter.

Imagine a group of interconnected enclosed football stadiums, and you can only begin to visualize the inside of a Consumer Electronics Show. In the course of less than a week, over 100,000 electronics-industry representatives, buyers, sellers, watchers, manufacturers, etc., will whisk through the hundreds and hundreds of exhibits, making buy and sell decisions that most of us won't see on store shelves for months, if ever. As we have those among us here who exhibit the decided traits of high-tech groupies, we invariably fall madly in need of one of those and two of those and...you get the picture.

Imagine seeing a quite exceptional digital television exhibiting multiple screens, incredible clarity, and amazing fidelity, and discovering that no mortals will be able to obtain one until maybe next November. Or imagine running across that product that's just exactly what you've been looking for and discovering (three months later) that its reception at the Consumer Electronics Show earned it a place on the list of products that were cancelled due to lack of interest. The same phenomenon that cancels our favorite television shows now manages to follow our product choices around. These digressions aside, we're really there to follow the pendings and happenings of our own special end of the industry, and the occasion of the fifth anniversary year of the Commodore 64 seems a good time to look back, and ahead.

We attended our first Winter Consumer Electronics Show in January 1980. There we introduced our then-new magazine, COMPUTE!. Commodore was an exhibitor at that show, with quite a large booth exhibiting their product mainstream: watches. In the very back corner of their booth, relegated to a lesser positioning so as not to interfere with the real business of the company, was a display of a couple of Commodore computers.

We were a very timid industry then, and there was very little in the way of activity for computer watchers at that show. Off in a separate hall, a company called Automated Simulations was demonstrating some of its software—it's the only software vendor we recall seeing then. Automated Simulations, for those of you who don't recall, is now Epyx. The intervening years have brought us great looming booths and displays from Commodore and Atari. We've also seen quite a bit of coming on strong and going away quietly: the massive personal computing extravaganzas of Texas Instruments, and Sinclair, and Acorn, and Ohio Scientific, and many, many others.

Now a great deal of the personal computing show activity has slowed. Some have moved to COMDEX, a computer-dealer/industry trade show that occurs in the fall. Some have simply opted for alternative avenues to visibility. CES is a trendy show, in part. In the midst of what one perceives as a great deal of stability among the present giants of the industry—the Sonys, the GEs, etc., one is aware of massive consumer trends moving through and around the exhibit halls. The excitement is quite real, and you can't help but be aware of the magnitude of moment in watching the first compact-disk read-only drive talk to an Atari, or be fascinated by the convergence of various product lines into an evolutionary marriage of electronic home products. So each year, while we're warming up for this, wondering why anyone would go spend a week in the Nevada desert during early January, we begin to get just a tiny bit excited, and wonder what we'll see this time.

We wanted to repeat this editorial from the January GAZETTE. As we go to press with this issue, COMDEX is beginning in Las Vegas. All indications are that it will be a very exciting show. The PC clone market is expanding rapidly, including the contributions soon to be entered by Commodore itself. 1987 is shaping up to be a very interesting year indeed.

Until next issue, enjoy your COMPUTE!.

Robert C. Lock

Robert C. Lock
Editor in Chief

(Not Bad for a 37-Ton Tank.)

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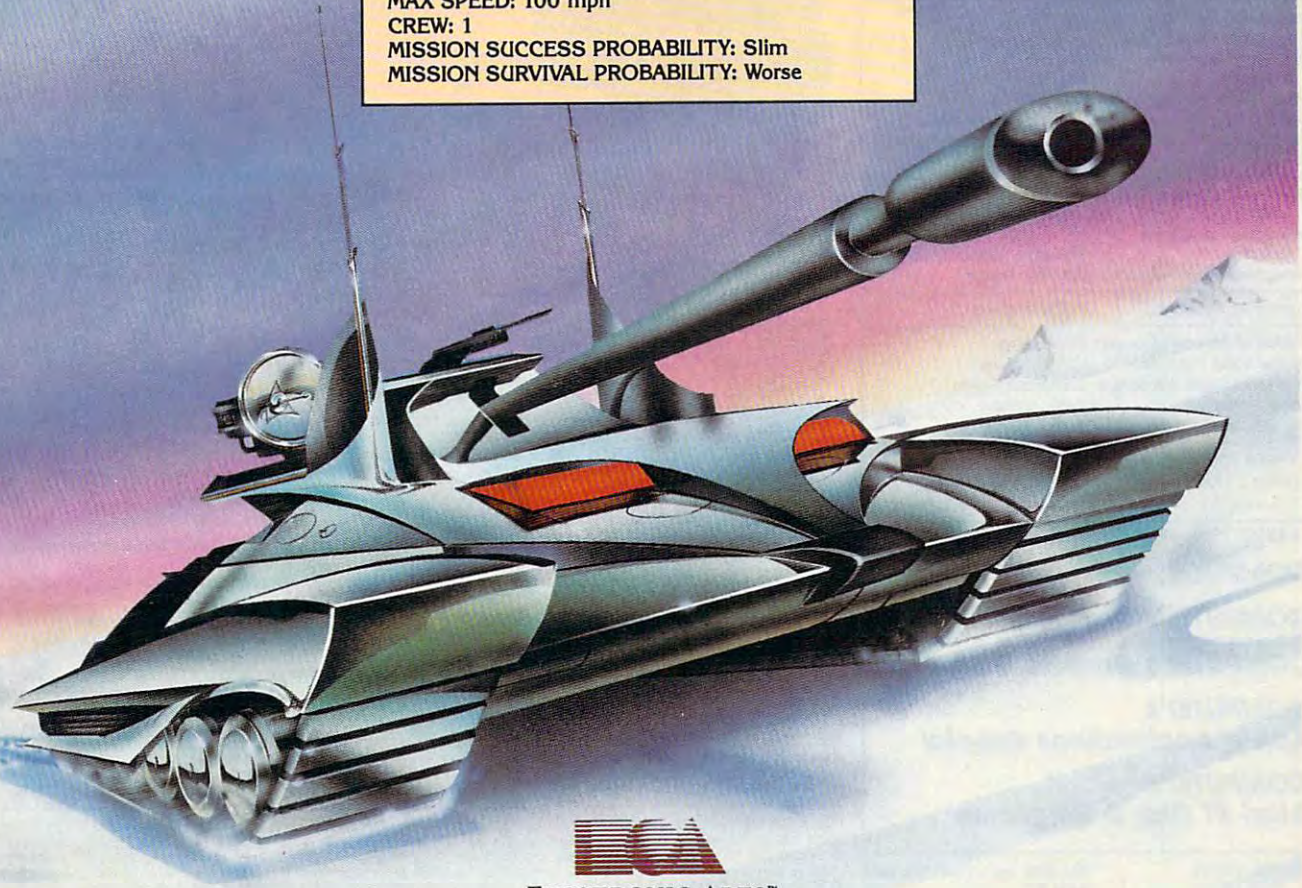
The Main Fortress. If you're good enough to find it, are you bad enough to destroy it?



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Editorial offices:	324 West Wendover Avenue, Suite 200, Greensboro, NC 27408 USA
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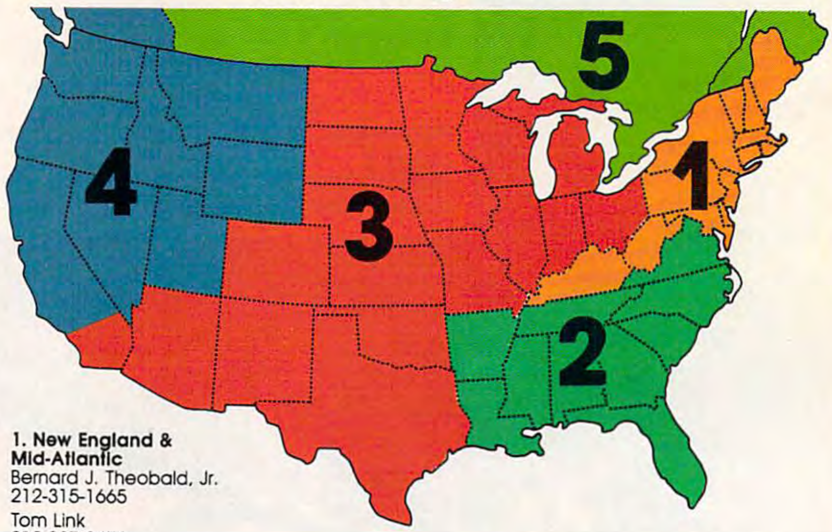

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Readers' Feedback

The Editors and Readers of COMPUTE!

If you have any questions, comments, or suggestions you would like to see addressed in this column, write to "Readers' Feedback," COMPUTE!, *P.O. Box 5406, Greensboro, NC 27403. Due to the volume of mail we receive, we regret that we cannot provide personal answers to technical questions.*

An American Computer In Paris

M. H. Trenker's question about using American computers in Europe ("Readers' Feedback," November 1986) rang a familiar note with me, since I faced a similar situation during the last year when I used a Commodore SX-64 in Paris. Your suggestions are correct, but I have some additional practical advice.

If you use a 200 volt/110 volt transformer, make sure it is rated at a minimum of 200 watts so that it can handle the load of a computer and all of its peripherals. I found it quite difficult to locate a female 110 volt plug adapter for the computer end of the transformer in Europe, so you may want to look for that item before you leave the United States. Another useful item is a high-quality surge-protector/line-filter power strip. Power-line fluctuations in some European cities are equal, at best, to rural conditions in North America. My experience is that all of these items are considerably cheaper in the U.S. than in Europe, so don't leave home without them.

I encountered no problems in running software, including copy-protected commercial programs, on my Commodore SX-64 with internal 1541 disk drive. I have not used a 1571 drive in Europe, but I suspect that drive would be just as forgiving as the 1541 in using 50 Hertz current. Given the rather finicky nature of Commodore drives, I would avoid having a drive adjusted unless necessary.

If possible, insist that all of your equipment, including computer, peripherals, and disks, be hand searched rather than X-rayed at airport security locations. Airport X-ray machines may not damage magnetic media under normal circumstances, but all too often they are out of adjustment or set at excessive power levels which can damage disks and erasable ROM chips. Don't forget that printers and printer interfaces contain ROM chips, too.

On the bureaucratic front, you should be aware that some countries, particularly those in Eastern Europe, place restrictions on the import and export of high-technology items. In the worst case, equipment brought in without proper authorization might be confiscated as illegal contraband. To facilitate entry into a European country, try to obtain a letter from an official European source (a school, business, or whatever) stating that your computer system is entering the country strictly for your temporary, personal use and that the entire system will leave the country when you do. To facilitate return to this country, you should also register your equipment with the United States Customs office before you leave.

Mario Sergio Bernardo

Thank you for the advice. The next two letters contain suggestions from other overseas readers.

Singapore Commodores

This refers to your answer to M. H. Trenker in the November 1986 issue of COMPUTE!. I would like to mention my experience from living in Singapore where the current is 220 volts and 50 Hertz. I used two computer systems there: a Commodore 64 with MSD-2 disk drive and 80-column green-screen monitor, and a Commodore 128 with 1571 disk drive and Commodore 1902 monitor. Except for having to use a 110 volt transformer, I did not need to make any modifications to either system. I have used hundreds of different programs on these computers.

I would encourage anyone about to travel overseas to purchase computer equipment in the United States because the prices are much lower. Repairs are usually not a problem (at least for Commodore computers) because the only hardware differences between U.S. and international models are in the power supply and video chip. In the rare event that a video chip fails, you can now obtain a replacement chip from Jameco Electronics and other mail order suppliers who advertise in computer magazines.

A United States Commodore computer gives readable video output when connected to a PAL-format European monitor, but without any color or sound. I don't know whether this is also true of the French SECAM format.

J.P. Kelsey

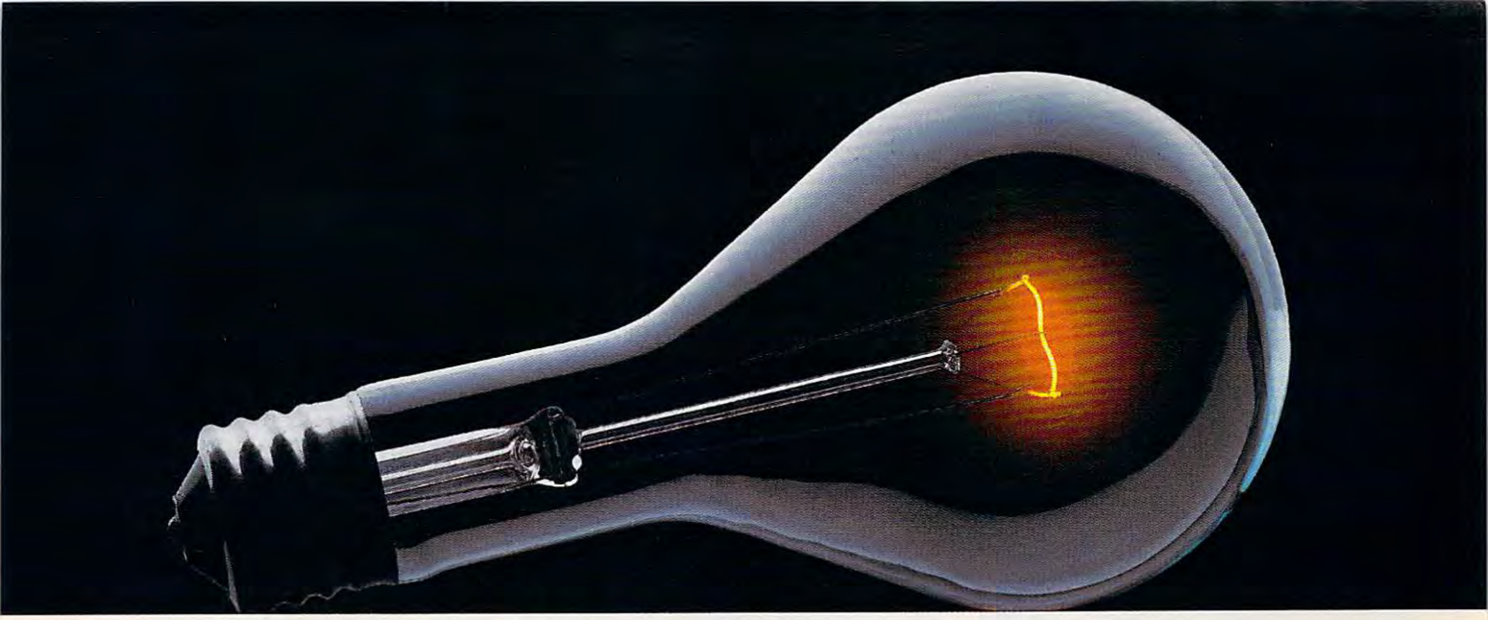
Dateline Zimbabwe

In the November 1986 installment of "Readers' Feedback" you asked for the experiences of readers who have used their computers overseas. I have lived in Harare, Zimbabwe since May 1985. When we came to this country, I brought from the States a Commodore 64, 1541 disk drive, 1702 monitor, and Star SG-10 printer. Because the power supply in Zimbabwe is 220 volts/50 Hertz, I invested about $50 in a good transformer. I can report that I have had no problems in using my system here in Africa. In fact, I'm glad that I have an American system. I don't know about Poland [see M. H. Trenker's letter in the November issue], but most of the world doesn't seem to share the mania for wall outlets that we have in the United States. It isn't unusual for a room to have only one outlet which accepts only one plug. Finding an adapter that would accept the four plugs required by my system would have been no small problem. Fortunately, I brought over a strip surge processor that solved two problems at one stroke.

I have been told that any software I might purchase overseas would not run properly if I bring it back to the United States. Since I didn't have problems running U.S. software in Africa, it doesn't seem there should be a problem going the other way. Do you have any information about this?

Ronnie Meek

We've never seen any software produced in Africa, but we have successfully run many programs that were written overseas, including commercial software and submissions from COMPUTE! *readers around the world. Many German programs are available for the Atari ST, in particular, since that computer was intro-*



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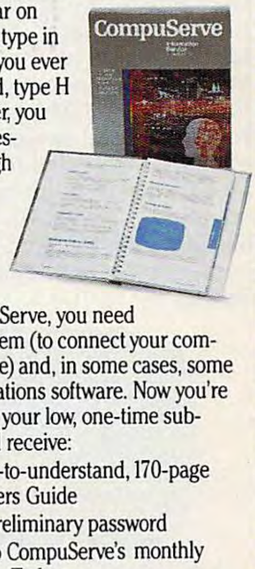

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duced in Europe several months before it appeared in the United States.

ST Directory Update

Here is an Atari ST trick which I've stumbled across. When you are searching disk directories on the desktop, instead of using the mouse to close the directory window and reopen it, simply insert the new disk and press the ESC key. The desktop automatically reads the directory from the new disk and displays it in the window.

Randy Hart

Thanks for the tip. Don't forget to close any subdirectories that are open on the active directory window before you press ESC. If you omit this step in a case where the new disk doesn't have a subdirectory of the same name, GEM displays an empty subdirectory. No harm is done (you can simply close the empty subdirectory after the fact), but the results can be confusing if you're expecting to see the root directory on the new disk. Many of our programmers use the ESC technique regularly. However, we have heard unconfirmed rumors that this method of updating disk information may be somewhat less reliable than closing the window and reopening it.

Language Translators

I need a program to translate Swedish into English, and vice versa. I have talked to many software dealers in large cities, and they tell me they know of no such program. If there is a program that can handle this task, please let me know.

Kenneth E. Pilquist

Unfortunately, general language-translation programs are probably years away, even for the largest and fastest computers. In the 1960s, some computer scientists believed that such programs were just around the corner. Some elaborate attempts were made, but the failures were often more notable than the successes. For example, one English-to-Russian program translated the English phrase The spirit is willing, but the flesh is weak *into the Russian equivalent* The vodka is strong, but the meat is raw.

Perhaps the major obstacle in the way of such programs is that human languages depend heavily on context. That is, the same word can signify many different things depending on how it's used. To take a simple example, consider the verb cast. *It commonly means* to throw, *as in the phrase* cast your nets on the water. *But it carries very different meanings in the phrases* cast a ballot, cast parts in a play, *or* cast a cement foundation. *The task becomes even more complex if you include specialized, technical definitions. In the C programming language, for instance,* cast *denotes a particular sort of conversion from one variable type to another.*

In order to translate the verb cast *reliably, a translation program would need to include fairly large amounts of real-world information about such dissimilar subjects as fishing, voting, theatrical management, and building construction. Without meaningful information about all the contexts in which a word can appear, translator programs can easily produce blunders such as mistranslating* spirit *as* vodka.

With these limitations in mind, however, you can use your computer as a simple language dictionary. Try this program.

```
10 DIM A$(20),B$(20),C$(20):RE
   M FOR ATARI ONLY
20 NUMWORDS=2
30 PRINT "1) ENGLISH TO SWEDIS
   H"
40 PRINT "2) SWEDISH TO ENGLIS
   H
50 INPUT I:IF I<>1 AND I<>2 TH
   EN 30
60 PRINT "WHAT IS THE WORD";:I
   NPUT C$:RESTORE
70 FOR J=1 TO NUMWORDS
80 READ A$,B$
90 IF I=1 THEN IF A$=C$ THEN P
   RINT B$:GOTO 30
100 IF I=2 THEN IF B$=C$ THEN
   {SPACE}PRINT A$:GOTO 30
110 NEXT J:PRINT "WORD NOT IN
   {SPACE}DICTIONARY"
120 GOTO 30
10000 DATA CAT,KATT
10001 DATA I,JEG
```

You can add more words and phrases to the DATA statements at the end of the program. When you are finished, put the number of words into line 20. You may find that when you add many words to the list, the program starts slowing down, so try to keep the most-used words at the beginning of the list. If the program is still too slow, you might consider rewriting the program to use a binary search. This would require a list sorted in alphabetical order.

More About Atari's COM

Just a note regarding the October 1986 installment of "Readers' Feedback," in which Brian Korn asked about using COM as a variable name in Atari BASIC. Your reply correctly states that COM is a reserved word and cannot be used in an implicit variable assignment such as COM=10. However, you *can* use any reserved word as a variable name by making an explicit assignment with LET. The statement LET COM=10 assigns the value 10 to the variable COM.

Implicit assignment (assignment without LET) works in an interesting way. LET is the last keyword in the keyword table, and thus becomes the

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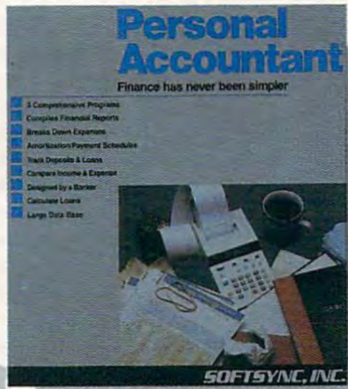

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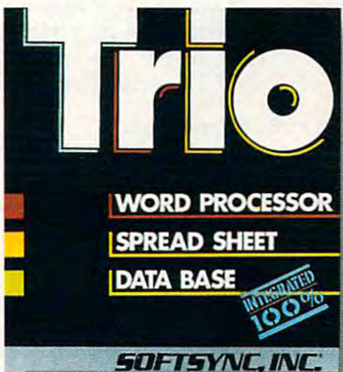

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default. If the interpreter can't find any other keyword at the beginning of a BASIC statement, it assumes you wish to perform an assignment and executes LET. As a result, the statement A=10 has the same effect as LET A=10. You can't assign COM implicitly (without a LET) because the keyword COM comes before LET in the keyword table. BASIC performs DIM in place of COM, and the interpreter never gets a chance to perform LET by default.

S.A. Robinson

Thank you for the clarification. LET does allow you to use any reserved word—GRAPHICS, PRINT, or whatever—as part of a variable name or as the entire name. Though it may be useful on occasion, we don't recommend that you embed keywords in variable names as a regular practice. The potential for confusion is great, and it's often possible to find an equally descriptive name that doesn't involve a keyword. For instance, instead of using COMP to signify COMPUTATION, why not substitute CALC (to signify CALCULATION)?

Plus/4 Programmer's Reference Guide

I read with interest your reply to Sean Donovan in the May 1986 installment of "Readers' Feedback," regarding custom character sets on the Commodore Plus/4. The *Plus/4 Programmer's Reference Guide* is now available from Scott, Foresman, 1900 East Lake Ave., Glenview, Illinois 60025. This book, which I coauthored with Sarah Meyer, contains material on all the graphics modes of the Plus/4, as well as a complete description of BASIC 3.5, the built-in software, and the use of machine language and peripherals. I hope you will make this information available to your readers.

Cyndie Merten

Thank you for the information.

Whatever Happened To Compatibility?

I remember reading some time ago about MSX computers which were all supposed to be compatible with each other. Compatibility seems to be a very important consideration. Why didn't these computers sell as well as Apples, Commodores, and Ataris? Also, since Microsoft made both MS-DOS and MSX-DOS, and since the Z80 and 8088 processors are closely related, are IBM computers compatible with MSX computers?

Satoru Fukushima

MSX computers are designed to be compatible with each other, but they have never become a significant factor in the United States market. Had they come to market one year earlier, the story might be very different. However, by the time MSX computers were ready for the U.S. market, that market was already making a dramatic shift away from 8-bit computers toward more powerful 16-bit machines. Despite the obvious attractiveness of a standard that applies to many different computers, it now seems unlikely that the MSX standard will ever become as widespread as many people had once thought.

MSX computers share some similarities with MS-DOS computers (a category that includes the IBM PC/PCjr and compatible machines). Both systems use similar file structures, and the Z80 and 8088 microprocessors have similar instruction sets. However, there are enough differences—especially hardware differences—between the two types of computers so that neither machine can read disks or run software created by the other.

If recent developments in 68000-based computers are any indication, you're not likely to see much cross-brand compatibility among 16-bit machines, either. The Apple Macintosh, Commodore Amiga, Atari ST, and Apple IIGS all use unique operating systems and disk formats. Thus, an Amiga can't run a Mac program, an Apple IIGS can't read ST disks, and so forth. There are superficial similarities in the operating-system interfaces used by these machines—they all use a mouse, menus, windows, and so forth—but they are profoundly different at the level of hardware and system software.

---

128 Merge Command

I recently upgraded from a VIC-20 (with a Programmer's Aid cartridge) to a 128 and have found that I no longer have a MERGE command. Since I've gotten used to writing my subroutines as separate programs to be merged later, I miss this command. Is there any way to merge two programs on the 128?

Robert Ridout

Yes. Let's say you want to merge a subroutine called QSORT into a program called FILEAWAY. First you need to create an ASCII listing of the QSORT program. Load QSORT and type this line:

```
OPEN 8,8,8, "QSORT.ASC,S,W": C
   MD8:LIST
```

When the file has been written and the cursor returns to the screen, enter PRINT#8: CLOSE8. Next, load the FILEAWAY program into which you want to merge the subroutine and type this:

```
OPEN 8,8,8, "QSORT.ASC": BANK1
   5: SYS 65478,0,8
```

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The BANK command isn't necessary unless you've been changing memory configurations. When the two programs are merged, you'll probably see a ?SYNTAX ERROR message, which you can ignore. To finish up, type **CLOSE2**.

The ASCII listing is essentially a typed-out version of the program. The SYS causes the 128 to look for input from the disk file instead of the keyboard, so the ASCII listing is typed into memory. If there are any duplicate line numbers, the line from the disk routine will replace the line already in memory.

Atari Disk Unfix

I own an Atari 130XE and a 1050 disk drive. I recently purchased the game *Summer Games*, which worked perfectly when I played it. Then I used a DOS 2.5 utility called DISKFIX.COM. One of the choices in this program was VERIFY DISK, so I thought I should use it to make sure the disk contained no bad sectors or files. While it was verifying, the computer flashed the message BAD LINK IN FILE 13—DELETING. When I ran the game again, the gymnastics event didn't work. Any suggestions on how I might recover the file?

M. Roberts

The DISKFIX utility which comes with DOS 2.5 is a very powerful utility, which tries very hard to recover all the files that it can. The reason it didn't work in this case is most likely due to copy protection. The copy-protection schemes used on many commercial disks often involve changing the sector link information on the disk. Apparently, DISKFIX thought that your disk was scrambled, and it did its best to correct the link information. If you write to the manufacturer of your game, perhaps they can suggest a way to recover the lost file.

Disks don't get scrambled very often. When they do, it's usually because a file wasn't closed after it was opened for writing. Unless you're experienced with disk programming, you should use disk utilities only as a last resort. Caution is particularly important if you're trying to repair a commercial disk. If possible, it's best to make a copy of the disk and run the utility on the copy rather than the original. If the utility does something unexpected, you'll at least be no worse off than when you started.

Double Or Dual?

I have heard that the 1571 is a double-sided disk drive. Does this mean it is like a dual drive? Does it need double-sided disks?

Eddy Belew

A single-sided drive such as the 1541 has one read/write head, so it accesses only one side of a disk (it reads and writes the bottom side of the disk). The 1571 is a double-sided drive; it has two read/write heads, so it can write to both sides of a disk. To maintain compatibility, the structure of the 1571's directory is similar to the 1541's, and the 1571 fills up the bottom side before it goes to the top of the disk.

But both the 1541 and 1571 can hold only one disk at a time, so both are single-drive units. A dual drive has two drive mechanisms and can hold two disks at the same time (this is not the same as two single drives). A dual drive may be single-sided or double-sided. Commodore has not manufactured a dual drive for some time. However, they are common on MS-DOS computers (the IBM PC and compatibles).

Thus, the 1571 is not a dual drive. At one time Commodore announced plans for a dual double-sided drive (named the 1572), but the' plans were apparently dropped.

If you should buy a 1571, we recommend using double-sided (DS) disks. Single-sided disks (which usually have SS on the label) are tested and certified for one side only. You may find that single-sided disks work in the 1571, but you can't know when the second side might fail. It's safer to stick with DS disks.

The Atari ST also uses both single-sided and double-sided disks. The 1040ST has one built-in double-sided drive. External floppy drives can be either single-sided or double-sided. Atari seems to be phasing out single-sided drives in favor of double-sided drives, since a double-sided ST drive can read and write to single-sided ST disks without any problems. However, since there are many single-sided drives still in use, virtually all commercial ST software is provided on single-sided disks. We have yet to see a dual drive for the ST. ©

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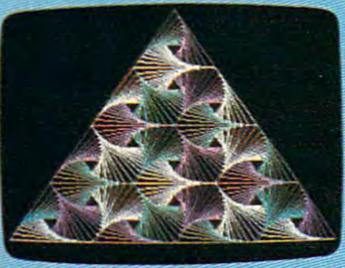
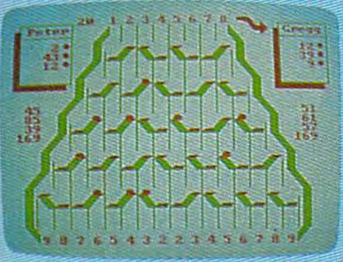
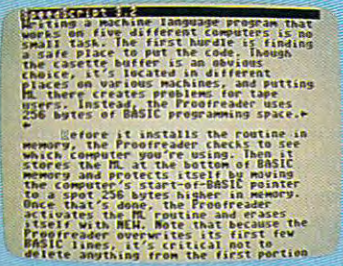

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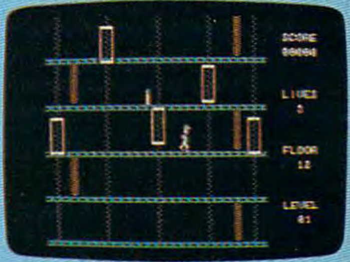

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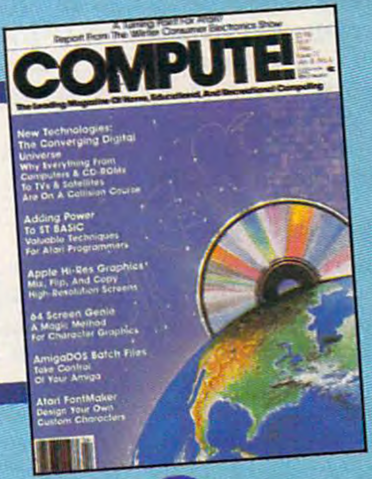

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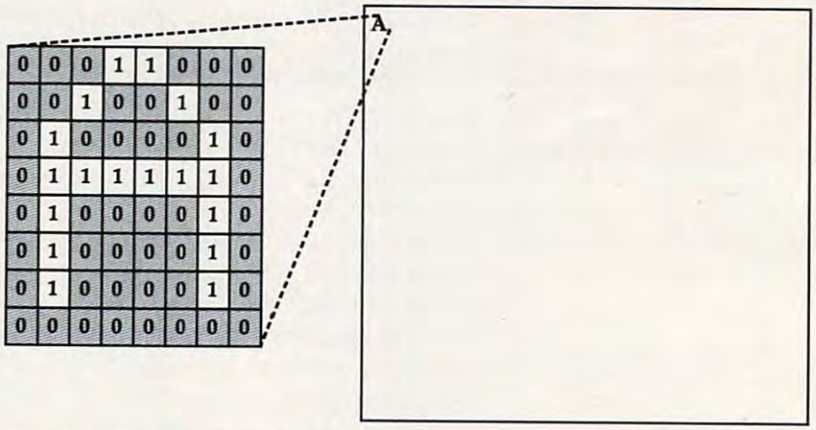
The Great Graphics Leap

Philip I. Nelson, Assistant Editor

Sixteen-bit microprocessors are changing the look of personal computer graphics. Here's an inside view of what makes graphics different on 16-bit computers such as the Amiga, Atari ST, and Macintosh.

Figure 1: Memory-Mapped Video



On computers with memory-mapped video, the computer translates on/off bit patterns in memory into matching patterns of light and dark pixels on the screen. Here, the on/off pattern found in 64 bits (8 bytes) of memory creates the letter A on the screen. The bits containing a 1 value are lit, while those containing a 0 are dark.

Few people interested in computers have failed to hear about the new 16-bit computers like the Atari ST, Amiga, and, most recently, the Apple IIGS. But are these computers truly superior to earlier, 8-bit computers? Part of the answer, of course, depends on what they're used for. For math, virtually any 8-bit computer can generate respectable results, but most computer users enjoy graphics. And, to a large extent, the better a computer's graphics look, the more fun it is to use.

One area where 16-bit machines definitely outshine their 8-bit brethren is graphics. What makes 16-bit graphics different from 8-bit graphics, and how are software companies taking advantage of these new capabilities? We'll begin with a comparison of graphics on 8-bit and 16-bit computers, and then look at some 16-bit software that differs notably from what's available in the 8-bit world.

Pixels And Bits

All microcomputers display graphics by lighting up patterns of phosphorescent screen dots known as *pixels* on a monitor or TV screen. The term pixel is short for *picture element.*

Most personal computers use *memory-mapped video* to control which pixels are lit and which are dark. Part of the computer's memory—which we'll loosely term *screen memory*—is reserved to contain information for the screen. The computer's video hardware translates the contents of the screen memory into video signals. The monitor, in turn, translates the video signals into the desired pattern of on and off pixels. Figure 1 illustrates this basic arrangement.

Screen memory is usually arranged in a manner that corresponds to the pattern of dots on the screen. Like all other memory, screen memory is composed of *bits,* the smallest information units a computer can handle. A bit, or binary digit, can contain either a 1 value or a 0 value. A *byte* contains eight bits, and a *word* contains sixteen bits.

The two possible states of a pixel—light or dark—correspond neatly to the two possible states of a bit—1 or 0, on or off. The term *memory-mapped video* aptly describes the process of *mapping,* or translating the on and off bit patterns found in screen memory into patterns of light and dark pixels on the screen.

Text And Graphics Modes

Eight-bit computers such as the Commodore 64 and Atari 800 have both *text modes* and *graphics modes.* Text modes generally require less memory and operate faster than graphics modes.

In graphics mode, the computer has direct control over individual dots on the screen. In the simplest case, if a bit is on, its corresponding screen pixel is lit; if a bit is off, its corresponding pixel is dark.

In text mode, the screen is divided into rows and columns of character-sized cells. Each character cell is further subdivided into rows and columns of dots. In this

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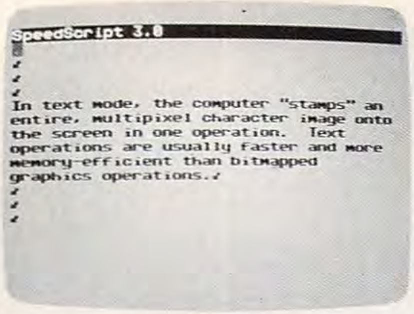
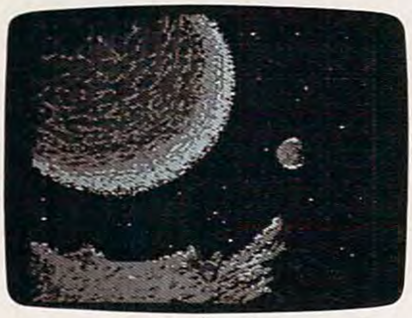


In text mode, the computer "stamps" an entire, multipixel character image onto the screen in one operation. Text operations are usually faster and more memory-efficient than bitmapped graphics operations.

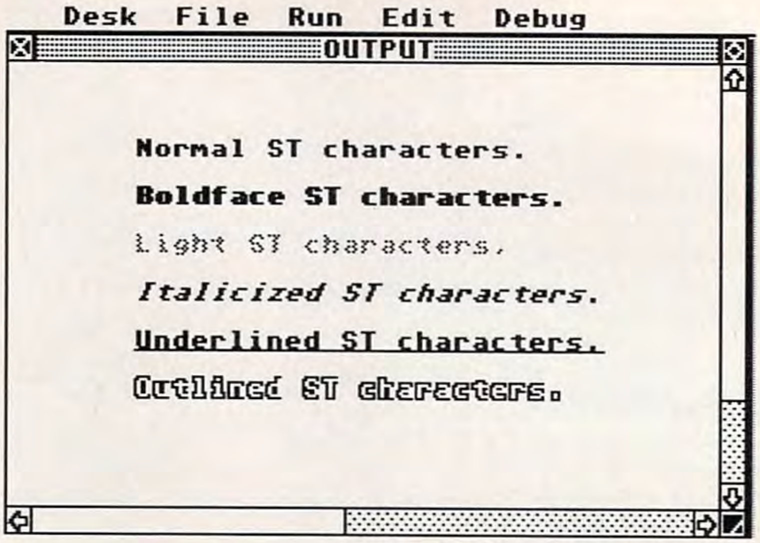


Bitmapped graphics screens require more memory and take more time to draw than text screens, since the computer must draw each screen pixel individually. This photo illustrates a screen drawn with KoalaPaint *for the Commodore 64.*

mode, each byte of data corresponds to a single character: When you press a key on the keyboard or PRINT a character, the computer's video hardware automatically draws an entire multidot character on the screen. Thus, a single text operation affects a number of pixels at once. Aided by special video hardware, the computer can "stamp" an entire character on the screen with one stroke, much as if it were using a rubber stamp.

Text screens require less memory than graphics screens because the video hardware translates one byte (the character code) into more than eight bits of display information. On the 64, for instance, only 1000 bytes are needed to store all the shape information for an entire 40 × 25 text screen. By comparison, the 64's bitmapped graphics mode requires 8000 bytes for shape data. For the same reason, text screens can be drawn much more rapidly than graphics screens.

Figure 2: Atari ST Special Text Effects



No Rubber Stamps

One major difference between 8-bit and 16-bit computers is the way they handle text. On 16-bit machines, the trend is to dispense with a separate text mode and display everything—including characters—via bitmapped graphics. This slows text operations somewhat, but permits much greater flexibility in the display of characters.

Both the ST and Amiga, for instance, lack a true text mode. Instead of stamping an entire character onto the screen in one operation, the computer draws it pixel by pixel with relatively slow software routines. However, the computer can change the appearance of text by making only slight alterations in the logic of character-drawing routines. This makes it easy to generate different sizes of characters and implement special effects such as italics, boldface, and underlining. To create italics, the computer simply slants the normal characters, and so on. Figure 2 illustrates such special text effects on the Atari ST.

The Amiga, Macintosh, and Apple IIGS also have a number of predefined *fonts* (text styles) that can be substituted for the normal system font. The following photo illustrates various fonts available on the Amiga. These patterns are part of the system software: You can simply load the desired font from disk and instruct the computer to use it in place of the normal font.

Eight-bit computers have the ability to display modified characters, but only at the cost of consid-

erable programming. The system typically includes only one font, so you must create new character patterns from scratch. And the computer has no innate ability to modify the normal font's appearance for special effects such as boldface.

Conventional text mode has another limitation: On most computers, you can display only one type of text on the screen at any given time. If you change the "rubber stamp" pattern for the letter *A*, for example, every *A* on the screen appears in that pattern. This constraint is largely avoided on 16-bit computers. Since each character is drawn individually, many different types and sizes of text can appear on the same screen.

Sprites, Bobs, And Outlaws

Much arcade-style animation involves moving a graphics object over an underlying background of some sort. To create an illusion of independence, the object must not change the appearance of the background over which it moves. The Commodore 64 and 128 solve this problem with special objects

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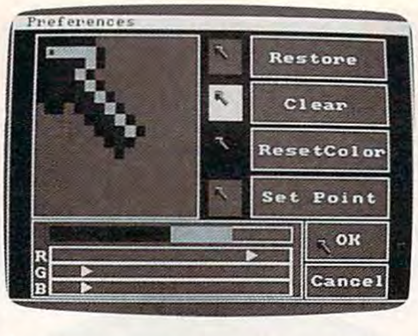
known as *sprites;* eight-bit Atari computers have a similar capability known as *player/missile (P/M) graphics.* Sprites and P/M graphics are created through special hardware, so they can be displayed with far less effort than if you had to do the same job entirely through software. However, sprites are limited both in size and in number.

The IBM PC/PCjr lacks hardware sprites, but compensates with GET and PUT commands that can store a graphics object in a BASIC array and stamp it onto the screen at any location. By stamping the same shape twice in XOR (exclusive OR) mode, you can restore whatever previously appeared in that area, making it possible to move a graphics object nondestructively. Unlike sprites, these objects are not limited in size or number; however, they are slower to manipulate and tend to produce unstable, flickering animation.

The Amiga includes eight hardware sprites which behave almost exactly like their cousins on the Commodore 64 and 128. Not surprisingly, the Amiga uses the hardware sprite capability to display its mouse pointer. Like any other hardware sprite, the mouse pointer has the ability to move rapidly over any sort of display without changing the background. And since it appears in a different logical plane from that of other graphics objects, the pointer sprite always appears "on top" of everything else on the screen, no matter how many windows are open.



The Amiga's mouse pointer is actually a hardware-based sprite. Like other sprites, the mouse pointer can easily be given a new shape and colors.

The Amiga's sprites are subject to most of the same limitations of sprites on the Commodore 64. Only eight can appear on a given horizontal line under normal circumstances, and each sprite can have only a few colors, even if it appears on a screen that supports, say, 32 colors. Because of their independence, hardware sprites can also be tricky to integrate with the Amiga's *Intuition* user interface. Other graphics objects belong to the current bitmap: If you close or resize a window, *Intuition* knows that it should erase or resize that window's contents. But sprites have no logical connection to the bitmap, so *Intuition* does not automatically erase them if you close the current window, nor does it change their appearance or location in concert with *Intuition* events such as window resizing.

In addition to eight hardware sprites, the Amiga supports sprite-like objects known as *vsprites* (virtual sprites) and *bobs* (blitter objects). Both involve significant programming overhead, but they offer different ways to overcome the limitations of hardware sprites.

The Amiga's vsprite system essentially lets you redisplay a hardware sprite at more than one screen location. Each hardware sprite can

The Amiga's bobs (blitter objects) move like hardware sprites, but are not limited in size, colors, or number. This screen from an Amiga BASIC game contains several bobs.

serve as the parent for several vsprites, which can have different colors, shapes, and locations from those of the parent. Among other things, this feature permits you to display more than eight sprites on the same horizontal screen line.

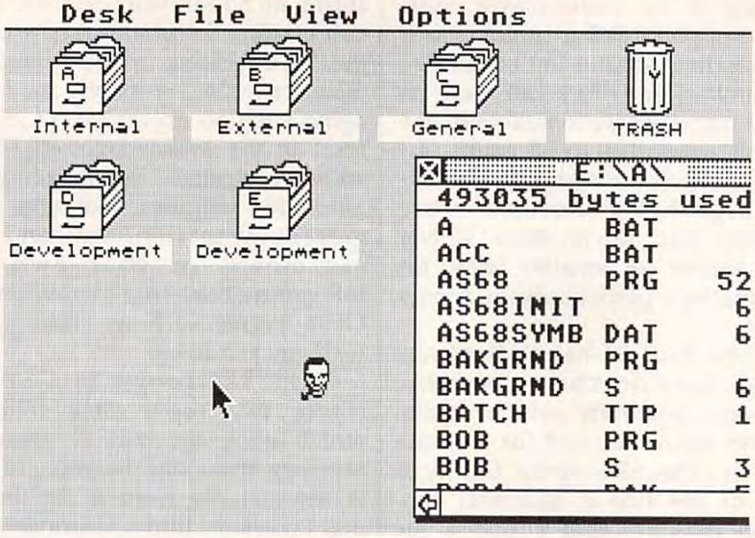
Bobs are the creation of another custom Amiga chip known as a *blitter*. Like sprite hardware, the blitter chip makes it possible to move an object nondestructively over a detailed background. This feature is analagous to GET and PUT animation on the IBM PC/PCjr, but it works much faster because of the blitter chip's hardware support. Bobs, unlike hardware sprites, are not limited in size or number, and they can have as many colors as are available in the current screen (up to 32 colors under normal circumstances). However, large bobs consume more memory and move more slowly than sprites (or smaller bobs, for that matter), particularly in Amiga BASIC.

The Atari ST has no hardware sprites, but it does have a spritelike software capability which, again, derives from the need for a mouse pointer. The ST's sprite facility is part of the *line A* assembly language interface that supports the VDI (Virtual Device Interface) portion of GEM. Software sprites are limited in size; the familiar busy-bee pointer shape is very close to the maximum size. However, there is no limit to the number of such sprites, and line A instructions operate rapidly enough for quite convincing animation. The sprite can have only two colors, but it may be placed on the screen in various modes, including XOR mode.

Like the Amiga's hardware sprite, an ST software sprite is a bit of an outlaw in relation to the computer's operating system interface. GEM provides no means for managing such an object except in the form of the mouse pointer. Using software sprites for arcade-style animation requires that you program at the machine level and create means of your own for integrating the sprite's activity with GEM events such as closing and resizing windows.

The VDI portion of GEM includes two *raster copy* routines which copy rectangular areas of memory from one location to another—usually from a portion of main memory into screen memory, or vice versa. As with GET and PUT in IBM or Amiga BASIC, the shape can be placed on the screen in various modes, including an XOR mode which allows nondestructive movement. Like the Amiga's bob facility, the ST's raster copy routines place no particular limit on the number of graphic objects you can move about the screen. However, raster copies are not supported with hardware like the Amiga's blitter chip. As a

Figure 3: ST Software Sprites



The ST lacks hardware sprites, but it relies on low-level operating system routines to display a mouse pointer with spritelike characteristics. In this screen, the man with a pipe is a software sprite, created by a short assembly language program that runs during the ST's vertical blank interrupt.

result, these operations are too slow for rapid, flicker-free animation, even in a compiled language such as C. At the time of this writing, ST BASIC has no commands that support raster copy operations.

The ST's line A interface offers another operation known as BITBLT (Bit Blitter), which closely resembles a VDI raster copy. Though it's somewhat more flexible than the VDI facility, BITBLT is scantily documented like all line A operations, and is available only in assembly language.

Bit Planes

Another notable difference between 8-bit and 16-bit computer graphics has to do with how the computer constructs a screen image. Figure 1 illustrates how a simple shape—the letter *A*—is displayed on the screen. The computer looks at the on/off pattern of bits in a specific area of memory and translates those patterns into a matching pattern of light and dark pixels on the screen. This mapping process is repeated for as many bits as are needed to define the entire screen.

In the simplest case—the ST's hi-res screen, for instance—the correspondence between bits and pixels is simple and direct. Each dark pixel corresponds to one bit containing a 0, and each light pixel corresponds to a bit containing a 1 value. Figure 4 illustrates this simple, one-to-one relationship.

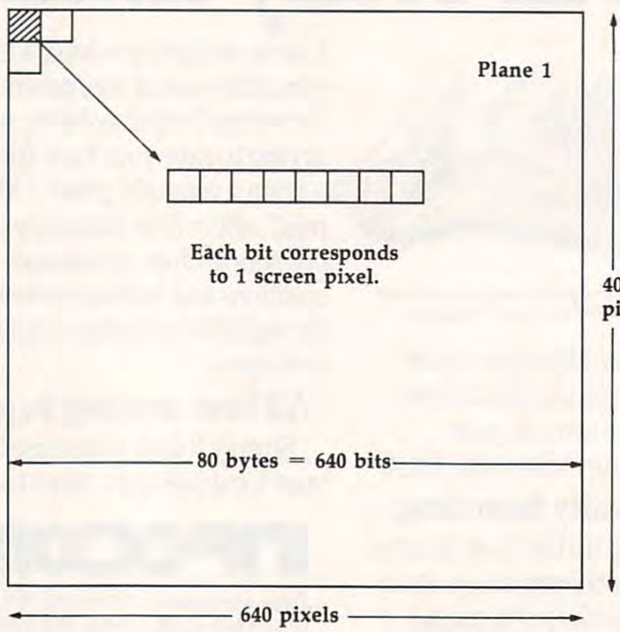
Thus, you can visualize the ST's screen memory in the form of a *plane* arranged in rows and columns which match the rows and columns of the screen. The first 80 bytes (640 bits) of memory contain on/off data for the top line of the screen, which—not coincidentally—contains exactly 640 pixels. The next 80 bytes of memory contain the dot pattern for the second screen line, and so on. An entire hi-res screen contains 256,000 pixels and requires 256,000 bits (32,000 bytes) of memory.

Adding color is usually a matter of combining two or more memory planes into a single screen image. The details of how this is done varies from machine to machine, but the concept of planes (usually called *bit planes* to accentuate the correspondence between bits and pixels) is useful for understanding all of them.

On most eight-bit computers, a maximum of two separate memory planes are combined to produce the final image. The Commodore 64's text mode, for instance, combines shape data from its screen memory with color data from its color memory to produce a screen of variously colored characters. In multicolor bitmap mode, the 64 draws shape and color information from different sources, but, again, combines only two planes. Sixteen-bit machines, on the other hand, can combine more than two bit planes for an even greater variety of colors.

The next step up from a two-color screen is a four-color screen.

Figure 4: ST Hi-Res Screen



The ST's monochrome screen consists of a single bit plane in which each bit of data corresponds to a single screen pixel. Eighty bytes (640 bits) of data are needed to define each of the 400 screen lines; therefore, 32,000 bytes (256,000 bits) are required to define the entire screen.

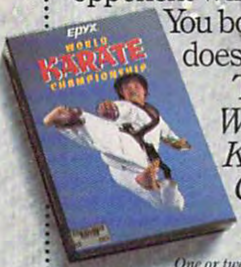


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Figure 5 represents a four-color, medium-resolution screen.

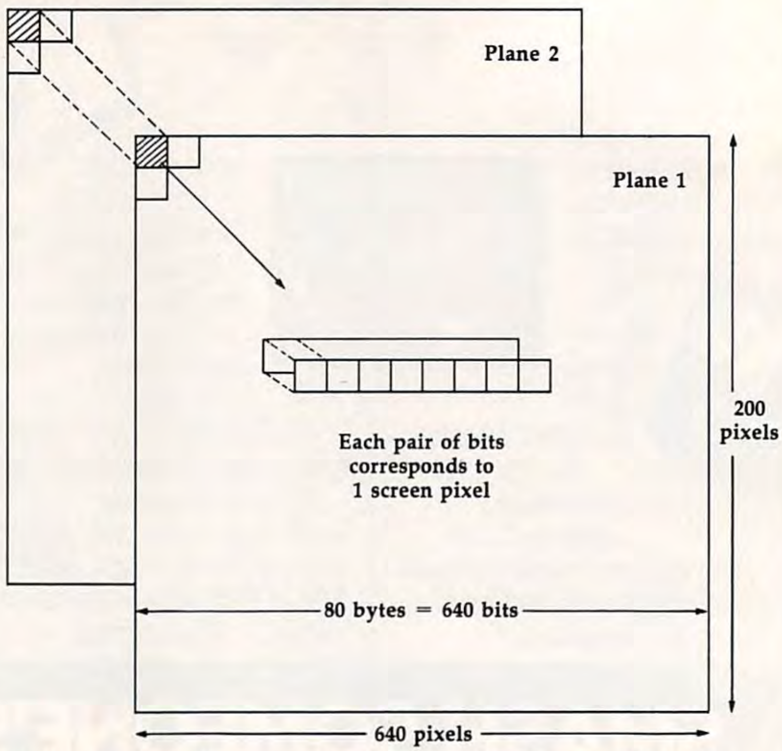
In a four-color screen, each pixel's color is defined by a pair of bits rather than a single bit. Since there are four possible combinations of two bits (00, 01, 10, and 11), a maximum of four colors are available.

To add more colors, you simply stack up additional bit planes. The next step up is typically a 16-color, 4–bit plane screen. Figure 6 is a diagram of the ST's 16-color screen.

For this resolution, four bits are required to define each pixel's color. Since there are 16 possible combinations of four bits (0001, 0010, 0011, and so on), a maximum of 16 colors are available.

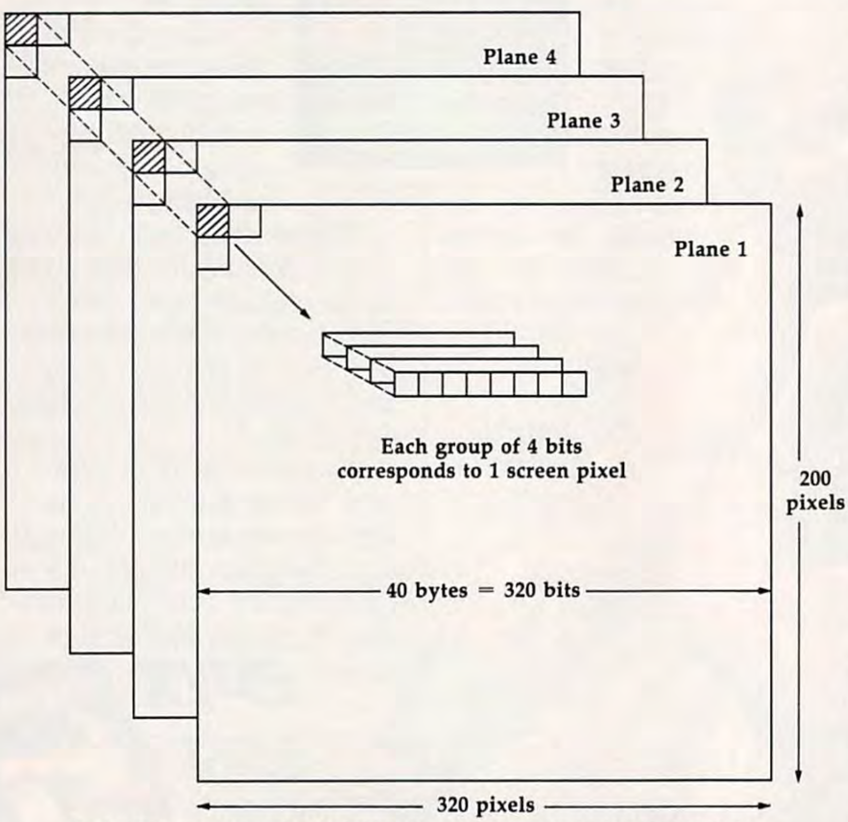
At four bit planes, we reach the limit for the ST. (The IBM PC/PCjr, by the way, offers four-color and sixteen-color screens similar to those on the ST, but color usage on the four-color screen is severely limited.) The Amiga can go even further, adding a fifth bit plane to display a total of 32 colors at one time. A 32-color screen is the limit under normal circumstances. However, the machine also supports two special modes that use six bit planes. In *hold and modify* mode, the Amiga can display as many as 4096 different color shades simultaneously. In *extra halfbrite* mode (not available on the earliest Amigas) the computer can display up to 64 distinct shades of color. The Amiga's six–bit plane modes are rarely used, however, because they are difficult to program and not documented as thoroughly as more conventional modes.

Figure 5: Four-Color, Two–Bit Plane Screen



*In the Atari ST medium-resolution screen, each bit plane contains 16,000 (80 * 200) bytes. A total of 32,000 (2 * 16,000) bytes are needed to define the entire screen. Four colors are obtained by layering two bit planes.*

Figure 6: Sixteen-Color, Four–Bit Plane Screen



*In the ST's lo-res mode, each bit plane contains 8000 (40 * 200) bytes. Thirty-two thousand (4 * 8000) bytes are needed to define the entire screen. Sixteen colors are obtained by layering four bit planes.*

Memory Versus Resolution

Extra colors, as we have seen, require additional memory. Pixel for pixel, the 16-color screen in Figure 6 requires four times as much memory as the 4-color screen in Figure 5. The Amiga and ST allocate memory for bit planes in quite different ways.

On the Amiga, each extra bit plane costs you another 8000 bytes. In noninterlaced modes, which are most widely used, a 32-color, low-resolution screen requires 40,000 bytes, while a 16-color, high-resolution screen requires 64,000 bytes. On a multitasking computer like

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the Amiga, memory consumption is always a major consideration, since the more memory one application uses, the less there is for other applications to use.

The ST simplifies the allocation problem by using the same amount of memory for bit planes regardless of resolution. Figures 4–6 demonstrate the arithmetic. In high resolution, the ST's screen memory consists of a single, 32,000-byte bit plane. In medium resolution, it consists of two 16,000-byte planes, and in low resolution it consists of four 8,000-byte planes. The same contiguous 32,000-byte memory zone is used in every case: The computer simply interprets its contents differently for different resolutions.

Since the amount of memory available for bit planes is always constant, the ST has to sacrifice resolution to gain extra colors. The medium-res screen gains two additional colors (one extra bit plane) by cutting vertical resolution in half: It is only 200 lines high, compared to 400 lines in a hi-res screen. The lo-res screen gains another 12 colors (two more bit planes) by cutting horizontal resolution in half; its display is 320 × 200 pixels, exactly half the number of pixels contained in the hi-res screen.

As a general consequence of this scheme, the ST offers far fewer screen options than the Amiga. Only three ST screen modes are available: low, medium, and high resolution. The Amiga offers nine different modes in noninterlaced modes, and a total of 20 different modes counting interlaced, extra halfbrite, and hold and modify.

Palettes

Color usage is another area in which 16-bit computers differ sharply from their 8-bit cousins. Simply put, a palette provides the means for redefining standard colors. This concept may be foreign to Commodore 64 users, who are used to a world in which color 0 is always black, color 1 is always white, and so on. On 8-bit Ataris and the IBM PC/PCjr, however, colors are easily redefined. Similar mechanisms are available on the Amiga, ST, and Apple IIGS.

The ST's palette, for instance, contains 16 color definitions. Each color is defined as a combination of three values, which correspond to intensities of red, green, and blue light. These colors can be remixed with the Control Panel desk accessory or under program control. Not all of the palette colors are significant in every resolution, of course. In medium resolution, only four colors are redefinable (the others can be redefined, but are not visible), while in high resolution only one palette setting (actually the low bit of the color 0 setting) is useful.

The Amiga's palette can define as many as 32 colors under normal circumstances. Again, the screen mode determines how many colors are actually available.

The Apple IIGS handles its palette in interesting ways. A basic palette consists of 16 color definitions, just as on the ST. However, you may redefine the palette for any screen line. This may be done a maximum of 16 times for a given screen under normal circumstances. In effect, the IIGS offers 16 separate palettes which can be assigned to different horizontal screen zones. With clever programming (which involves interrupt techniques) this capability can be extended even further.

Besides allowing you to choose exactly the shades you want, a modifiable palette lets you change large areas of the screen almost instantaneously. For instance, say that you define color 2 as black and draw a filled square in that color. If you redefine color 2 as orange, the entire square changes to orange immediately.

By shifting the palette through a series of combinations, you can even make various objects seem to appear and disappear, a simple kind of animation. Such color cycling is familiar to those who have used programs such as *NEOchrome* on the ST or *Graphicraft* on the Amiga. The next photos illustrate a *Graphicraft* screen that uses color cycling to create an animated owl and rabbit: When color cycling is turned on, the owl and rabbit seem to move across the screen. In fact, *all* of the owl and rabbit images are on the screen at all times. Only one pair of animal images appears at any given time because all the others are given the same color as the background.

Clever color cycling can make objects appear and disappear. These photos show the progress of an owl and rabbit moving across the screen.

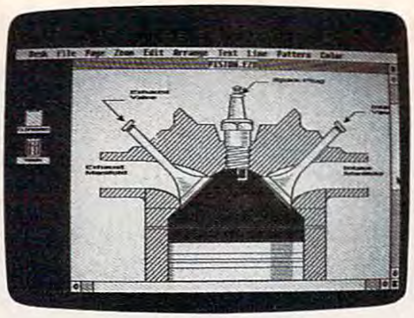
In this photo, the colors have been changed to reveal all of the owl and rabbit images at once. When cycling is in effect, only one pair of images appears at a given time.

Color cycling can be used for many other subtle effects, as well. Shapes, including text, can fade in and out of view; highlights can sparkle; water can shimmer and flow; and so forth. In the hands of an accomplished programmer, color cycling can create powerful, almost magical effects. Much of the impact of the Amiga program *Polyscope*, for instance, is achieved through carefully contrived manipulations of a 32-color palette.

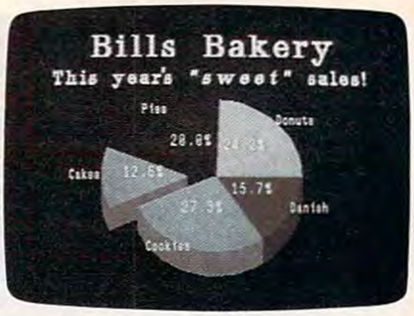
My Interface, Right Or Wrong

The graphics capabilities of 16-bit machines are not always fully exploited. One reason why some 16-

This screen from Aegis Draw *for the Amiga includes two different elevations of a houseplan.*



Easy Draw *for the Atari ST was used to create this illustration.*



A business chart created with Impact! *for the Amiga. The program includes a slide-show feature for displaying a series of related screens.*

bit software looks like 8-bit software concerns maintaining a consistent user interface. Certain complex programs—word processors, databases, flight simulators, or whatever—involve many commands and take time to learn. For instance, imagine that you already have a very popular, keyboard-driven PC word processor named "Word Whiz," and wish to introduce a new version for the Atari ST. If the translation works just like the original, existing users can easily migrate to the new version without learning a host of new commands. This logic is especially compelling for programs which already have a large installed base or which, as in the case of a word processor, are used in both homes and offices.

The Right Stuff

Interface philosophy notwithstanding, there are many pieces of 16-bit software that go far beyond the capabilities of any 8-bit machine. In some cases, this is due to unique graphics features. In others, the difference arises from the superior processing power of a 16-bit machine.

Not surprisingly, most graphics programs for the Macintosh, ST, and Amiga offer at least a few features that would be difficult or flatly impossible to achieve on any eight-bit computer. The most obvious differences are based in hardware. The Amiga, for instance, has the hardware to support many more screen modes and colors than any eight-bit machine can possibly emulate, and its graphics software tends to reflect that fact. The flexible color palette of the Amiga, ST, and Apple IIGS also opens the door to color cycling and similar effects that few eight-bit computers can simulate.

Other differences relate to the drawing tools themselves. Every drawing program must provide some sort of movable cursor, pointer, or stylus as a means of indicating the current screen position. On 16-bit computers, the mouse and mouse pointer are integral to the operating system interface: Hardware and system software handle most of the work of reading the mouse and displaying the pointer. Because it "comes with the computer," the mouse pointer is very responsive and can be maintained with little programming overhead. Eight-bit computers weren't designed with a mouse in mind, and must use a graphics pad, joystick, game paddles, or keyboard as a substitute.

Other 16-bit strengths can be emulated by 8-bit machines, but only at the cost of considerable extra programming. Cut and paste operations, for instance, are very common in drawing programs. On a Macintosh, ST, or Amiga, the programmer can simply call native system routines to read the drawing tool's location and movement, draw an expanding box around the captured portion of the screen, store that image elsewhere in memory, and paste it back onto the screen at a later time. On any 8-bit computer, these operations must be programmed from scratch, which increases the size of the program and may also lead to slower execution.

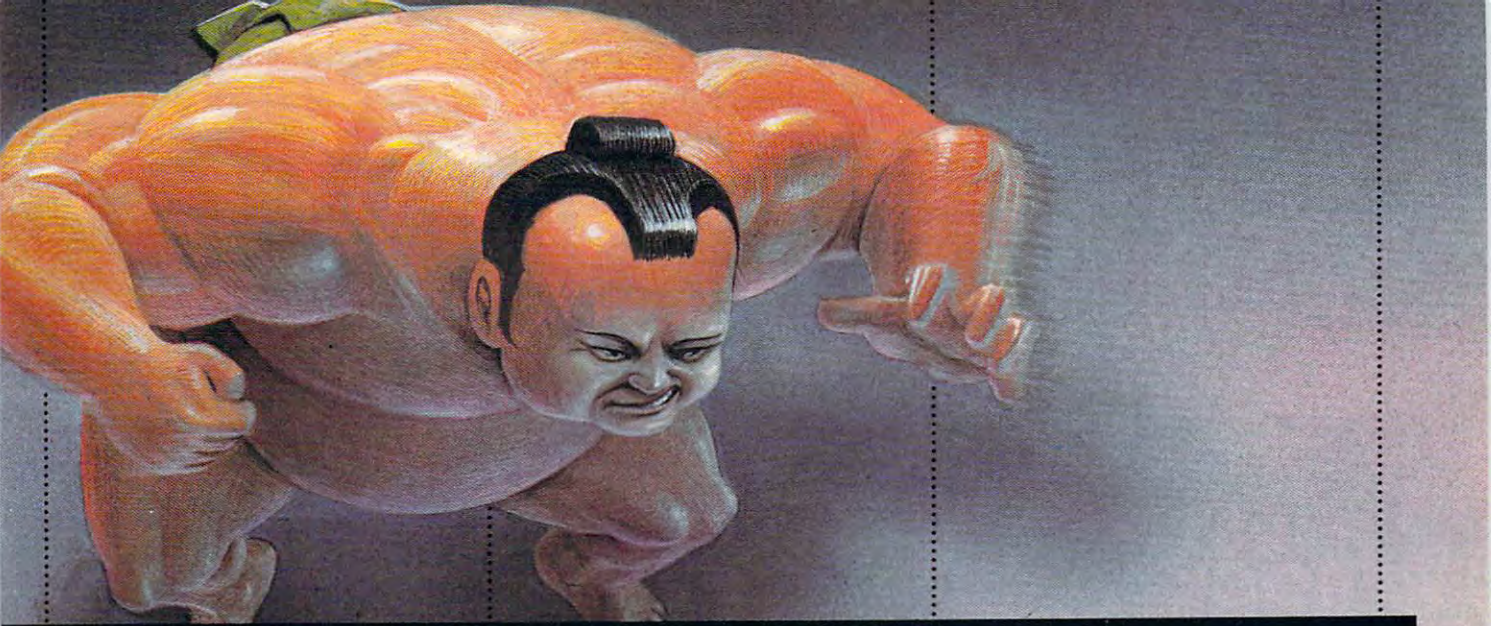
The computer's memory capacity is another important factor. Half-megabyte and megabyte (one million byte) memories are common among 16-bit machines, while 8-bit machines usually have forty to fifty thousand bytes of free RAM.

Increased memory also makes programs less disk-dependent and simplifies many programming problems. Consider an *undo* option, for instance. The easiest way to let the user undo the most recent operation is to store a complete copy of the screen between every drawing event. When you choose to undo something, the program simply copies the saved screen image back into the work area. With a half-million or a million bytes of memory, a 16-bit program shouldn't have much difficulty finding room for a spare screen image. In an 8-bit environment, where the program itself might consume half of available RAM, that simple solution may not be available, leading the programmer to invent a more circuitous solution or omit the option altogether.

The Heart Of The Matter

Perhaps the most important graphics device of all, however, is the microprocessor itself. The great processing speed of the 68000 chip (65816 on the Apple IIGS) now opens up entirely new categories of programs.

Consider, for example, CAD (Computer-Aided Design) software. Many of the operations in a CAD program, such as drawing a complex, three-dimensional projection or repeatedly scaling a two-dimensional image, require an enormous number of calculations. It's possible, of course, for an eight-bit computer to perform those calculations, but it lacks the number-crunching horsepower to do the job



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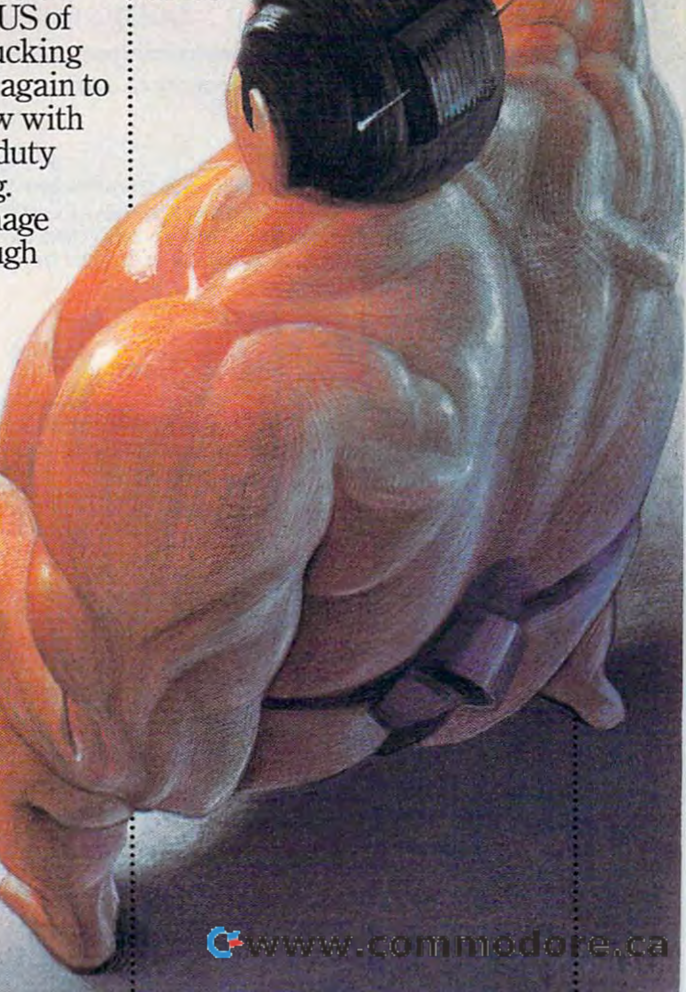

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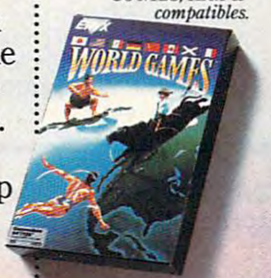

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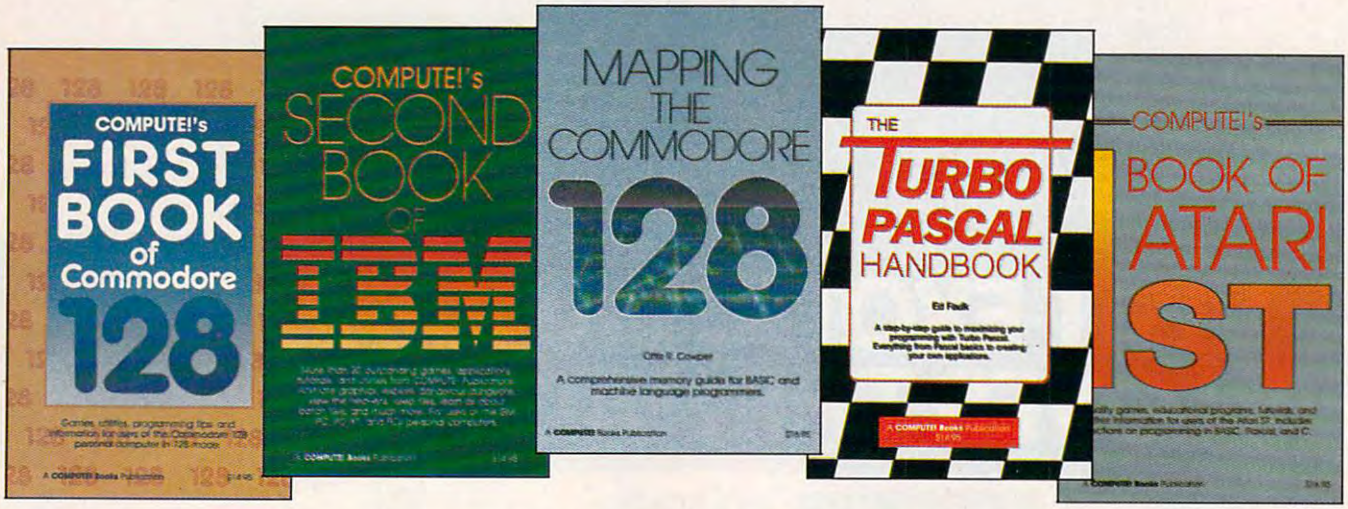

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The Turbo Pascal Handbook
Ed Faulk
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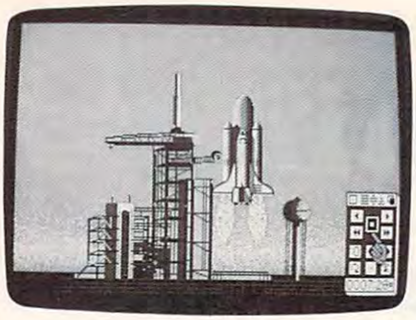
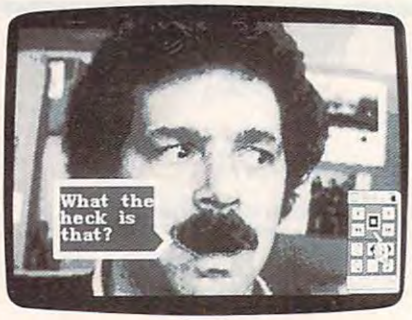


A spacecraft leaves Earth in this frame from a Deluxe Video *animation.*



A computer-generated speech balloon is overlaid on a digitized video image in this Deluxe Video *sequence.*

Deluxe Video *includes preprogrammed scene-generator routines for commonly used features such as titles, credits, and charts. This animated bear emits a digitized growl as he moves his head from side to side.*

Scene from Defender of the Crown, *an interactive movie in the Cinemaware series from Mindscape.*

at acceptable speeds. For this reason, professional-quality CAD software has historically been available only to mainframe and minicomputer users.

The Macintosh, Amiga, ST, and Apple IIGS have enough processing power to perform calculation-intensive graphics activities at acceptable speeds. A number of professional design systems are already available for these machines, and that number is likely to increase as the 16-bit programming community gains maturity and the professional graphics market proves its viability.

Two examples, *Easy Draw* for the ST and *Aegis Draw* for the Amiga, are programs of a type that virtually didn't exist in the home computer market as recently as two years ago. As the photos illustrate, these programs are primarily intended for making *structured drawings* for architecture, engineering, business charts, and similar pursuits.

Business graphics are another newly emerging category. As you might expect, business-specific programs such as *Impact!*, another Aegis package for the Amiga, place heavy emphasis on charts, graphs, and text.

Home Movies

Among the showiest new 16-bit graphics programs are those which simulate television or films. These programs are also good examples of software that's simply too big and complicated to run successfully in an 8-bit environment.

Deluxe Video, a current Amiga offering from Electronic Arts, lets you create your own "videos" complete with detailed moving graphics and musical accompaniment or sound effects in the background. This highly sophisticated package (it occupies three Amiga disks) provides everything you need to create quite elaborate animated sequences. You may import IFF-format image files from *Deluxe Paint* and sound effects or music files from *Deluxe Music* and compatible programs. The program is also compatible with the Amiga frame grabber, a utility that captures digitized video images in IFF-format files, and the genlock peripheral, which lets you overlay Amiga-generated graphics onto other video footage.

In the pure-entertainment category, the yet-to-be released Cinemaware series from Mindscape offers *interactive movies*: highly realistic, role-playing adventures with detailed graphics and cinematic viewing options such as zooms, cuts, pans, and shifts of perspective. The plot is nonlinear, like an interactive text adventure. Instead of passively watching events unfold, as in a motion picture, you act through a computerized alter ego, deciding at the moment where to go and what to do.

Not surprisingly, Mindscape plans to release interactive movie software solely for 16-bit computers (the Mac, Amiga, and ST). Full 3-D animation requires huge amounts of information: One of the Cinemaware adventures reportedly includes a full megabyte of graphics data alone.

What does the future hold? If present trends continue, we'll see more sophisticated drawing programs with an increasing emphasis on animation and easy integration with other media such as film and video. In the entertainment arena, programs will rely more on three-dimensional animation and provide highly detailed simulations of real-life events. When software reaches this level of sophistication, the personal computer will likely be found in nearly every home.

Aegis Draw
Impact!
Aegis Development
2210 Wilshire #227
Santa Monica, CA 90403

Cinemaware series
Defender of the Crown
Mindscape
3444 Dundee Rd.
Northbrook, IL 60062

Deluxe Paint
Deluxe Video
Electronic Arts
1820 Gateway Dr.
San Mateo, CA 94404

Easy Draw
Migraph
720 S. 33, Suite 201
Federal Way, WA 98003

Graphicraft
Commodore Business Machines
1200 Wilson Dr.
West Chester, PA 19380 ©

A Buyer's Guide To Computer Paint Programs

No matter what kind of computer you own, there are software programs that can introduce you to the fun and creativity of computer graphics. Among the most popular and versatile graphics packages are the paint programs that present even the nonartist with the electronic tools to draw in ways that simply aren't possible with more traditional media.

The paint programs listed below are all available for under $100, are easy to use, and show off the graphics potential of your computer.

Analytic Art
Crystal Rose Software, 109 S. Los Robles, Pasadena, CA 91101
$59.95
A color paint-and-design program for the Amiga.

Animate
Brøderbund Software, 17 Paul Dr., San Rafael, CA 94903-2101
$69.95
A double-high-resolution graphics program for the Apple IIc and 128K Apple IIe that is compatible with Brøderbund's *Dazzle Draw* and allows for easy animation of figures.

The Animator
Michtron, 576 S. Telegraph, Pontiac, MI 48053
$39.95
An Atari ST program that lets you animate your color pictures created with the *DEGAS* and *NEOchrome* paint programs.

***Atari Artist* (Touch Tablet)**
Atari, 1196 Borregas Ave., P.O. Box 3427, Sunnyvale, CA 94088-3427
$64.95
A paint program, similar to *Paint*, but included with the Atari Touch Tablet package for Atari eight-bit computers.

Bitmap Coloring Book
Bitmap, P.O. Box 237, Westwego, LA 70094
$18.95
An Atari ST coloring book and image resource that uses drawings from early twentieth-century design books, for systems with color monitors.

Blazing Paddles
Baudville, 1001 Medical Park Dr., SE, Grand Rapids, MI 49509
$34.95
A color drawing program for Atari eight-bit, Commodore 64, and Apple II–series computers that also contains a library of predrawn shapes.

Colourspace
Llamasoft Software, 49 Mount Pleasant, Tadley, England
(An American distributor for this program may be announced by the time you read this.)
$29.95
A colorful light-show drawing program for the ST that first appeared on Atari eight-bit computers, for color monitors.

Dazzle Draw
Brøderbund Software, 17 Paul Dr., San Rafael, CA 94903
$59.95
A color drawing program for the Apple IIc, IIGS, and IIe (with 128K).

DEGAS
Batteries Included, 30 Mural Street, Unit 9, Richmond Hill, Ontario, Canada L4B 1B5
$39.95
DEGAS is a full-featured art-and-design program for the Atari ST with color or monochrome monitor.

DEGAS Elite
Batteries Included, 30 Mural St., Unit 9, Richmond Hill, Ontario, Canada L4B 1B5
$79.95
An advanced art-and-design drawing program for the Atari ST with color or monochrome monitor.

Deluxe Paint
Electronic Arts, 1820 Gateway Dr., San Mateo, CA 94404
$99.95
A sophisticated paint program for the Commodore Amiga and Apple IIGS computers, containing many advanced graphics features.

Doodle
Crystal Rose Software, 109 S. Los Robles, Pasadena, CA 91101
$39.95
A color drawing program for the Commodore 64 that works in true high resolution.

Easy Draw
Migraph, 720 S. 333, Suite 201, Federal Way, WA 98003
$99.95
An object-oriented drawing program for the Atari ST.

Fantavision
Brøderbund Software, 17 Paul Dr., San Rafael, CA 94903
$49.95
A color paint program for the Apple II–series computers (with 64K) that combines drawing and animation.

FullPaint
Ann Arbor Softworks, 308½ S. State St., Ann Arbor, MI 48104
$99.95
A paint program for the 512K Macintosh.

geoPaint
Berkeley Softworks, 2150 Shattuck Ave., Berkeley, CA 94704
$59.95 (*GEOS*)
A full-featured color graphics workshop for the Commodore 64. *geoPaint* is a part of *GEOS*.

Graphicraft
Commodore Business Machines, 1200 Wilson Dr., West Chester, PA 19380
$49.95
An easy-to-use color paint program for the Amiga that allows simple animation.

The Graphics Magician
Penguin Software, 830 Fourth Ave., P.O. Box 311, Geneva, IL 60134
$39.95 (Apple II series); $49.95 (Macintosh)
Two graphics programs in one package, which let you draw and then animate your pictures.

The Graphics Magician Painter
Penguin Software, 830 Fourth Ave., P.O. Box 311, Geneva, IL 60134
$24.95
A paint program for the Atari eight-bit, Commodore 64, and IBM PC and compatible computers, similar to *The Graphics Magician*, but without the animation feature.

HippoArt
Hippopotamus Software, 985 University Ave., Suite 12, Los Gatos, CA 95030
$39.95
This is a series of Atari ST disks, issued separately, which contain collections of pictures on a variety of subjects to be edited and colored.

Images
Aegis Development, 2210 Wilshire #227, Santa Monica, CA 90403
$79.95
A painting program that lets you mix your own colors and use up to 32 colors in one drawing. For the Amiga with 512K.

Movie Maker
Interactive Picture Systems. (Distributed by Electronic Arts, 1820 Gateway Dr., San Mateo, CA 94404)
$34.95 (Commodore 64); $32.95 (Atari eight-bit); $39.95 (Apple II series)
A color animation program that lets you draw pictures that can then be animated into sequences.

NEOchrome* and *NEOchrome Sampler
Atari, 1196 Borregas Ave., P.O. Box 3427, Sunnyvale, CA 94088-3427
$29.95 (price tentative at press time)
The *NEOchrome Sampler* was originally included free with each ST system sold; now a full-featured commercial version of *NEOchrome* is for sale from Atari, and free distribution of the *Sampler* has been discontinued.

Paint
Atari, 1196 Borregas Ave., P.O. Box 3427, Sunnyvale, CA 94088-3427
$29.95
An entry-level paint and design program for the eight-bit Atari computers; works with joystick.

PaintPro
Abacus Software, P.O. Box 7219, Dept. S9, Grand Rapids, MI 49510
$49.95
A multifeatured drawing program for the Atari ST that allows multiple windows, works with color or monochrome monitors, and lets you create lines, circles, ellipses, boxes, fills, and other images.

PaintWorks
Activision, 2350 Bayshore Frontage Rd., Mountain View, CA 94043
$69.95
A full-featured Atari ST painting program that works in all three screen resolutions and allows color cycling. Originally released by Audio Light as *N-Vision*.

PC Palette
IBM Personally Developed Software, P.O. Box 3280, Wallingford, CT 06494-3280
$39.95
A color painting program for the IBM PC–series computers and compatibles with a minimum of 128K of memory.

Personal Computer Picture Graphics
IBM Personally Developed Software, P.O. Box 3280, Wallingford, CT 06494-3280
$29.95
For the IBM PC series, or compatibles, this is a color drawing and illustration program. Requires 256K.

Picture Draw
IBM Personally Developed Software, P.O. Box 3280, Wallingford, CT 06494-3280
$24.95
A color drawing program for freehand artwork, pictures, and diagrams for the IBM PC–series computers, or compatibles, with at least 256K.

ProDraw
I/O Design, P.O. Box 156, Rumson, NJ 07760
$74.95
A color drawing-and-drafting program for the Macintosh that has the capabilites to generate camera-ready separations for four-color printing on an ImageWriter II or LaserWriter.

ST Coloring Book
The Dragon Group, 148 Poca Fork Rd., Elkview, WV 25071
$34.95
A coloring book and image resource package that includes *NEOchrome*-compatible pictures on a variety of different topics. Edit and color them to suit your own use.

SuperPaint
Silicon Beach Software, P.O. Box 261430, 9580 Mountina Rd., Suite E, San Diego, CA 92126
$99
Bitmapped and object-oriented drawing are combined in this package for the Macintosh with 512K.

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"The ST is noticeably faster than the Macintosh, not only because of the faster clock rate but because it has a faster disk drive." *—Personal Computing*

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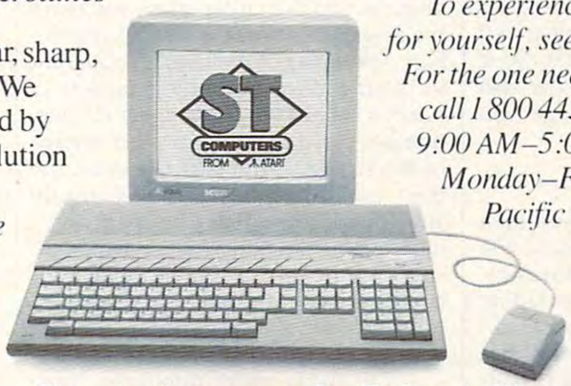


Technology So Advanced, It's Affordable.

World Tour Golf For The IBM PC

Chris Many

Requirements: IBM PC and compatible computers.

Despite the recent onslaught of golf simulations to hit the home computer market, I had never actually played one until I tried *World Tour Golf (WTG)* from Electronic Arts. Not being a golfer, I wondered what was so exciting about a sport that prompted Sir Winston Churchill to describe golf as "a game whose aim is to hit a very small ball into an even smaller hole, with weapons singularly ill designed for the purpose." After playing *WTG*, I am beginning to understand the golfer's passion for the game.

WTG is one of those addicting games you want to keep coming back to for just one more round. You can play a fast 18 holes in less than an hour, and this is an easy game to learn—at least, on a computer. You can play a round by yourself, against a computer opponent, or get together a few friends and make it a foursome.

As you boot up the program, you select from a number of options that configure the game to your liking. You can choose to play or practice your game, either on the driving range or the putting green. If there is a particular hole you'd like to practice, you have that option as well. You can also alter the attributes of your player to balance players of different abilities. Drive distance, accuracy, tendency to hook or slice the ball, and recovery skill are all under your control. You can set up your player to play as you do on the real links, or give yourself the edge you always wanted.

Many Courses

After your player is accepted, you then choose which world-famous course you want to play. There are 22 courses included with the program, including Pebble Beach, Augusta, Oakmont, and St. Andrews. Several of the courses are fictional, and one includes some of golfing's greatest holes. None of the courses I played were very easy, but they appear to be pretty accurate representations of the real thing.

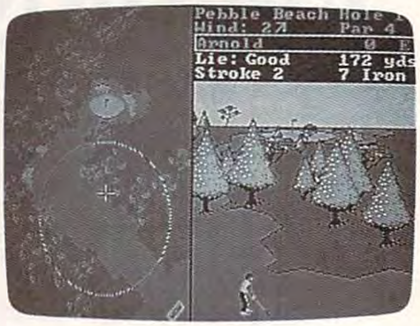
Having chosen your course, you are first presented with the scorecard screen. This lists the *par* (target score), yardage, and *handicap* (relative difficulty) of each hole on the course. You can also handicap your players (*handicap* is a term also used to denote the number of strokes allotted to equalize scores). You return to this screen after each hole, and it can be printed out at any time.

The weather and speed of the greens are different each time you play. Sometimes the wind is particularly strong, so you'll have to compensate for it in your swing. Sometimes the greens are fast, and your putts will go 30 percent farther than normal. In any case, it's this extra touch that will make playing your favorite course different no matter how many times you play it.

Teeing Up

It's time to tee up. The screen is divided into two sections: an overhead view of the hole and a golfer's-eye view, which also includes other important information such as wind strength and direction, par for the hole, number of strokes taken, and the type of club you are using. You have 14 clubs at your disposal: three woods, ten irons, and one putter. At tee-off, your caddy automatically hands you your driver, just as he gives you the putter when you're on the green. There are two ways to hit the ball. The easier of the two, if you're not in the mood for dexterity games, is to select a number in the range 1–5, each number corresponding to a percentage of the strength with which you hit the ball. You'll then hit the ball perfectly straight, and you don't have to worry much about hooking (making the ball curve to the left) or slicing (making it curve to the right). However, a wonderfully easy simulation of hitting the ball is available with the swing meter.

The swing meter duplicates three specific movements of the golf club. By pressing a key, you begin to swing the club (backswing). A second press begins the downswing and sets the strength of your swing. A third press determines the accuracy of your shot. This is all represented on a circle with a clock hand measuring the points when you press the key. If you want to hit the ball full strength, press the key when the swing meter reaches the 100-percent position. When putting, for example, press the key at the 10- or 20-percent-strength positions; otherwise you'll find yourself overshooting the hole. If you press the key too late when setting your accuracy, your shot will slice. Hit it too early and it will hook. It takes some practice to get your swing just right, but that's what the driving range is for.



A split screen with two perspectives is one of many outstanding features in World Tour Golf.

There are a number of hazards on the courses, just as on real courses. Trees, hills, and water are the main barriers, but you also must deal with the "lie" of the ball. (The lie is the environment in which your ball rolls to a halt.) The ball can be sitting in sand or weeds, stuck in the mud, or totally unobscured. Different clubs are better for different lies, so choose your club carefully. If you don't, you run the risk of flubbing your shot and your ball will just dribble a few feet.

As I played hole after hole, I found myself cursing when I hit the ball in water or got stuck behind a tree. I cheered out loud when I chipped in a shot from 25 yards out and got an eagle on the seventeenth hole. *World Tour Golf* is an involving simulation, something many games promise but fail to deliver. The graphics are great (despite the purple trees and blue putting greens we're forced to endure on an IBM) and convey a real feel for the course you're playing. The fact is, I keep on coming back to *WTG* day after day, hoping to beat my best score at Pebble Beach.

A Golf Course Construction Set

There is one more feature included that makes *WTG* one of the best golf programs available and a great value for the money: You can create your own course or quickly modify existing courses. The construction of your own personalized course is actually pretty simple, considering the number of parameters you can affect. Drawing terrain, placing hazards, setting yardage, and creating dog-leg holes, par markers, green slopes, and so on, are all easily accessed and implemented. You can test out the hole and edit it to meet your specifications or remove a particularly pesky sand trap on the eleventh hole of Cypress Point. The course-editing routine is simply great. Electronic Arts pioneered the construction-set genre of programs, so you know this is a strong feature in *WTG*.

This is a great game for the novice and the expert—and one for which you won't have to invest in years of golf lessons to learn how to play, either.

World Tour Golf
Electronic Arts
1820 Gateway Dr.
San Mateo, CA 94404
$49.95

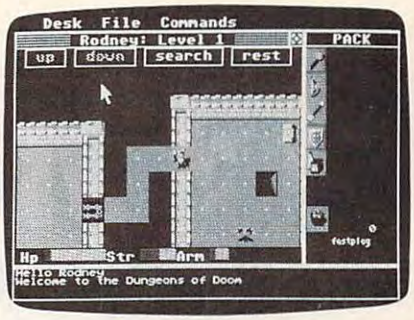
Rogue: A Dungeon Adventure

Robert J. Stumpf

Requirements: Amiga, Atari ST, IBM PC and compatibles, and Macintosh computers.

When I first got my *Rogue* disk for the Amiga, I was expecting to find something similar to the public domain version of the game, but with graphics added. After playing it for only a short while, though, I realized that this new *Rogue* has a significantly different character. Many of its features are extremely appealing.

The variety of monsters encountered keeps you constantly on your toes, and you must learn how to handle each one. There are tactics which will defeat any monster in the game, but you must discover the appropriate means of killing or avoiding each of them. Some monsters, in fact, are better off left alone (beware the Jabberwock).



Rogue *is an intriguing D & D game with excellent graphics. (This screen is from the Atari ST version.)*

The graphics are very well done, and extremely fast. The screen update for this *Rogue* seems no slower than the screen update for the public domain version, which uses text characters to represent objects. The one disappointment in the graphics is the scale. In order to present a dungeon level of reasonable size, some of the images are just small enough that the tiny visual details are lost to all but the most careful scrutiny. The various armor and weapon types, potions, scrolls, wands, and monsters do remain, however, easily identifiable.

You may select actions using the mouse, the main keyboard, the numeric keypad, or a combination of any of the three. I found that the numeric keypad, assisted by the shift and function keys (and at times the mouse) is an easy and pleasant way to guide myself through the dungeon.

In addition, *Rogue*'s designers have made provision for the player to program the function keys as macros. By doing so, you can press a function key to generate a standard sequence of commands you use repeatedly. Some of the function keys are pre-programmed to perform such operations as Search 10 Times, Replace Armor, and so on. Because you can tailor the function keys to your own style of play, this feature is extremely valuable.

Strange Effects

The most intriguing feature about *Rogue* is its wonderful variety of magical items and potions, and their effects on your character. Some items directly affect your character's capabilities, while others, such as "Ring of Searching" or "Ring of Slow Digestion" have an indirect effect on your survival. There is also an item that contains "wild magic," the effects of which are both unpredictable and uncontrollable. This item may sometimes be tremendously beneficial, but usually it works to your disadvantage. Use it if you dare—then hang on and see what happens.

As enjoyable as *Rogue* is, it does contain a couple aggravating features. The greatest annoyance is that when you restore a saved game, the saved game is then deleted; if your character subsequently dies, you must start over at level 1. I realize this is in keeping with the rules, but it's highly frustrating when it happens for the fourth or fifth time below the tenth level (and it will). Through experimentation, I've found that you can save your game to a DOS-formatted disk in Drive 1 by specifying "df1:*filename*" in response to the *save game* prompt. Then, before restarting the game, copy the file to your *Rogue* disk in Drive 0. Once you've started a new game, select the restore option from the menu, or press "AMIGA-R", and type in the filename you've copied to the *Rogue* disk in the boot drive. This leaves you with a character backup in drive 1, in case you don't make it back.

A warning. *Don't* try to run the game from Drive 1. There is a warning about this in the manual, but as one of those who reads the manual only after I have played the game a while, I missed it. The results were fatal, and I was able to complete this review only by borrowing a friend's copy. Although the files on the disk can be listed, there seems to be some form of copy protection which treats the game disk in Drive 1 as an invalid copy, writing to the disk as a result. After I made the mistake, I was promptly killed by a "Protection Thug" every time I tried to play the game. Beware.

Based as it is on one of the all-time greats in dungeon adventures, *Rogue* starts you off with great expectations, and it does not disappoint. Intriguing and delightful, the game will give you many hours of gaming fun, and in the enriched environment provided by the Amiga, it is especially enjoyable and entertaining.

Rogue
Epyx
1043 Kiel Ct.
Sunnyvale, CA 94089
$29.95–$39.95 (Amiga, Atari ST, and Macintosh)
$24.95–$34.95 (IBM PC and compatibles)

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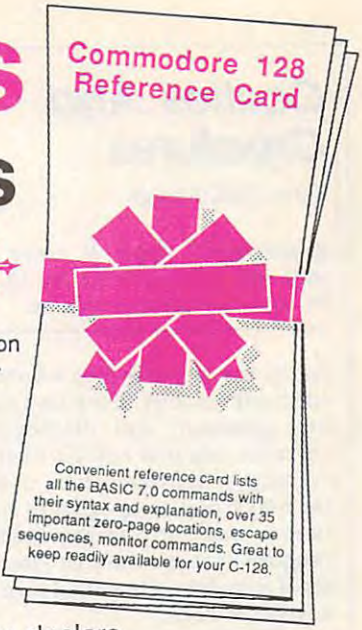

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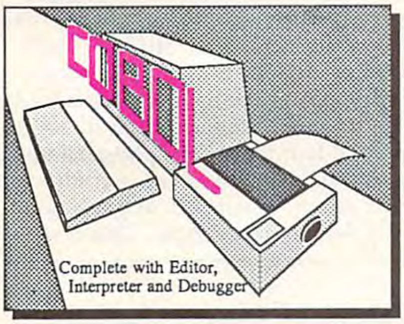

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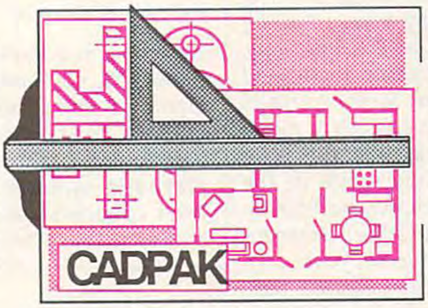

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Castles And Creatures

Karen McCullough

Requirements: Apple II series with at least 64K RAM, Commodore 64, or IBM PC and compatible computers.

For all the ten-year-olds who've wanted to write a story, but found the spelling, grammar, and development of character and plot beyond their ability, Woodbury Software offers a solution: the PlayWriter series. *Castles and Creatures* is one entry in the series; it's a program that provides children with a set of tools for writing their own fantasy adventure book.

The PlayWriter program provides the framework for the story, but the child personalizes it by giving the details: naming the characters, locations, and key objects, describing them, and making up the action. Most of this is accomplished through a series of menu choices. The program asks for the name of the town that is the scene of the action and offers the choices of Tribula, Mastria, Louisville, or Other. Other allows entry of a name of your own choice. Commonly the program suggestions include one or two fantasy-sounding options, and a clever or funny one. Occasionally the program will ask the child to write a sentence describing a character, or a paragraph relating a critical bit of action.

The Final Product

When the story is finished, a procedure that takes about an hour (it can be saved and reloaded later), the child has several options. A rudimentary word processor allows the entire story to be reviewed and edited, or it can be printed in several formats. Eventually, you'll want to print the story on the special paper that comes in the package. But before then it should be printed on plain paper for review and correction. The manual suggests creating several versions of the story and choosing the child's favorite to turn into a book.

The package includes everything necessary to publish the story in hard cover: the proper size of paper, stickers for illustrating the story, end papers, and cover. The procedure for binding isn't difficult but does require assistance from an adult. The company will provide refills of the book package, but they aren't necessary. There are definite advantages to allowing a child to create his own drawings and cover for a story printed on standard-sized paper.

The program's functions are straightforward and easy to use, but there are weaknesses. Most noticeable and irritating is the long wait while the program saves a chapter and prepares to create the next. The very bad riddles it offers in the interim are only mildly diverting.

Another problem is the complicated plot and the number of characters; even though you named everyone, you may still have difficulty keeping track of who's who before the end of the story. And educators may validly object to the amount of work the program does for the child. PlayWriters are best used as an introduction and supplement to normal story-writing exercises. They can be valuable for launching children who are intimidated by the work involved in creating a story, or to stimulate the imagination of an entire class.

Castles and Creatures
Woodbury Software
127 White Oak Lane, CN 1001
Old Bridge, NJ 08857
$39.95 for all versions
(plus $2.50 shipping and handling)

Battlefront

Chris Many

Requirements: Commodore 64 or 128 computer; Apple II–series computer with 64K minimum.

Battlefront is a fantastic new war game from SSG, combining all the best elements of computer gaming. It introduces a great new system of play, is easy to use, has fast and exciting game play, and captures the feel for corps-level command of World War II land battles as few other war games have—computerized or not. And as with previous SSG strategy games, a comprehensive design kit to develop your own battles or edit existing scenarios is part of the whole package.

You have the role of corps commander, leading as many as three divisions of men. The groups are battalion-size, represented by a variety of infantry, armor, and artillery units. They are organized into larger formations called regiments, each composed of up to four battalions. Each division has up to four regiments, plus an additional four independent battalions which can be assigned to any regiment to supplement its strength. This makes

a total of up to 60 separate battalions you'll be commanding.

There is a substantial amount of emphasis placed on the military hierarchy, and for good reason. Unlike in most other computer war games, you do not give direct orders to every battalion under your command. Instead, you give your general orders to regimental commanders, who then command the battalions to execute them as best they can. So, as corps commander, you issue a general order to each regiment and every battalion attached to that regiment will then attempt to carry out the order. Although this may sound complex, it's amazingly simple once you get used to it.

This system also speeds up game play enormously. Movement is carried out by the computer as individual battalions position themselves to follow your orders. Unfortunately, the best-laid plans often go awry. You may have issued orders to a regiment to storm a certain town, but as the regiment moves toward its objective, an enemy battalion opens fire. You can't very well expect your men to ignore a hail of bullets, so they stop their advance and engage the enemy. If it's a large force sniping at your men from a thickly wooded area, it may take a day or two to dislodge them.

Logical Menu System

Orders are issued through a menu system similar to those used in previous SSG releases. The system looks overwhelming when you're first viewing the menu charts, but it's laid out very logically and is much easier than remembering key commands. After you've played just a few turns, it becomes second nature to cycle through the menus rapidly, issuing orders to specific regiments, reassigning your roving battalions, and crossing your fingers as your men attack the enemy.

As combat ensues, you receive general reports of the fighting, such as heavy losses, light losses, and much more. Additionally, both sides may suffer fatigue and/or strength-point losses as a result of being adjacent to opposing units. If the battle goes too badly against a battalion, the unit may end up running from battle. And, of course, there's always the distinct possibility that a battalion may be killed in action.

You can receive an overall report on your troops at any time while you are issuing your orders. Your men range in their level of experience from green and fairly useless to elite troops of the highest quality. Their fatigue rate—from fresh to exhausted—is also shown. Each battalion's combat and supply state is available as well, so as commander you can insure that your exhausted men are allowed to recover before you commit them to a major operation—if you can afford the time.

The problem is that the value of your objectives changes as time goes on. A certain number of victory points can be assigned to an objective for a set number of turns, after which the objective becomes worthless. So, if you don't cross a river and take a town within two days (eight turns), you may find yourself pursuing a worthless objective. You're under the gun to achieve specific targets as the game progresses, all the while trying to give your men enough rest and supplies so they can be successful in reaching these goals. It's keeping these factors balanced, combined with sound strategy and tactics, that makes for a successful campaign.

There are four scenarios included with the game: Crete, Stalingrad, Saipan, and Bastogne. You can play either side against the computer, or go head-to-head with a friend. There is a way to handicap play, but it only changes the values of victory-point ratios at the end—it doesn't give either side more men or expand the computer's intelligence. All the scenarios are great fun to play, and you can finish each one in an hour or two. Other scenarios, and a great deal of design data, will be forthcoming in future issues of *RUN 5*, SSG's magazine of software support for their programs.

Battlefield Construction Set

If this game didn't have the editing features, it would still be a must for any serious gamer. And that you get a full-blown construction set as part of the game environment makes this package an even better value. You're given complete control to create or edit every single factor of the game, from the map terrain layout to the HQ administration levels. The editing is also run through a menu system, and you can design your own scenarios from scratch, or edit any one of the four included. (But trust me—if you're going to design your own, have it well planned out in advance. It's no small undertaking.)

For those who relish the idea of being able to manipulate any detail of a game system, *Battlefront* is heaven. Do you think the Panzers don't roll over the Allied troops fast enough in the Bastogne scenario? No problem; just increase their strength and quality-of-equipment rating. Not enough reinforcements in the Stalingrad scenario? Just add another regiment or two, or even a division that will enter on the fifth day. What would have happened if the Commonwealth troops on Crete were expecting a German invasion and were prepared for it? Increase the defense and preparation levels of the men. There is nothing you can't alter within the confines of the game system itself.

There are a few points that could stand some improvement, or at least clarification. No attention is given in the documentation to different types of units fighting each other, such as infantry fighting armored units. The emphasis is placed on fatigue state, casualty level, and supply state of the troops. Although it is stated that combat mechanics take care of the interrelationships, one tends to just push units at the enemy, as long as they are fresh, well supplied, and close to full strength, with no attention given to what kind of units. In that there are 14 different types of battalions you are dealing with, it would have been nice to weight the game to take these differences more into account. Another addition could have been a sighting-only option, as enemy units are always seen. It was rare indeed if WWII corps commanders had completely accurate intelligence as to the placement of all enemy troops opposing their advance.

But these points aside, *Battlefront* is one of the most exciting new war games to be issued in recent years. It provides a whole new perspective of the battlefield and with it a fresh approach to the computer war game. The scenarios included are balanced enough to challenge the veteran, yet easy enough to learn, so the novice won't be scared away. *Battlefront* is an excellent game—certainly one of the best of the past year.

Battlefront
SSG
Distributed by Electronic Arts
1820 Gateway Dr.
San Mateo, CA 94404
$39.95

©

Chain Reaction

Mark Tuttle

In this explosive strategy game for a variety of computers, the contest is never finished until your last bomb has been thrown. The original version is written for the Commodore 64. We've written new translations for the Atari ST; Amiga; Apple II series (including Apple IIGS); Atari 400, 800, XL, and XE; and IBM PC/PCjr. The ST version requires a color monitor. The Amiga version requires 512K of memory. A joystick is required to play the 64 and eight-bit Atari games. The IBM PC/PCjr version of "Chain Reaction" requires a color monitor as well as BASIC and a color/graphics card for the PC and cartridge BASIC for the PCjr.

"Chain Reaction" is a clever strategy game for one or two players. Whether you play against the computer or another human, the objective is the same: to eliminate all of your opponent's bomb-shaped pieces from the field of play. The game is played on a 5 × 6 grid of squares, and the players alternate turns, placing one bomb in a square on each turn.

The results of a move depend on how many bombs are already in the chosen square and adjacent squares. Whenever any square reaches "critical mass," it explodes and sends its bombs into neighboring squares. If those squares are already loaded to capacity, they explode too, creating a chain reaction that can engulf a large area of the board.

Type in the version for your computer and save a copy of the program. Before you run the game, consult the special instructions for your computer as well. Some games are played with keyboard controls, while others use a joystick.

Bomb Begets Bomb

When you run Chain Reaction, it begins by asking whether you wish to play with one or two players. If you've never played before, you may want to play a game or two against the computer to learn what sort of strategies it favors. When you choose to play against the computer, the program also asks whether you'd like the computer to take the first turn.

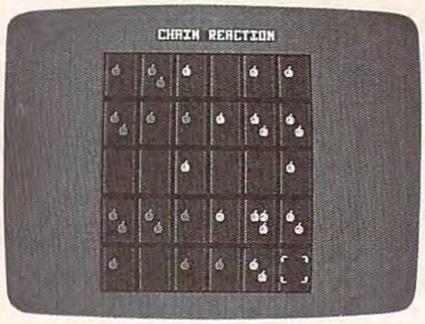
The first part of most games involves placement of initial pieces, without many explosions. As the board fills up, however, explosions occur with increasing frequency. Play continues until one player's pieces are completely eliminated from the board.

The position of a square in the grid determines how many bombs it requires to create an explosion. A corner square can hold a maximum of one bomb. When you place a second bomb in a corner square that already holds one, both bombs explode, sending a bomb of your color into two neighboring squares. After an explosion, the original square is emptied.

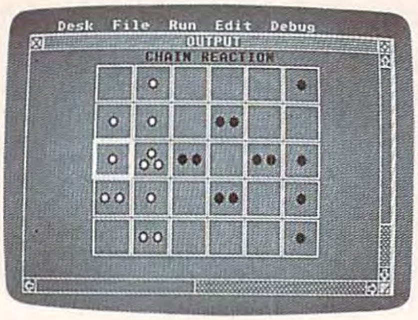
Other squares require more bombs to create an explosion. A border square that isn't on a corner can hold a maximum of two bombs. When you place a third bomb in a border square, its explosion sends three bombs into the squares that adjoin it. Squares in the center of the game board hold the most bombs and also create the most devastating explosions. When you place a fourth bomb in a central square, it sends four bombs into squares which adjoin that position.

When an explosion sends bombs into adjacent squares, any bombs in that square change color to match the color of the exploding bombs. Should one of the adjoining squares surpass its limit, that square, too, will explode, creating the potential for even more explosions. This process continues until no more explosions are possible.

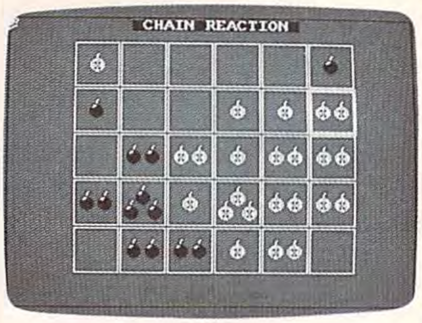
Thus, the situation in Chain Reaction is often volatile. The lead frequently seesaws back and forth between players, as each creates increasingly more widespread chain reactions. Even if defeat seems almost certain, you can often regain



"Chain Reaction" for the Commodore 64, an explosive strategy game.



Atari ST version of "Chain Reaction."



"Chain Reaction" for the 512K Amiga.

the lead with clever play. When a game ends, the program announces the winner and permits you to play a new game or quit.

Like other games of strategy and placement, Chain Reaction rewards the player who can think ahead. At first, you may be tempted to start making explosions as quickly as possible. But that's not always the best long-term tactic. By spreading bombs of your color throughout the board, you may be able to survive chain reactions that would otherwise wipe you out.

Commodore 64 Version

This version of Chain Reaction (Program 1) requires at least one joystick (plug the joystick into port 2 if you are using one joystick). If you choose the two-player option, the program also asks whether you wish to use one or two joysticks. A movable cursor of your color indicates your current position on the board. To place a bomb, move the cursor to the desired square and press the joystick button.

Atari ST Version

The ST version of Chain Reaction (Program 2) runs on any 520ST or 1040ST computer. A color monitor is required. Use the Set Preferences option to set the computer in low resolution before you activate ST BASIC. Use the cursor keys to move the cursor. To place a bomb, press the space bar.

Amiga Version

Chain Reaction for the Amiga (Program 3) requires 512K of memory. Use the cursor keys to move the cursor and press the space bar to place a bomb in the desired square.

Apple II Version

This version of Chain Reaction (Program 4) runs on any Apple II–series computer, including the Apple IIGS. Use the I, J, K, and M keys to move the cursor up, left, right, and down, respectively. To place a bomb, press the space bar.

Atari 400, 800, XL, And XE Version

Chain Reaction for eight-bit Atari computers (Program 5) requires a joystick. Plug the joystick into port 1 before you run the program. This version of Chain Reaction works exactly like the Commodore 64 game. Move the cursor to the square where you wish to place a bomb, then press the fire button.

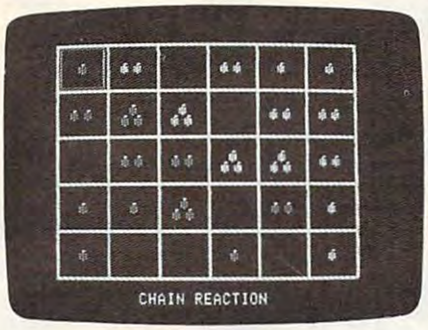
IBM PC/PCjr Version

The IBM PC/PCjr version of Chain Reaction requires BASICA and a color/graphics card for the PC and cartridge BASIC for the PCjr. A color monitor is also required. Move the cursor with the cursor keys and press the space bar to place a bomb.

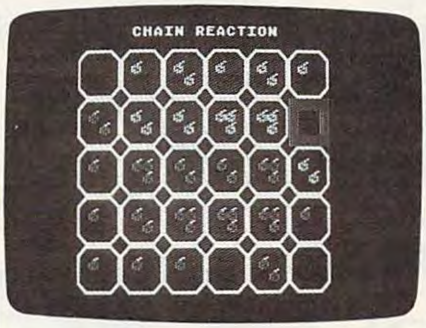
For instructions on entering these programs, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

Program 1. Commodore 64 Chain Reaction

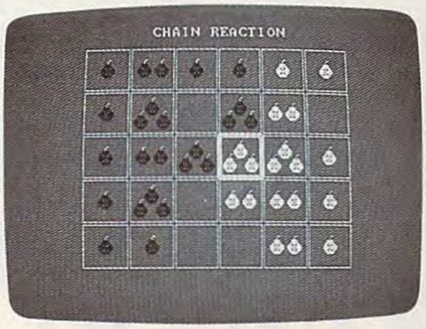
```
CK 10 Y=30:DIM U(Y),H(Y),L(Y),
      J(Y),T1(Y),CA(Y),CD(Y),R
      T(Y),TR(Y)
MC 20 POKE 53269,0:PRINT"{CLR}
      ":POKE 53280,11:POKE 532
      81,11:Y=RND(-TI)
HR 30 ML$="⁅I⁆"+CHR$(8)+"⁅X⁆<"
      +CHR$(3)+"⁅2⁆XJ"+CHR$(16
      )+CHR$(248)+"L⁅B⁆⁅T⁆":PO
      KE 835,0
XJ 40 POKE 53272,PEEK(53272)AN
      D 240 OR 12
PR 50 POKE 836,208:POKE 830,0:
      POKE 831,216:POKE828,0:P
      OKE 829,56:POKE 56334,0
QH 60 POKE 1,51:ML$=ML$:SYS(PE
      EK(51)+256*PEEK(52)):POK
      E 1,55:POKE56334,1
PP 70 FOR I=12296 TO 12487:REA
      D J:POKE I,J:NEXT
DH 80 YY=7:XX=12:GOSUB530:PRIN
      T"{CYN}CUAGI MDACOGKI"
HE 90 YY=11:XX=8:GOSUB530:PRIN
      T"IBJPDM KE LHAYDMN
      {YEL}Q{CYN} KM {YEL}R
EK 100 GOSUB700:IF KT$<>"1" AN
       D KT$<>"2" THEN100
FQ 110 NP=VAL(KT$):IF NP=2 THE
       N YY=15:GOTO160
CS 120 COMPUTER=1:YY=15:XX=9:G
       OSUB530:PRINT"{CYN}CKJL
       BODM EGMNO {YEL}Y{CYN}
       {SPACE}KM {YEL}I
SE 130 GOSUB700:IF KT$<>"Y" AN
       D KT$<>"N" THEN130
HE 140 TU=0:IF KT$="Y" THEN TU
       =1
XX 150 GOTO190
HF 160 YY=15:XX=7:GOSUB530:PRI
       NT"{CYN}IBJPDM KE SKYNO
       GCTN {YEL}Q{CYN} KM
       {YEL}R
AD 170 GOSUB700:IF KT$<>"1" AN
       D KT$<>"2" THEN170
HF 180 POKE 828,VAL(KT$)-1:F2=
       PEEK(828)
CQ 190 YY=19:XX=14:GOSUB530:PR
       INT"{CYN}LHDAND WAGO"
EK 200 M$="O⁅2 Y⁆P{DOWN}
       {4 LEFT}⁅H⁆{2 SPACES}
       ⁅N⁆{DOWN}{4 LEFT}⁅H⁆
       {2 SPACES}⁅N⁆{DOWN}
       {4 LEFT}L⁅2 P⁆@":B$="
       {3 UP}":PL(0)=15:PL(1)=
       10
PR 210 P$(1)="V {DOWN}{2 LEFT}
       {2 SPACES}":P$(2)="V
       {DOWN}{2 LEFT} V":P$(3)
       ="VV{DOWN}{2 LEFT} V":P
       $(4)="VV{DOWN}{2 LEFT}V
       V"
HP 220 UP=79:LM=91:RM=251:DN=2
       07:CL(0)=15:CL(1)=10:MV
       =1:MA=1:MD=1
FJ 230 FOR J=0 TO 24:POKE 5427
       2+J,0:READ X:POKE 54272
       +J,X:NEXT
QM 240 FOR V=1 TO 30:READ J(V)
       :NEXT
PS 250 SV=53248:MX=79:MY=92:PO
       KE 2042,11:FOR I=0 TO62
       :READ Q:POKE 704+I,Q:NE
       XT
BR 260 FOR I=1 TO 30:READ CD(I
```



The Apple II version of "Chain Reaction" also runs on the new Apple IIGS.

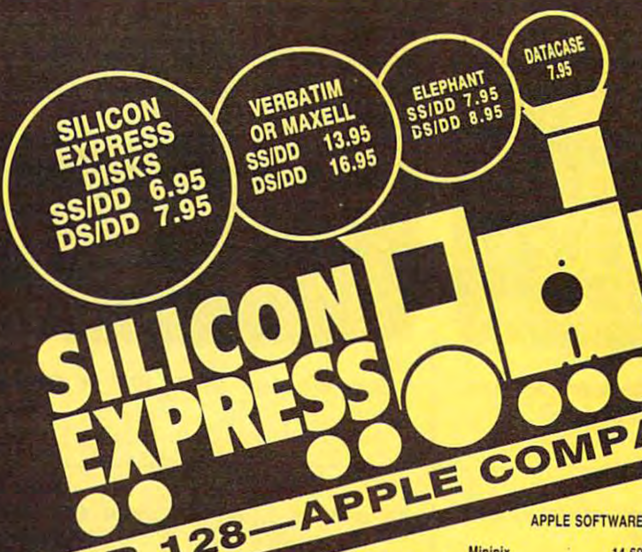


This version of "Chain Reaction" runs on Atari 400, 800, XL, and XE computers.



"Chain Reaction" for the IBM PC/PCjr.

```
       ),CA(I):NEXT
BM 270 POKE 53280,6:POKE 53281
       ,6:PRINT CHR$(31)"{CLR}
       {BLU}";
QP 280 FOR I=0 TO 23:PRINT"
       {RVS}{39 SPACES}"
CM 290 POKE 1063+(40*I),160:PO
       KE 55335+(40*I),6:NEXT
EX 300 PRINT"{RVS}{39 SPACES}
       {HOME}{BLK}":POKE2023,1
       60:POKE56295,6
RE 310 POKE 53281,11:PRINT SPC
       (14)"{CYN}CUAGI MDACOGK
       I{BLK}{DOWN}"
AC 320 FOR I=1 TO 5:PRINT SPC(
       8)M$B$M$B$M$B$M$B$M$B$M
       $:NEXT
HB 330 PRINT"{DOWN}{RVS}{BLU}
       {32 SPACES}{HOME}":POKE
       SV+41,7:GOSUB690
KF 340 X=TU:GOTO370
EB 350 FG=0:FOR H=1 TO 30:IF U
       (H)>=J(H) THEN FG=1:GOS
       UB710
EC 360 NEXT:IF FG=1 THEN350
ED 370 X=-X+1:PN=PN+1
BR 380 IF COMPUTER AND NOT X T
       HEN POKE 53269,0:RD=0:G
       OTO970
RH 390 POKE SV+41,CL(X):GOTO54
       0
EC 400 H=MV
MA 410 IF L(H)<>X+1 AND L(H) T
       HEN380
PK 420 U(H)=U(H)+1:FS(X)=FS(X)
       +1:IF L(H)=0 THEN L(H)=
       X+1
XK 430 GOSUB510:PRINT P$(U(H))
AJ 440 IF U(H)>=J(H) THEN POKE
        53269,0:GOSUB710:GOTO3
       50
AB 450 GOTO370
MR 460 XX=15:YY=24:GOSUB530:PR
       INT"{CYN}FAJD{RVS}{BLU}
        {OFF}{CYN}KXDM{HOME}":
       FOR Z=1 TO 2000:NEXT
DJ 470 XX=8:YY=24:GOSUB530:PRI
       NT"LMDNN{RVS}{BLU}
       {OFF}{CYN}EGMDPBOOKI
       {RVS}{BLU} {OFF}{CYN}OK
       {RVS}{BLU} {OFF}{CYN}LH
       AY{HOME}"
HS 480 WAIT 56320+X*F2,16,16:R
       UN
QD 490 IF L(O)<>X+1 THEN FS(X)
       =FS(X)+U(O):FS(-X+1)=FS
       (-X+1)-U(O)
JP 500 L(O)=X+1:U(O)=U(O)+1:GO
       SUB520:PRINT P$(U(O)):R
       ETURN
RB 510 XX=5+(4*CA(H)):YY=4*CD(
       H):POKE 646,CL(X):GOSUB
       530:RETURN
MG 520 XX=5+(4*CA(O)):YY=4*CD(
       O):POKE 646,CL(X):GOSUB
       530:RETURN
KF 530 POKE 783,0:POKE 781,YY:
       POKE 782,XX:SYS 65520:R
       ETURN
PC 540 POKE 53269,4
FF 550 JY=15-(PEEK(56320+X*F2)
       AND15):JB=PEEK(56320+X*
       F2)AND16
QB 560 IF JB=0 THEN400
SC 570 IF JY=8 THEN JY=3
FF 580 IF JY<1 OR JY>4 THEN550
PC 590 ON JY GOTO600,620,640,6
       60
QC 600 IF MX-4<UP THEN550
XR 610 MX=MX-32:MV=MV-6:MD=MD-
       1:GOTO680
MF 620 IF MX+4>DN THEN550
RJ 630 MX=MX+32:MV=MV+6:MD=MD+
       1:GOTO680
GC 640 IF MY+4>RM THEN550
FQ 650 MY=MY+32:MV=MV+1:MA=MA+
       1:GOTO680
FR 660 IF MY-4<LM THEN550
AC 670 MY=MY-32:MV=MV-1:MA=MA-
       1
JG 680 GOSUB690:GOTO550
XA 690 POKE SV+4,MY:POKE SV+5,
       MX:RETURN
MH 700 KT$="":POKE 198,0:WAIT
       {SPACE}198,1:GET KT$:RE
       TURN
PF 710 POKE 54276,64:POKE 5429
       0,128:POKE 24276,65:POK
       E 54290,129:FOR V=1 TO
       {SPACE}4
CA 720 GOSUB510:POKE 646,PL(X)
       :PRINT"{RVS}{UP}{LEFT}"
       M$:GOSUB510:PRINT"{BLK}
       {UP}{LEFT}"M$
XQ 730 FOR TD=1 TO 125:NEXT:NE
       XT
KH 740 U(H)=U(H)-J(H)
MR 750 IF U(H)>0 THEN GOSUB510
       :PRINT P$(U(H)):GOTO770
GJ 760 L(H)=0
QX 770 IF CD(H)=1 THEN790
ED 780 O=H-6:GOSUB490
AG 790 IF CA(H)=1 THEN810
CR 800 O=H-1:GOSUB490
FJ 810 IF CA(H)=6 THEN830
RC 820 O=H+1:GOSUB490
MQ 830 IF CD(H)=5 THEN850
RG 840 O=H+6:GOSUB490
XK 850 IF FS(0)<1 OR FS(1)<1 T
       HEN460
MR 860 RETURN
RH 870 LP=0:IF CD(H)=1 THEN890
KQ 880 IF L(H-6)=2 THEN KZ=H-6
       :GOTO960
GX 890 IF CA(H)=1 THEN910
JC 900 IF L(H-1)=2 THEN KZ=H-1
       :GOTO960
MB 910 IF CA(H)=6 THEN930
CA 920 IF L(H+1)=2 THEN KZ=H+1
       :GOTO960
RP 930 IF CD(H)=5 THEN RETURN
SP 940 IF L(H+6)=2 THEN KZ=H+6
       :GOTO960
CD 950 RETURN
FQ 960 LP=1:RETURN
BF 970 FOR I=1 TO 30:RT(I)=0:T
       R(I)=0:NEXT
XE 980 XT=0:FOR I=1 TO 30:IF L
       (I)=2 THEN1000
PP 990 T1(XT+1)=I:XT=XT+1
AH 1000 NEXT:RD=0
HH 1010 XX=16:YY=24:GOSUB530:P
        RINT"{CYN}OUGITGIF
        {HOME}"
BR 1020 FOR I=30 TO 30-XT STEP
        -1:RT(I)=0:NEXT:FOR I=
        1 TO XT
XM 1030 H=T1(I):GOSUB870
JD 1040 IF FG=1 AND LP AND U(H
        )>0 THEN1220
GS 1050 IF U(H)+1=J(H) AND LP=
        1 AND U(KZ)+1=J(KZ) TH
        EN RT(I)=6:GOTO1170
PB 1060 IF U(H)+1=J(H) AND LP=
        1 THEN RT(I)=2:GOTO117
        0
RE 1070 IF U(H)+1=J(H) AND LP=
        0 THEN RT(I)=1:GOTO117
        0
CH 1080 IF J(H)=2 AND LP=0 AND
         U(H)=1 THEN RT(I)=1:G
        OTO1170
JS 1090 IF J(H)=2 AND LP=0 AND
         U(H)=0 THEN RT(I)=4:G
        OTO1170
JQ 1100 IF J(H)=2 AND LP=1 AND
         U(H)=1 THEN RT(I)=4:G
        OTO1170
FE 1110 IF U(KZ)+1=J(KZ) THEN
        {SPACE}RT(I)=1:GOTO117
        0
SJ 1120 IF U(H)+2>=J(H) AND LP
        =1 AND U(KZ)+1< J(KZ)
        {SPACE}THEN RT(I)=5:GO
        TO1170
AH 1130 IF U(H)+2>=J(H) AND LP
        =0 THEN RT(I)=3:GOTO11
        70
AP 1140 IF U(H)+2>=J(H) THEN R
        T(I)=2:GOTO1170
MJ 1150 IF LP=0 THEN RT(I)=2:G
        OTO1170
SE 1160 RT(I)=1
```



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```
MQ 1170 NEXT I:TC=1:ZT=0:AB=6
KS 1180 FOR I=1 TO XT:IF RT(I)
        =AB THEN TR(TC)=I:ZT=Z
        T+1:TC=TC+1
QQ 1190 NEXT:IF ZT>0 THEN1210
CF 1200 AB=AB-1:GOTO1180
HP 1210 DH=INT(ZT*RND(1))+1:HD
        =TR(DH):H=T1(HD)
HJ 1220 XX=15:YY=24:GOSUB530:P
        RINT"{RVS}{BLU}
        {11 SPACES}{HOME}":FG=
        FG+1:GOTO410
HC 1230 DATA 126,102,102,126,1
        02,102,102,0,102,102,1
        02,102,102,102,126,0
DX 1240 DATA 126,98,96,96,96,9
        8,126,0,126,98,96,120,
        96,98,126,0,126,98
JS 1250 DATA 98,120,96,96,96,0
        ,126,102,96,110,102,10
        2,126,0,126,90,24,24
QP 1260 DATA 24,90,126,0,96,96
        ,96,96,98,98,126,0,102
        ,118,126,126,110,102
MX 1270 DATA 102,0,99,119,127,
        107,99,99,99,0,126,102
        ,102,102,102,102,126
QC 1280 DATA 0,126,102,102,126
        ,96,96,96,0,126,102,10
        2,126,120,108,102,0
GJ 1290 DATA 126,102,96,126,6,
        102,126,0,126,90,24,24
        ,24,24,24,0,124,102
SS 1300 DATA 102,124,102,102,1
        24,0,56,24,24,24,24,24
        ,60,0,60,54,6,12,48
BR 1310 DATA 48,62,0,30,12,12,
        12,12,108,124,0,230,10
        8,120,112,120,108
GS 1320 DATA 230,0,231,102,102
        ,126,102,102,231,0,0,8
        ,16,124,222,190,254
AH 1330 DATA 124,198,198,198,2
        14,254,238,198,0,231,1
        02,102,102,102,60,24
HQ 1340 DATA 0,4,0,12,64,10,
        0,0,0,0,12,64,12,0,0,4
        ,0,12,128,12,0,0,50
CF 1350 DATA 244,47,2,3,3,3,3,
        2,3,4,4,4,4,3,3,4,4,4,
        4,3,3,4,4,4,4,3,2,3
XK 1360 DATA 3,3,3,2,0,0,0,0,0
        ,0,120,0,30,192,0,3,19
        2,0,3,192,0,3,0,0,0
JA 1370 DATA 0,0,0,0,0,0,0,0,0
        ,0,0,0,0,0,0,0,0,0,0,0
        ,0,0,0,0,0,0,0,192,0
CB 1380 DATA 3,192,0,3,192,0,3
        ,120,0,30,0,0,0,1,1,1,
        2,1,3,1,4,1,5,1,6,2,1
AD 1390 DATA 2,2,2,3,2,4,2,5,2
        ,6,3,1,3,2,3,3,3,4,3,5
        ,3,6,4,1,4,2,4,3,4
DQ 1400 DATA 4,4,5,4,6,5,1,5,2
        ,5,3,5,4,5,5,5,6
```

Program 2. Atari ST Chain Reaction

Version by Tim Midkiff, Editorial Programmer

```
10    OPENW 2:FULLW 2:CLEARW 2:
      RANDOMIZE 0
20    DIM u(4,5),l(4,5),j(4,5),
      rt(30),tr(30),tx(30),ty(3
      0)
30    FOR i=0 TO 1:fs(i)=0:hx(i
      )=0:hy(i)=0:NEXT
40    FOR i=0 TO 4:FOR j=0 TO 5
      :u(i,j)=0:l(i,j)=0:j(i,j)
      =4:NEXT
50    j(i,0)=3:j(i,5)=3:NEXT
60    RESTORE 70:FOR j=1 TO 4:j
      (0,j)=3:j(4,j)=3:READ a,b
      :j(a,b)=2:NEXT
70    DATA 0,0,0,5,4,0,4,5
80    RESTORE 110:FOR i=0 TO 12
      :READ a$:FOR j=1 TO 3
90    c$=MID$(a$,j,1):co=VAL(c$
      )*125:POKE intin+j*2,co:N
      EXT
100   POKE intin,i:POKE contrl,
      14:POKE contrl+6,4:vdisys
      (0):NEXT
110   DATA 224,541,665,651,000,
      700,500,300,100,070,050,0
      30,010
120   RANDOMIZE 0
130   COLOR 4:GOTOXY 0,3:PRINT
      TAB(14)"CHAIN REACTION";
140   COLOR 3:GOTOXY 7,6:PRINT
      "Number of players (1/2)?
      ";
150   np=VAL(INPUT$(1)):IF np<>
      1 AND np<>2 THEN 150
160   IF np=2 THEN 210
170   GOTOXY 0,9:PRINT TAB(10)"
      Computer first (Y/N)?";
180   tu=ASC(INPUT$(1)):IF tu>1
      00 THEN tu=tu-32
190   IF tu<>89 AND tu<>78 THEN
       180
200   tu=ABS(tu=89)
210   COLOR 4:PRINT:CLEARW 2:GO
      TOXY 11,0:PRINT "CHAIN RE
      ACTION";:GOSUB 650
220   tu=-tu+1:co=tu*4+5
230   IF np=1 AND tu=0 THEN GOS
      UB 970:GOTO 260
240   GOSUB 400
250   IF l(y,x)<>tu+1 AND l(y,x
      )<>0 THEN 240
260   pu=u(y,x):u(y,x)=pu+1:fs(
      tu)=fs(tu)+1:IF l(y,x)=0
      THEN l(y,x)=tu+1
270   GOSUB 770
280   IF u(y,x)=j(y,x) THEN 300
290   GOTO 220
300   e=0:fg=0:FOR p=0 TO 4:FOR
       q=0 TO 5:y=p:x=q
310   IF u(y,x)>=j(y,x) AND e=0
       THEN fg=1:GOSUB 490
320   NEXT q,p:IF e=1 THEN 350
330   IF fg=1 THEN 300
340   GOTO 220
350   COLOR 3:GOTOXY 13,17:PRIN
      T "GAME OVER";
360   FOR i=1 TO 3:PRINT CHR$(7
      );:FOR j=1 TO 500:NEXT:NE
      XT
370   GOTOXY 4,17:PRINT "Press
      space bar to play again."
      ;
380   k=INP(2):IF k<>32 THEN 38
      0
390   CLEARW 2:CLEAR:GOTO 20
400   x=hx(tu):y=hy(tu):GOSUB 7
      10:PRINT CHR$(7);
410   dx=0:dy=0:k=INP(2)
420   IF k= 32 THEN hx(tu)=x:hy
      (tu)=y:co=0:GOSUB 710:co=
      tu*4+5:RETURN
430   IF k=200 THEN IF y>0 THEN
       dy=-1
440   IF k=208 THEN IF y<4 THEN
       dy=1
450   IF k=203 THEN IF x>0 THEN
       dx=-1
460   IF k=205 THEN IF x<5 THEN
       dx=1
470   IF dx=0 AND dy=0 THEN 410
480   co=0:GOSUB 710:x=x+dx:y=y
      +dy:co=tu*4+5:GOSUB 710:G
      OTO 410
490   tx=x:ty=y:co=4:GOSUB 710
500   IF tx>0 THEN x=tx-1:GOSUB
       570
510   IF tx<5 THEN x=tx+1:GOSUB
       570
520   x=tx:IF ty>0 THEN y=ty-1:
      GOSUB 570
530   IF ty<4 THEN y=ty+1:GOSUB
       570
540   IF fs(0)<1 OR fs(1)<1 THE
      N e=1
550   y=ty:pu=u(y,x):u(y,x)=pu-
      j(y,x):GOSUB 770:IF u(y,x
      )=0 THEN l(y,x)=0
560   co=0:x=tx:y=ty:GOSUB 710:
      RETURN
570   IF l(y,x)<>tu+1 THEN fs(t
      u)=fs(tu)+u(y,x):fs(-tu+1
      )=fs(-tu+1)-u(y,x)
580   l(y,x)=tu+1:pu=u(y,x):u(y
      ,x)=pu+1:GOSUB 770:RETURN
590   lp=0:IF y>0 THEN IF l(y-1
      ,x)=2 THEN ay=y-1:GOTO 64
      0
600   IF x>0 THEN IF l(y,x-1)=2
       THEN ax=x-1:GOTO 640
610   IF x<5 THEN IF l(y,x+1)=2
       THEN ax=x+1:GOTO 640
620   IF y<4 THEN IF l(y+1,x)=2
       THEN ay=y+1:GOTO 640
630   RETURN
640   lp=1:RETURN
650   COLOR 1,1,2:FOR y=0 TO 4:
      yy=28*y+12:FOR x=0 TO 5:x
      x=32*x+59
660   LINEF xx,yy,xx+30,yy:LINE
      F xx+30,yy,xx+30,yy+26
670   LINEF xx+30,yy+26,xx,yy+2
      6:LINEF xx,yy+26,xx,yy
680   NEXT x,y:RETURN
690   COLOR 1,0,tu*4+4+i:CIRCLE
       bx,by,i:RETURN
700   COLOR 1,0,0:CIRCLE bx,by,
      4-i:RETURN
710   yy=28*y+11:xx=32*x+58:COL
      OR 1,co,co
720   LINEF xx,yy,xx+32,yy:LINE
      F xx+32,yy,xx+32,yy+28
730   LINEF xx+32,yy+28,xx,yy+2
      8:LINEF xx,yy+28,xx,yy
740   LINEF xx+2,yy+2,xx+30,yy+
      2:LINEF xx+30,yy+2,xx+30,
      yy+26
750   LINEF xx+30,yy+26,xx+2,yy
      +26:LINEF xx+2,yy+26,xx+2
      ,yy+2
760   RETURN
770   yy=28*y+12:xx=32*x+59
780   ON pu+1 GOSUB 890,900,910
      ,930,950,950
790   k=u(y,x)+1:IF k=6 THEN k=
      5
800   ON k GOTO 810,820,830,850
      ,870,870
810   RETURN
820   FOR i=1 TO 4:bx=xx+15:by=
      yy+13:GOSUB 690:NEXT:RETU
      RN
830   by=yy+13:FOR i=1 TO 4:bx=
      xx+9:GOSUB 690
840   bx=xx+21:GOSUB 690:NEXT:R
      ETURN
850   FOR i=1 TO 4:bx=xx+15:by=
      yy+9:GOSUB 690:by=yy+17
860   bx=xx+9:GOSUB 690:bx=xx+2
      1:GOSUB 690:NEXT:RETURN
870   FOR i=1 TO 4:by=yy+13:bx=
      xx+9:GOSUB 690:bx=xx+21:G
      OSUB 690
880   bx=xx+15:by=yy+7:GOSUB 69
```

```
     0:by=yy+19:GOSUB 690:NEXT
     :RETURN
890  RETURN
900  FOR i=0 TO 3:bx=xx+15:by=
     yy+13:GOSUB 700:NEXT:RETU
     RN
910  by=yy+13:FOR i=0 TO 3:bx=
     xx+9:GOSUB 700
920  bx=xx+21:GOSUB 700:NEXT:R
     ETURN
930  FOR i=0 TO 3:bx=xx+15:by=
     yy+9:GOSUB 700:by=yy+17
940  bx=xx+9:GOSUB 700:bx=xx+2
     1:GOSUB 700:NEXT:RETURN
950  FOR i=0 TO 3:by=yy+13:bx=
     xx+9:GOSUB 700:bx=xx+21:G
     OSUB 700
960  bx=xx+15:by=yy+7:GOSUB 70
     0:by=yy+19:GOSUB 700:NEXT
     :RETURN
970  xt=0:FOR y=0 TO 4:FOR x=0
      TO 5:IF l(y,x)=2 THEN 99
     0
980  xt=xt+1:ty(xt)=y:tx(xt)=x

990  NEXT x,y
1000 GOTOXY 0,16:PRINT:PRINT T
     AB(15)"Thinking...";
1010 FOR i=1 TO xt:rt(i)=0:tr(
     i)=0:y=ty(i):x=tx(i):GOSU
     B 590
1020 IF fg=1 AND lp<>0 AND u(y
     ,x)>0 THEN 1230
1030 IF u(y,x)+1<>j(y,x) THEN
     1070
1040 IF lp=1 AND u(ay,ax)+1=j(
     ay,ax) THEN rt(i)=6:GOTO
     1180
1050 IF lp=1 THEN rt(i)=2:GOTO
      1180
1060 IF lp=0 THEN rt(i)=1:GOTO
      1180
1070 IF j(y,x)<>2 THEN 1110
1080 IF lp=0 AND u(y,x)=1 THEN
      rt(i)=1:GOTO 1180
1090 IF lp=0 AND u(y,x)=0 THEN
      rt(i)=4:GOTO 1180
1100 IF lp=1 AND u(y,x)=1 THEN
      rt(i)=4:GOTO 1180
1110 IF u(ay,ax)+1=j(ay,ax) TH
     EN rt(i)=1:GOTO 1180
1120 IF u(y,x)+2<j(y,x) THEN 1
     160
1130 IF lp=1 AND u(ay,ax)+1<j(
     ay,ax) THEN rt(i)=5:GOTO
     1180
1140 IF lp=0 THEN rt(i)=3:GOTO
      1180
1150 rt(i)=2:GOTO 1180
1160 IF lp=0 THEN rt(i)=2:GOTO
      1180
1170 rt(i)=1
1180 NEXT:zt=0:ab=6
1190 FOR i=1 TO xt:IF rt(i)=ab
      THEN zt=zt+1:tr(zt)=i
1200 NEXT:IF zt>0 THEN 1220
1210 ab=ab-1:GOTO 1190
1220 dh=INT(zt*RND)+1:hd=tr(dh
     ):y=ty(hd):x=tx(hd)
1230 GOTOXY 0,16:PRINT:PRINT T
     AB(15)"                ";:fg=f
     g+1:RETURN
```

Program 3. Amiga Chain Reaction

Version by Tim Midkiff, Editorial Programmer

```
DEFINT a-z:DEFSNG r,g,b◄
SCREEN 1,320,200,3,1:WINDOW 3,""
,(Ø,Ø)-(311,186),16,1:WINDOW OUT
PUT 3:COLOR 3,Ø◄
DIM s(42,1),u(4,5),p(4,5),j(4,5)
,bx(4,5),by(4,5),n(1,5),er(528),
wl(255),w2(255),rt(3Ø),tr(3Ø),tx
(3Ø),ty(3Ø)◄
FOR i=Ø TO 255:wl(i)=RND*255-128
:w2(i)=RND*255-128:NEXT◄
RESTORE PaletteData:FOR i=Ø TO 7
:READ r,g,b:PALETTE i,r,g,b:NEXT
◄
PaletteData: ◄
DATA Ø,Ø,.7,Ø,Ø,Ø,.8,.8,Ø,.7,.7,
.7,.33,.87,Ø,.9,.9,.9,.6,Ø,Ø,Ø,.
6,Ø◄
WIDTH 4Ø:CLS:RANDOMIZE TIMER◄
GOSUB InitShapes:e=Ø◄
FOR i=1 TO 3:FOR j=1 TO 4:j(i,j)
=4:NEXT:j(i,Ø)=3:j(i,5)=3:NEXT◄
RESTORE Corners:FOR j=1 TO 4:j(Ø
,j)=3:j(4,j)=3:READ a,b:j(a,b)=2
:NEXT◄
Corners: DATA Ø,Ø,Ø,5,4,Ø,4,5◄
RESTORE BombPos:FOR i=1 TO 4:FOR
j=1 TO i:READ bx(i,j),by(i,j):NE
XT j,i◄
bx(4,5)=bx(4,4):by(4,5)=by(4,4)◄
BombPos: DATA 13,9,6,9,20,9,13,5
,4,15,22,15,13,3,13,17,4,9,22,9◄
LOCATE 8,14:PRINT "CHAIN REACTIO
N"◄
LOCATE 12,9:PRINT "Number of pla
yers (1/2)?";◄
WHILE np<>1 AND np<>2:np=VAL(INK
EY$):WEND◄
IF np<>2 THEN◄
LOCATE 16,10:PRINT "Computer fir
st (Y/N)?";◄
WHILE k$<>"Y" AND k$<>"N":k$=UCA
SE$(INKEY$):WEND◄
tu=ABS(k$="Y")◄
END IF◄
CLS:COLOR 3,1:LOCATE 1,13:PRINT
" CHAIN REACTION ";◄
GOSUB DrawGrid◄
◄
MainLoop:◄
WHILE e=Ø:tu=-tu+1:co=tu+6◄
IF np=1 AND tu=Ø THEN◄
GOSUB Computer◄
ELSE◄
GOSUB Human◄
WHILE p(y,x)<>tu+1 AND p(y,x):GO
SUB Human:WEND◄
END IF◄
u(y,x)=u(y,x)+1:FS(tu)=FS(tu)+1:
IF p(y,x)=Ø THEN p(y,x)=tu+1◄
GOSUB PlaceBomb◄
IF u(y,x)=j(y,x) THEN ◄
CheckGrid: e=Ø:fg=Ø:FOR p=Ø TO 4
:FOR q=Ø TO 5:y=p:x=q◄
IF u(y,x)>=j(y,x) AND e=Ø THEN f
g=1:GOSUB FullSquare◄
NEXT q,p:IF fg=1 AND e=Ø THEN Ch
eckGrid◄
END IF◄
WEND◄
◄
EndGame:◄
COLOR 3,1:LOCATE 24,15:PRINT " G
AME OVER ";:FOR i=1 TO 1ØØØØ:NEX
T◄
LOCATE 24,5:PRINT " Press space
bar to play again. ";◄
k$="":WHILE k$<>" ":k$=INKEY$:WE
ND◄
SCREEN CLOSE 3:WINDOW CLOSE 3:RU
N◄
◄
Human:◄
WHILE INKEY$<>"":WEND:x=hx(tu):y
=hy(tu):dx=Ø:dy=Ø:GOSUB DrawCurs
or:k$=""◄
WHILE k$<>" ":k$=INKEY$◄
IF k$=CHR$(28) THEN IF y>Ø THEN
dy=-1◄
IF k$=CHR$(29) THEN IF y<4 THEN
dy=1◄
IF k$=CHR$(31) THEN IF x>Ø THEN
dx=-1◄
IF k$=CHR$(3Ø) THEN IF x<5 THEN
dx=1◄
IF dx<>Ø OR dy<>Ø THEN◄
co=Ø:GOSUB DrawCursor◄
x=x+dx:y=y+dy:co=tu+6:GOSUB Draw
Cursor◄
dx=Ø:dy=Ø◄
END IF◄
WEND:hx(tu)=x:hy(tu)=y◄
co=Ø:GOSUB DrawCursor:co=tu+6:RE
TURN◄
◄
FullSquare:◄
r=Ø:yy=32*y+15:xx=36*x+5Ø:WAVE Ø
,wl:WAVE 1,w2◄
FOR i=1 TO 4:PUT(xx+2,yy+2),er,P
SET◄
FOR j=1 TO 4:n(1,j)=INT(RND*3)-1
:NEXT◄
r=-r+1:k=u(y,x)+1:bn=co-6:IF k=6
THEN k=5◄
ON k GOSUB bØ,bl,b2,b3,b4,b4◄
FOR m=255 TO 1Ø STEP-2Ø:SOUND 1Ø
Ø,.1,m,Ø◄
SOUND 1ØØ,.1,m,3:FOR n=1 TO RND*
2Ø:NEXT n,m:NEXT◄
tx=x:ty=y:J1=Ø:K1=k-1:y1=32*y+15
+by(1,1):x1=36*x+5Ø+bx(1,1)◄
IF tx>Ø THEN x=tx-1:dx=-1:dy=Ø:G
OSUB ExplodeBombs:GOSUB AddBomb◄
IF tx<5 THEN x=tx+1:dx=1:dy=Ø:GO
SUB ExplodeBombs:GOSUB AddBomb◄
x=tx:IF ty>Ø THEN y=ty-1:dy=-1:d
x=Ø:GOSUB ExplodeBombs:GOSUB Add
Bomb◄
IF ty<4 THEN y=ty+1:dy=1:dx=Ø:GO
SUB ExplodeBombs:GOSUB AddBomb◄
IF FS(Ø)<1 OR FS(1)<1 THEN e=1◄
y=ty:u(y,x)=u(y,x)-j(y,x):GOSUB
PlaceBomb:IF u(y,x)=Ø THEN p(y,x
)=Ø◄

RETURN◄
◄
AddBomb:◄
IF p(y,x)<>tu+1 THEN FS(tu)=FS(t
u)+u(y,x):FS(-tu+1)=FS(-tu+1)-u(
y,x)◄
p(y,x)=tu+1:u(y,x)=u(y,x)+1:GOSU
B PlaceBomb:RETURN◄
◄
DrawGrid:◄
FOR y=Ø TO 4:yy=32*y+16:FOR x=Ø
TO 5:xx=36*x+51◄
LINE(xx,yy)-(xx+34,yy+3Ø),2,b◄
NEXT x,y◄
GET(xx+1,yy+1)-(xx+33,yy+29),er:
RETURN◄
◄
DrawCursor:◄
yy=32*y+15:xx=36*x+5Ø◄
LINE(xx,yy)-(xx+36,yy+32),co,b◄
LINE(xx+2,yy+2)-(xx+34,yy+3Ø),co
,b ◄
RETURN◄
◄
PlaceBomb:◄
yy=32*y+15:xx=36*x+5Ø:r=Ø:bn=co-
6◄
PUT(xx+2,yy+2),er,PSET:k=u(y,x)+
1:IF k=6 THEN k=5◄
ON k GOTO bØ,bl,b2,b3,b4,b4◄
bØ: RETURN◄
bl: PUT(xx+bx(1,k-1),yy+by(1,k-1
)),s(Ø,bn):RETURN◄
b2: FOR j=1 TO k-1:PUT(xx+bx(2,j
)+n(r,j),yy+by(2,j)+n(r,j)),s(Ø,
bn):NEXT:RETURN◄
b3: FOR j=1 TO k-1:PUT(xx+bx(3,j
)+n(r,j),yy+by(3,j)+n(r,j)),s(Ø,
```

```
bn):NEXT:RETURN◄
b4: FOR j=1 TO k-1:PUT(xx+bx(4,j
)+n(r,j),yy+by(4,j)+n(r,j)),s(Ø,
bn):NEXT:RETURN◄
◄
CheckNeighbor:◄
fp=1:IF y>Ø THEN IF p(y-1,x)=2 T
HEN ay=y-1:RETURN◄
IF x>Ø THEN IF p(y,x-1)=2 THEN a
x=x-1:RETURN◄
IF x<5 THEN IF p(y,x+1)=2 THEN a
x=x+1:RETURN◄
IF y<4 THEN IF p(y+1,x)=2 THEN a
y=y+1:RETURN◄
fp=Ø:RETURN◄
◄
Computer:◄
xt=Ø:FOR y=Ø TO 4:FOR x=Ø TO 5◄
IF p(y,x)<>2 THEN xt=xt+1:ty(xt)
=y:tx(xt)=x◄
NEXT x,y◄
LOCATE 24,15:COLOR 3,Ø:PRINT "Th
inking...";◄
FOR i=1 TO xt:rt(i)=Ø:tr(i)=Ø:y=
ty(i):x=tx(i):GOSUB CheckNeighbo
r◄
IF fg=1 AND fp AND u(y,x)>Ø THEN
EndComputer◄
IF u(y,x)+1=j(y,x) THEN ◄
IF fp=1 AND u(ay,ax)+1=j(ay,ax)
THEN rt(i)=6:GOTO CheckNext◄
IF fp=1 THEN rt(i)=2:GOTO CheckN
ext◄
IF fp=Ø THEN rt(i)=1:GOTO CheckN
ext◄
END IF◄
IF j(y,x)=2 THEN◄
IF fp=Ø AND u(y,x)=1 THEN rt(i)=
1:GOTO CheckNext◄
IF fp=Ø AND u(y,x)=Ø THEN rt(i)=
4:GOTO CheckNext◄
IF fp=1 AND u(y,x)=1 THEN rt(i)=
4:GOTO CheckNext◄
END IF◄
IF u(ay,ax)+1=j(ay,ax) THEN rt(i
)=1:GOTO CheckNext◄
IF u(y,x)+2>=j(y,x) THEN◄
IF fp=1 AND u(ay,ax)+1<j(ay,ax)
THEN rt(i)=5:GOTO CheckNext◄
IF fp=Ø THEN rt(i)=3:GOTO CheckN
ext◄
rt(i)=2:GOTO CheckNext◄
END IF◄
IF fp=Ø THEN rt(i)=2:GOTO CheckN
ext◄
rt(i)=1◄
CheckNext: NEXT:zt=Ø:ab=6◄
WHILE zt=Ø◄
FOR i=1 TO xt:IF rt(i)=ab THEN z
t=zt+1:tr(zt)=i◄
NEXT:ab=ab-1◄
WEND◄
dh=INT(zt*RND)+1:hd=tr(dh):y=ty(
hd):x=tx(hd)◄
EndComputer: LOCATE 24,15:PRINT
"           ";:fg=fg+1:RETURN◄
◄
ExplodeBombs:◄
J1=J1+1:xx=x1-bx(1,1):yy=y1-by(1
,1):s=1087:bn=co-6◄
WAVE Ø,SIN:SOUND 660,.5,255◄
FOR j=1 TO 500:NEXT:SOUND Ø,Ø,Ø◄
PUT(xx+bx(K1,J1)+n(r,J1),yy+by(K
1,J1)+n(r,J1)),s(Ø,bn)◄
IF dy=Ø THEN ◄
X2=x1+35*dx:dx=dx*4:PUT(x1,y1),s
(Ø,bn)◄
FOR i=x1 TO X2 STEP dx:s=s-4Ø:SO
UND s,1,5Ø◄
PUT(i,y1),s(Ø,bn):PUT(i+dx,y1),s
(Ø,bn):NEXT◄
PUT(xx+3,yy+3),er◄
ELSE◄
Y2=y1+31*dy:dy=dy*4:PUT(x1,y1),s
(Ø,bn)◄
FOR i=y1 TO Y2 STEP dy:s=s-4Ø:SO
UND s,1,5Ø◄
PUT(x1,i),s(Ø,bn):PUT(x1,i+dy),s
(Ø,bn):NEXT◄
PUT(xx+3,yy+3),er◄
END IF◄
RETURN◄
◄
InitShapes:◄
RESTORE RedBomb◄
FOR j=Ø TO 1:FOR i=Ø TO 42◄
READ a$:s(i,j)=VAL("&H"+a$):NEXT
i,j:RETURN◄
◄
RedBomb: DATA B,D,3,2ØØ,4ØØ,4ØØ,
Ø,18ØØ◄
DATA 3ØØØ,1BØØ,AØØ,4ØØ,AØØ,1BØØ,
Ø,Ø◄
DATA Ø,Ø,Ø,EØØ,278Ø,4FCØ,E4EØ,F5
EØ◄
DATA FBEØ,F5EØ,64CØ,3F8Ø,EØØ,2ØØ
,4ØØ,4ØØ◄
DATA EØØ,3F8Ø,7FCØ,E4EØ,F5EØ,FBE
Ø,F5EØ,64CØ◄
DATA 3F8Ø,EØØ,3F8Ø◄
◄
GreenBomb: DATA B,D,3,2ØØ,4ØØ,4Ø
Ø,EØØ,3F8Ø◄
DATA 7FCØ,FFEØ,FFEØ,FFEØ,FFEØ,7F
CØ,3F8Ø,EØØ◄
DATA Ø,Ø,Ø,EØØ,278Ø,4FCØ,E4EØ,F5
EØ◄
DATA FBEØ,F5EØ,64CØ,3F8Ø,EØØ,2ØØ
,4ØØ,4ØØ◄
DATA EØØ,3F8Ø,7FCØ,E4EØ,F5EØ,FBE
Ø,F5EØ,64CØ◄
DATA 3F8Ø,EØØ,3F8Ø◄
◄
◄
```

Program 4. Apple II Chain Reaction

Version by Tim Midkiff, Editorial Programmer

```
F9 1Ø  DIM U(4,5),L(4,5),J(4,5),B
       X(4,5),BY(4,5),RT(3Ø),TR(3
       Ø),TX(3Ø),TY(3Ø)
EF 15  FOR I = 1 TO 3: FOR J = 1
       TO 4:J(I,J) = 4: NEXT :J(I
       ,Ø) = 3:J(I,5) = 3: NEXT
E3 2Ø  FOR J = 1 TO 4:J(Ø,J) = 3:
       J(4,J) = 3: READ A,B:J(A,B
       ) = 2: NEXT
8B 25  DATA Ø,Ø,Ø,5,4,Ø,4,5
A9 3Ø  TEXT : HOME : VTAB 8: HTAB
        14: PRINT "CHAIN REACTION
       "
C5 35  VTAB 12: HTAB 9: PRINT "NU
       MBER OF PLAYERS (1/2)?";
26 4Ø  GET K$: IF K$ < > "1" AND
       K$ < > "2" THEN 4Ø
31 45  NP = VAL (K$): IF NP = 2 T
       HEN 31Ø
5B 5Ø  VTAB 16: HTAB 1Ø: PRINT "C
       OMPUTER FIRST (Y/N)?";
Ø3 55  GET K$: IF K$ < > "Y" AND
       K$ < > "N" THEN 55
6C 6Ø  TU = ABS (K$ = "Y")
3E 31Ø HGR : VTAB 21: HTAB 14: P
       RINT "CHAIN REACTION";: G
       OSUB 1ØØØ
6B 37Ø TU = - TU + 1
2F 38Ø IF NP = 1 AND TU = Ø THEN
        GOSUB 197Ø: GOTO 42Ø
5B 39Ø GOSUB 54Ø
D1 41Ø IF L(Y,X) = - TU + 2 THEN
        39Ø
B2 42Ø U(Y,X) = U(Y,X) + 1:FS(TU
       ) = FS(TU) + 1: IF L(Y,X)
        = Ø THEN L(Y,X) = TU + 1
CC 43Ø GOSUB 13ØØ
A3 44Ø IF U(Y,X) = J(Y,X) THEN 4
       5Ø
B1 445 GOTO 37Ø
29 45Ø E = Ø:FG = Ø: FOR A = Ø T
       O 4: FOR B = Ø TO 5:Y = A
       :X = B
52 455 IF U(Y,X) > = J(Y,X) AND
       E = Ø THEN FG = 1: GOSUB
       71Ø
A2 46Ø NEXT B,A: IF E = 1 THEN 4
       7Ø
4B 463 IF FG = 1 THEN 45Ø
B5 465 GOTO 37Ø
CA 47Ø HTAB 16: VTAB 23: PRINT "
       GAME OVER";: FOR I = 1 TO
        1ØØØ: NEXT
45 48Ø HTAB 6: PRINT "PRESS SPAC
       E BAR TO PLAY AGAIN.";
ØB 49Ø POKE 49168,Ø:K = PEEK (49
       152) - 128: IF K < > 32 T
       HEN 49Ø
A7 5ØØ RUN
ØF 54Ø X = HX(TU + 1):Y = HY(TU
       + 1): HCOLOR= TU * 4 + 1:
        GOSUB 12ØØ: POKE (49168)
       ,Ø
98 545 DX = Ø:DY = Ø:K = PEEK (4
       9152) - 128: IF K < Ø THE
       N 545
26 548 K$ = CHR$ (K): POKE 49168
       ,Ø: IF K$ = " " THEN HCOL
       OR= 4: GOSUB 12ØØ:HX(TU +
        1) = X:HY(TU + 1) = Y: R
       ETURN
97 55Ø IF K$ = "I" THEN IF Y > Ø
        THEN DY = - 1
BE 56Ø IF K$ = "M" THEN IF Y < 4
        THEN DY = 1
99 57Ø IF K$ = "J" THEN IF X > Ø
        THEN DX = - 1
C2 58Ø IF K$ = "K" THEN IF X < 5
        THEN DX = 1
9E 585 IF DX = Ø AND DY = Ø THEN
        545
23 59Ø HCOLOR= 4: GOSUB 12ØØ:X =
        X + DX:Y = Y + DY: HCOLO
       R= TU * 4 + 1: GOSUB 12ØØ
       : GOTO 545
DØ 71Ø R = Ø:YY = 3Ø * Y:XX = 38
        * X + 3Ø
ED 715 FOR I = 1 TO U(Y,X):S = P
       EEK ( - 16336): FOR J = 1
        TO 5: NEXT J,I
ØC 72Ø U(Y,X) = U(Y,X) - J(Y,X):
        GOSUB 13ØØ
D5 73Ø IF U(Y,X) = Ø THEN L(Y,X)
        = Ø
B1 74Ø TX = X:TY = Y
Ø2 75Ø IF TX > Ø THEN X = TX - 1
       : GOSUB 8ØØ
Ø4 76Ø IF TX < 5 THEN X = TX + 1
       : GOSUB 8ØØ
6A 77Ø X = TX: IF TY > Ø THEN Y
       = TY - 1: GOSUB 8ØØ
68 78Ø IF TY < 4 THEN Y = TY + 1
       : GOSUB 8ØØ
84 79Ø IF FS(Ø) < 1 OR FS(1) < 1
        THEN E = 1
82 795 Y = TY: RETURN
B4 8ØØ IF L(Y,X) < > TU + 1 THEN
        FS(TU) = FS(TU) + U(Y,X)
       :FS( - TU + 1) = FS( - TU
        + 1) - U(Y,X)
37 81Ø L(Y,X) = TU + 1:U(Y,X) =
       U(Y,X) + 1:S = PEEK ( - 1
       6336): GOSUB 13ØØ: RETURN
67 87Ø LP = Ø: IF Y > Ø THEN IF
       L(Y - 1,X) = 2 THEN AY =
       Y - 1: GOTO 96Ø
9C 89Ø IF X > Ø THEN IF L(Y,X -
       1) = 2 THEN AX = X - 1: G
       OTO 96Ø
7D 91Ø IF X < 5 THEN IF L(Y,X +
```

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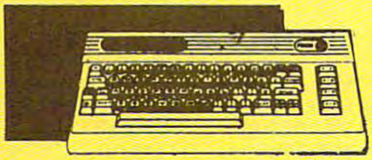

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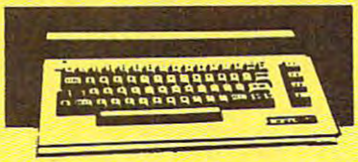

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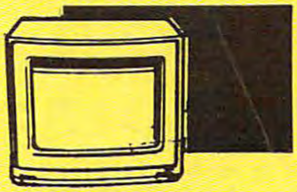

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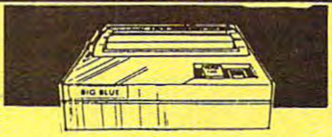

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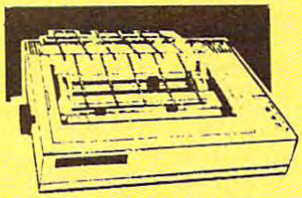

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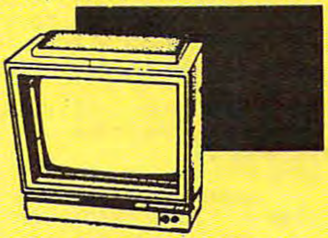

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```
     1) = 2 THEN AX = X + 1: G
     OTO 960
9D 930 IF Y < 4 THEN IF L(Y + 1,
     X) = 2 THEN AY = Y + 1: G
     OTO 960
23 950 RETURN
46 960 LP = 1: RETURN
E5 1000 HCOLOR= 7: FOR I = 0 TO
     1: FOR Y = 0 TO 5:YY = 3
     0 * Y + I
6E 1010 HPLOT 30,YY TO 258,YY: N
     EXT Y,I
BA 1020 FOR I = 0 TO 1: FOR X =
     0 TO 6:XX = 38 * X + 30
     + I: HPLOT XX,0 TO XX,15
     0: NEXT X,I
DD 1030 RETURN
1C 1100 HCOLOR= 7: HPLOT P + 3,Q
     : HPLOT P + 4,Q
A2 1105 HCOLOR= TU * 4 + 1: HPLO
     T P + 2,Q + 1 TO P + 4,Q
     + 1
F9 1110 FOR N = 2 TO 5: HPLOT P,
     Q + N TO P + 6,Q + N: NE
     XT
37 1120 HPLOT P + 2,Q + 6 TO P +
     4,Q + 6: RETURN
79 1200 FOR I = 2 TO 3:X1 = 38 *
     X + 30 + I:X2 = X1 + 33
     :Y1 = 30 * Y + I:Y2 = Y1
     + 26
BA 1210 HPLOT X1,Y1 TO X2,Y1 TO
     X2,Y2 TO X1,Y2 TO X1,Y1:
     NEXT : RETURN
27 1300 XX = 38 * X + 30:YY = 30
     * Y: HCOLOR= 4:K = U(Y,
     X) + 1: IF K = 6 THEN K
     = 5
B9 1305 FOR Q = YY + 6 TO YY + 2
     6: HPLOT XX + 10,Q TO XX
     + 28,Q: NEXT : HCOLOR=
     TU * 4 + 1
E7 1310 ON K GOTO 1320,1330,1340
     ,1350,1360,1360
DF 1320 RETURN
B5 1330 P = XX + 16:Q = YY + 13:
     GOSUB 1100: RETURN
EF 1340 P = XX + 10:Q = YY + 13:
     GOSUB 1100:P = XX + 20:
     GOSUB 1100: RETURN
E1 1350 P = XX + 16:Q = YY + 10:
     GOSUB 1100:P = XX + 10:
     Q = YY + 17: GOSUB 1100:
     P = XX + 20: GOSUB 1100:
     RETURN
C5 1360 P = XX + 16:Q = YY + 6:
     GOSUB 1100:Q = YY + 19:
     GOSUB 1100:P = XX + 10:Q
     = YY + 13: GOSUB 1100:P
     = XX + 22: GOSUB 1100:
     RETURN
48 1970 XT = 0: FOR Y = 0 TO 4:
     FOR X = 0 TO 5: IF L(Y,X
     ) = 2 THEN 2000
E0 1990 XT = XT + 1:TY(XT) = Y:T
     X(XT) = X
3C 2000 NEXT X,Y
D0 2010 HTAB 15: VTAB 23: PRINT
     "THINKING...";
6C 2020 FOR I = 1 TO XT:RT(I) =
     0:TR(I) = 0:Y = TY(I):X
     = TX(I): GOSUB 870
4E 2040 IF FG = 1 AND LP AND U(Y
     ,X) > 0 THEN 2220
62 2045 IF U(Y,X) + 1 < > J(Y,X)
     THEN 2075
3D 2050 IF LP = 1 AND U(AY,AX) +
     1 = J(AY,AX) THEN RT(I)
     = 6: GOTO 2170
13 2060 IF LP = 0 AND U(Y,X) = 0
     THEN RT(I) = 4: GOTO 21
     70
13 2070 IF LP = 0 THEN RT(I) = 1
     : GOTO 2170
5E 2075 IF J(Y,X) < > 2 THEN 211
     0
A9 2080 IF LP = 0 AND U(Y,X) = 1
     THEN RT(I) = 1: GOTO 21
     70
1F 2090 IF LP = 0 AND U(Y,X) = 0
     THEN RT(I) = 4: GOTO 21
     70
8D 2100 IF LP = 1 AND U(Y,X) = 1
     THEN RT(I) = 1: GOTO 21
     70
51 2110 IF U(AY,AX) + 1 = J(AY,A
     X) THEN RT(I) = 1: GOTO
     2170
27 2115 IF U(Y,X) + 2 < J(Y,X) T
     HEN 2150
AE 2120 IF LP = 1 AND U(AY,AX) +
     1 < J(AY,AX) THEN RT(I)
     = 5: GOTO 2170
25 2130 IF LP = 0 THEN RT(I) = 3
     : GOTO 2170
19 2140 RT(I) = 2: GOTO 2170
1D 2150 IF LP = 0 THEN RT(I) = 2
     : GOTO 2170
39 2160 RT(I) = 1
D1 2170 NEXT :ZT = 0:AB = 6
34 2180 FOR I = 1 TO XT: IF RT(I
     ) = AB THEN ZT = ZT + 1:
     TR(ZT) = I
77 2190 NEXT : IF ZT > 0 THEN 22
     10
F1 2200 AB = AB - 1: GOTO 2180
E9 2210 DH = INT (ZT * RND (1))
     + 1:HD = TR(DH):Y = TY(H
     D):X = TX(HD)
8B 2220 HTAB 15: PRINT "
          ";:FG = FG + 1: RETUR
     N
```

Program 5. Chain Reaction For Atari 400, 800, XL, And XE

Version by Tim Midkiff, Editorial Programmer

```
6E 10 GRAPHICS 0:POKE 752,1:
   SETCOLOR 2,0,0:? "PLEA
   SE WAIT...":GOSUB 690
JJ 20 OPEN #1,4,0,"K:"
6I 30 DIM U(4,5),L(4,5),J(4,
   5),FS(1),PB$(2),PS$(2)
   ,TS$(2),B$(1),S$(1),BL
   $(2)
DH 40 DIM RT(30),TR(30),TX(3
   0),TY(30)
CP 50 FS(0)=0:FS(1)=0:HX=0:H
   Y=0:PS$="#$":PB$="%&":
   BL$="  "
6B 60 FOR I=0 TO 4:FOR J=0 T
   O 5:U(I,J)=0:L(I,J)=0:
   J(I,J)=4:NEXT J
MI 70 J(I,0)=3:J(I,5)=3:NEXT
   I
DK 80 RESTORE 90:FOR J=1 TO
   4:J(0,J)=3:J(4,J)=3:RE
   AD A,B:J(A,B)=2:NEXT J
EJ 90 DATA 0,0,0,5,4,0,4,5
LK 100 ? CHR$(125)
ED 110 POSITION 13,7:? "CHAI
   N REACTION"
66 120 POSITION 8,11:? "NUMB
   ER OF PLAYERS (1/2)?"
   ;
NA 130 GET #1,NP:NP=NP-48:IF
   NP<>1 AND NP<>2 THEN
   130
PJ 140 IF NP=2 THEN 180
CL 150 POSITION 9,15:? "COMP
   UTER FIRST (Y/N)?";
CI 160 GET #1,TU:IF TU<>89 A
   ND TU<>78 THEN 160
CL 170 TU=(TU=89):GOTO 200
BC 180 POSITION 7,15:? "NUMB
   ER OF JOYSTICKS (1/2)
   ?";
BN 190 GET #1,F2:F2=F2-49:IF
   F2<>0 AND F2<>1 THEN
   190
JP 200 ? CHR$(125):POSITION
   13,0:? "CHAIN REACTIO
   N"
NA 210 FOR Y=0 TO 4:FOR X=0
   TO 5:GOSUB 770:NEXT X
   :NEXT Y
AC 220 TU=-TU+1:S$=PS$(TU+1,
   TU+1):B$=PB$(TU+1,TU+
   1)
IM 230 IF NP=1 AND -TU+1 THE
   N GOSUB 940:GOTO 260
LC 240 GOSUB 390
DB 250 IF L(Y,X)<>TU+1 AND L
   (Y,X) THEN 240
ML 260 U(Y,X)=U(Y,X)+1:FS(TU
   )=FS(TU)+1:IF L(Y,X)=
   0 THEN L(Y,X)=TU+1
LI 270 GOSUB 870
CD 280 IF U(Y,X)=J(Y,X) THEN
   300
GI 290 GOTO 220
PF 300 E=0:FG=0:FOR Y=0 TO 4
   :FOR X=0 TO 5
JO 310 IF U(Y,X)>=J(Y,X) AND
   E=0 THEN FG=1:GOSUB
   480
EB 320 NEXT X:NEXT Y:IF E=1
   THEN 350
OC 330 IF FG=1 THEN 300
GE 340 GOTO 220
JO 350 POSITION 15,23:PRINT
   "GAME OVER";:FOR I=1
   TO 1000:NEXT I
OC 360 POSITION 5,23:PRINT "
   PRESS FIREBUTTON TO P
   LAY AGAIN";
NK 370 IF STRIG(0) AND STRIG
   (1) THEN 370
DJ 380 GOTO 50
JG 390 X=HX:Y=HY:GOSUB 820
BF 400 DX=0:DY=0:JY=STICK(TU
   *F2)
PN 410 IF STRIG(TU*F2)=0 THE
   N HX=X:HY=Y:GOSUB 770
   :RETURN
FG 420 IF JY=14 THEN IF Y>0
   THEN DY=-1
CL 430 IF JY=13 THEN IF Y<4
   THEN DY=1
FD 440 IF JY=11 THEN IF X>0
   THEN DX=-1
PP 450 IF JY=7 THEN IF X<5 T
   HEN DX=1
NC 460 IF DX=0 AND DY=0 THEN
   400
PD 470 GOSUB 770:X=X+DX:Y=Y+
   DY:GOSUB 820:GOTO 400
FC 480 V=15:DV=INT(15/(U(Y,X
   )*2)):TS$=S$:XX=X*4+8
   :YY=Y*4+2:FOR I=1 TO
   U(Y,X):BL$(1)=S$:BL$(
   2)=S$:S$=" "
BB 490 GOSUB 890:GOSUB 820:G
   OSUB 1210:BL$="  ":S$
   =TS$:GOSUB 890
NG 500 GOSUB 820:GOSUB 1210:
   NEXT I:GOSUB 770:FOR
   I=0 TO 3:SOUND I,0,0,
   0:NEXT I
NH 510 U(Y,X)=U(Y,X)-J(Y,X):
   GOSUB 870
CM 520 IF U(Y,X)=0 THEN L(Y,
   X)=0
FB 530 TX=X:TY=Y
GA 540 IF TX>0 THEN X=TX-1:G
   OSUB 600
```

```
GC 55Ø IF TX<5 THEN X=TX+1:G
       OSUB 6ØØ
OA 56Ø X=TX:IF TY>Ø THEN Y=T
       Y-1:GOSUB 6ØØ
GG 57Ø IF TY<4 THEN Y=TY+1:G
       OSUB 6ØØ
LO 58Ø IF FS(Ø)<1 OR FS(1)<1
        THEN E=1
PL 59Ø Y=TY:RETURN
LN 6ØØ IF L(Y,X)<>TU+1 THEN
       FS(TU)=FS(TU)+U(Y,X):
       FS(-TU+1)=FS(-TU+1)-U
       (Y,X)
JP 61Ø L(Y,X)=TU+1:U(Y,X)=U(
       Y,X)+1:GOSUB 87Ø:RETU
       RN
PD 62Ø LP=Ø:IF Y>Ø THEN IF L
       (Y-1,X)=2 THEN Y1=Y-1
       :GOTO 67Ø
KO 63Ø IF X>Ø THEN IF L(Y,X-
       1)=2 THEN X1=X-1:GOTO
        67Ø
KO 64Ø IF X<5 THEN IF L(Y,X+
       1)=2 THEN X1=X+1:GOTO
        67Ø
LB 65Ø IF Y<4 THEN IF L(Y+1,
       X)=2 THEN Y1=Y+1:GOTO
        67Ø
HM 66Ø RETURN
MB 67Ø LP=1:RETURN
HF 68Ø GOTO 68Ø
CA 69Ø POKE 752,1:CHBAS=5734
       4:CHSET=(PEEK(1Ø6)-8)
       *256
CL 7ØØ FOR I=Ø TO 1Ø24:POKE
       CHSET+I,PEEK(CHBAS+I)
       :NEXT I
NI 71Ø POKE 756,CHSET/256
EH 72Ø RESTORE 73Ø:FOR I=CHS
       ET+24 TO CHSET+55:REA
       D A:POKE I,A:NEXT I:R
       ETURN
KI 73Ø DATA 17Ø,17Ø,17Ø,17Ø,
       17Ø,17Ø,17Ø,17Ø
FB 74Ø DATA 85,85,85,85,85,8
       5,85,85
KN 75Ø DATA 3,12,4Ø,17Ø,138,
       162,17Ø,4Ø
PH 76Ø DATA 3,12,2Ø,85,69,81
       ,85,2Ø
AC 77Ø XX=X*4+8:YY=Y*4+2:POS
       ITION XX,YY:? "{F}
       {2 M}{G}"
BE 78Ø FOR K=1 TO 2
IA 79Ø POSITION XX,YY+K:? "
       {V}":POSITION XX+3,YY
       +K:? "{B}":NEXT K
BC 8ØØ POSITION XX,YY+3:? "
       {G}{2 N}{F}":POKE 77,
       Ø
HJ 81Ø RETURN
CA 82Ø XX=X*4+8:YY=Y*4+2:POS
       ITION XX,YY:? S$;S$;S
       $;S$
BA 83Ø FOR K=1 TO 2
MK 84Ø POSITION XX,YY+K:? S$
       :POSITION XX+3,YY+K:?
        S$:NEXT K
AE 85Ø POSITION XX,YY+3:? S$
       ;S$;S$;S$
HO 86Ø RETURN
OC 87Ø XX=X*4+8:YY=Y*4+2
NI 88Ø ON U(Y,X)+1 GOTO 89Ø,
       9ØØ,91Ø,92Ø,93Ø,93Ø
MC 89Ø POSITION XX+1,YY+1:?
       BL$:POSITION XX+1,YY+
       2:? BL$:RETURN
KI 9ØØ GOSUB 89Ø:POSITION XX
       +1,YY+1:? B$:RETURN
KD 91Ø GOSUB 9ØØ:POSITION XX
       +2,YY+2:? B$:RETURN
KE 92Ø GOSUB 91Ø:POSITION XX
       +2,YY+1:? B$:RETURN
KG 93Ø GOSUB 92Ø:POSITION XX
       +1,YY+2:? B$:RETURN
LC 94Ø XT=Ø:FOR Y=Ø TO 4:FOR
        X=Ø TO 5:IF L(Y,X)=2
        THEN 96Ø
IB 95Ø XT=XT+1:TY(XT)=Y:TX(X
       T)=X
AI 96Ø NEXT X:NEXT Y
OK 97Ø POSITION 15,23:? "THI
       NKING...";
NK 98Ø FOR I=1 TO XT:RT(I)=Ø
       :TR(I)=Ø:Y=TY(I):X=TX
       (I):GOSUB 62Ø
FB 99Ø IF FG=1 AND LP AND U(
       Y,X)>Ø THEN 12ØØ
BF 1ØØØ IF U(Y,X)+1<>J(Y,X)
        THEN 1Ø4Ø
KC 1Ø1Ø IF LP=1 AND U(Y1,X1)
        +1=J(Y1,X1) THEN RT(
        I)=6:GOTO 115Ø
HE 1Ø2Ø IF LP=1 THEN RT(I)=2
        :GOTO 115Ø
HD 1Ø3Ø IF LP=Ø THEN RT(I)=1
        :GOTO 115Ø
HA 1Ø4Ø IF J(Y,X)<>2 THEN 1Ø
        8Ø
DJ 1Ø5Ø IF LP=Ø AND U(Y,X)=1
         THEN RT(I)=1:GOTO 1
        15Ø
DM 1Ø6Ø IF LP=Ø AND U(Y,X)=Ø
         THEN RT(I)=4:GOTO 1
        15Ø
DP 1Ø7Ø IF LP=1 AND U(Y,X)=1
         THEN RT(I)=4:GOTO 1
        15Ø
MH 1Ø8Ø IF U(Y1,X1)+1=J(Y1,X
        1) THEN RT(I)=1:GOTO
         115Ø
OB 1Ø9Ø IF U(Y,X)+2<J(Y,X) T
        HEN 113Ø
KA 11ØØ IF LP=1 AND U(Y1,X1)
        +1<J(Y1,X1) THEN RT(
        I)=5:GOTO 115Ø
HE 111Ø IF LP=Ø THEN RT(I)=3
        :GOTO 115Ø
KN 112Ø RT(I)=2:GOTO 115Ø
HF 113Ø IF LP=Ø THEN RT(I)=2
        :GOTO 115Ø
HE 114Ø RT(I)=1
NE 115Ø NEXT I:ZT=Ø:AB=6
AH 116Ø FOR I=1 TO XT:IF RT(
        I)=AB THEN ZT=ZT+1:T
        R(ZT)=I
DA 117Ø NEXT I:IF ZT>Ø THEN
        119Ø
KG 118Ø AB=AB-1:GOTO 116Ø
KB 119Ø DH=INT(ZT*RND(Ø))+1:
        HD=TR(DH):Y=TY(HD):X
        =TX(HD)
CO 12ØØ POSITION 15,23:? "
        {11 SPACES}";:FG=FG+1
        :RETURN
HE 121Ø V=V-DV
BO 122Ø SOUND Ø,2ØØ,4,V
CK 123Ø SOUND 1,255,4,V
CJ 124Ø SOUND 2,225,4,V
EG 125Ø SOUND 3,15Ø,8,V:RETU
        RN
```

Program 6. IBM PC/PCjr Chain Reaction

Version by Tim Midkiff, Editorial Programmer

```
MARK TUTTLE/CHAIN REACTION
Program  (IBM VERSION)

BM 1Ø KEY OFF:DEF SEG=Ø:DEFINT A
      -Z:POKE 1Ø47,PEEK(1Ø47) OR
      64:RANDOMIZE TIMER
NM 2Ø SCREEN 1,Ø:COLOR 1,Ø:WIDTH
      4Ø:CLS
MK 3Ø DIM U(4,5),L(4,5),J(4,5),B
      X(4,5),BY(4,5),N(1,5),ER(2
      56),RT(3Ø),TR(3Ø),TX(3Ø),T
      Y(3Ø),BR(22),BG(22)
CJ 4Ø GOSUB 117Ø
GJ 5Ø FOR I=1 TO 3:FOR J=1 TO 4:
      J(I,J)=4:NEXT:J(I,Ø)=3:J(I
      ,5)=3:NEXT
GG 6Ø RESTORE 7Ø:FOR J=1 TO 4:J(
      Ø,J)=3:J(4,J)=3:READ A,B:J
      (A,B)=2:NEXT
KB 7Ø DATA Ø,Ø,Ø,5,4,Ø,4,5
GI 8Ø RESTORE 1ØØ:FOR I=1 TO 4:F
      OR J=1 TO I:READ BX(I,J),B
      Y(I,J):NEXT J,I
CB 9Ø BX(4,5)=BX(4,4):BY(4,5)=BY
      (4,4)
ED 1ØØ DATA 13,9,6,9,2Ø,9,13,5,4
       ,15,22,15,13,3,13,17,4,9,
       22,9
HL 11Ø LOCATE 8,14:PRINT "CHAIN
       REACTION"
AE 12Ø LOCATE 12,9:PRINT "Number
        of players (1/2)?";
JJ 13Ø K$=INKEY$:IF K$<>"1" AND
       K$<>"2" THEN 13Ø
KN 14Ø NP=VAL(K$):IF NP=2 THEN 1
       8Ø
DC 15Ø LOCATE 16,1Ø:PRINT "Compu
       ter first (Y/N)?";
IP 16Ø K$=INKEY$:IF K$<>"Y" AND
       K$<>"N" THEN 16Ø
LM 17Ø TU=ABS(K$="Y")
EA 18Ø CLS:LOCATE 1,14:PRINT "CH
       AIN REACTION";:GOSUB 67Ø
HD 19Ø TU=-TU+1:CO=TU+1
BL 2ØØ IF NP=1 AND TU=Ø THEN GOS
       UB 9ØØ:GOTO 23Ø
JJ 21Ø GOSUB 36Ø
FA 22Ø IF L(Y,X)<>TU+1 AND L(Y,X
       ) THEN 21Ø
CN 23Ø U(Y,X)=U(Y,X)+1:FS(TU)=FS
       (TU)+1:IF L(Y,X)=Ø THEN L
       (Y,X)=CO
JG 24Ø GOSUB 82Ø
JJ 25Ø IF U(Y,X)=J(Y,X) THEN 27Ø
HM 26Ø GOTO 19Ø
PG 27Ø E=Ø:FG=Ø:FOR P=Ø TO 4:FOR
        Q=Ø TO 5:Y=P:X=Q
KL 28Ø IF U(Y,X)>=J(Y,X) AND E=Ø
        THEN FG=1:GOSUB 45Ø
EF 29Ø NEXT Q,P:IF E=1 THEN 32Ø
OI 3ØØ IF FG=1 THEN 27Ø
GD 31Ø GOTO 19Ø
FC 32Ø LOCATE 24,16:PRINT "GAME
       OVER";:FOR I=1 TO 5ØØØ:NE
       XT
JP 33Ø LOCATE 24,6:PRINT "Press
       space bar to play again."
       ;
HG 34Ø K$=INKEY$:IF K$<>" " THEN
        34Ø
GH 35Ø RUN
OI 36Ø X=HX(CO):Y=HY(CO):GOSUB 7
       8Ø:WHILE INKEY$<>"":WEND
OG 37Ø DX=Ø:DY=Ø:K$=RIGHT$(INKEY
       $,1):IF K$="" THEN 37Ø
ON 38Ø K=ASC(K$):IF K=32 THEN HX
       (CO)=X:HY(CO)=Y:CO=Ø:GOSU
       B 78Ø:CO=TU+1:RETURN
JE 39Ø IF K=72 THEN IF Y>Ø THEN
       DY=-1
LJ 4ØØ IF K=8Ø THEN IF Y<4 THEN
       DY=1
HC 41Ø IF K=75 THEN IF X>Ø THEN
       DX=-1
ND 42Ø IF K=77 THEN IF X<5 THEN
       DX=1
OK 43Ø IF DX=Ø AND DY=Ø THEN 37Ø
KN 44Ø CO=Ø:GOSUB 78Ø:X=X+DX:Y=Y
       +DY:CO=TU+1:GOSUB 78Ø:GOT
       O 37Ø
```

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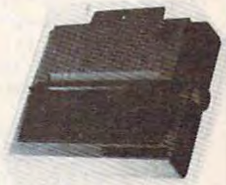

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```
HM 450 R=Ø:YY=32*Y+15:XX=36*X+5Ø
       :FOR I=1 TO 4
CP 460 PUT(XX+2,YY+2),ER,PSET
MN 470 FOR J=1 TO 4:N(1,J)=INT(R
       ND(1)*3)-1:NEXT:R=-R+1:K=
       U(Y,X)+1:IF K=6 THEN K=5
IN 480 IF CO=1 THEN ON K GOSUB 7
       3Ø,74Ø,75Ø,76Ø,77Ø,77Ø
FE 490 IF CO=2 THEN ON K GOSUB 8
       5Ø,86Ø,87Ø,88Ø,89Ø,89Ø
CB 500 FOR J=1 TO 25:SOUND 37,1:
       NEXT:SOUND 37,Ø:NEXT
GM 510 TX=X:TY=Y:J1=Ø:K1=K-1:Y1=
       32*Y+15+BY(1,1):X1=36*X+5
       Ø+BX(1,1)
LH 520 IF TX>Ø THEN X=TX-1:DX=-1
       :DY=Ø:GOSUB 127Ø:GOSUB 59
       Ø
DD 530 IF TX<5 THEN X=TX+1:DX=1:
       DY=Ø:GOSUB 127Ø:GOSUB 59Ø
II 540 X=TX:IF TY>Ø THEN Y=TY-1:
       DY=-1:DX=Ø:GOSUB 127Ø:GOS
       UB 59Ø
FH 550 IF TY<4 THEN Y=TY+1:DY=1:
       DX=Ø:GOSUB 127Ø:GOSUB 59Ø
KJ 560 IF FS(Ø)<1 OR FS(1)<1 THE
       N E=1
AB 570 Y=TY:U(Y,X)=U(Y,X)-J(Y,X)
       :GOSUB 82Ø:IF U(Y,X)=Ø TH
       EN L(Y,X)=Ø
NP 580 RETURN
GN 590 IF L(Y,X)<>TU+1 THEN FS(T
       U)=FS(TU)+U(Y,X):FS(-TU+1
       )=FS(-TU+1)-U(Y,X)
DD 600 L(Y,X)=TU+1:U(Y,X)=U(Y,X)
       +1:GOSUB 82Ø:RETURN
ML 610 LP=Ø:IF Y>Ø THEN IF L(Y-1
       ,X)=2 THEN AY=Y-1:GOTO 66
       Ø
HJ 620 IF X>Ø THEN IF L(Y,X-1)=2
        THEN AX=X-1:GOTO 66Ø
BJ 630 IF X<5 THEN IF L(Y,X+1)=2
        THEN AX=X+1:GOTO 66Ø
KF 640 IF Y<4 THEN IF L(Y+1,X)=2
        THEN AY=Y+1:GOTO 66Ø
NK 650 RETURN
MF 660 LP=1:RETURN
CL 670 FOR Y=Ø TO 4:YY=32*Y+16:F
       OR X=Ø TO 5:XX=36*X+51
LJ 680 DRAW "BM=XX;,=YY;R34D3ØL3
       4U3Ø"
PN 690 NEXT X,Y:GET(XX+1,YY+1)-(
       XX+33,YY+29),ER
MB 700 RETURN
FF 710 PUT(XX+2,YY+2),ER,PSET:K=
       U(Y,X)+1:IF K=6 THEN K=5
PO 720 ON K GOTO 73Ø,74Ø,75Ø,76Ø
       ,77Ø,77Ø
MH 730 RETURN
PH 740 PUT(XX+BX(1,K-1),YY+BY(1,
       K-1)),BG:RETURN
KL 750 FOR J=1 TO K-1:PUT(XX+BX(
       2,J)+N(R,J),YY+BY(2,J)+N(
       R,J)),BG:NEXT:RETURN
PL 760 FOR J=1 TO K-1:PUT(XX+BX(
       3,J)+N(R,J),YY+BY(3,J)+N(
       R,J)),BG:NEXT:RETURN
EL 770 FOR J=1 TO K-1:PUT(XX+BX(
       4,J)+N(R,J),YY+BY(4,J)+N(
       R,J)),BG:NEXT:RETURN
ON 780 YY=32*Y+15:XX=36*X+5Ø
IF 790 DRAW "C=CO;BM=XX;,=YY;R36
       D32L36U32"
CE 800 DRAW "C=CO;BM+2,+2R32D28L
       32U28"
ME 810 RETURN
DN 820 YY=32*Y+15:XX=36*X+5Ø:R=Ø
       :IF CO=1 THEN 71Ø
GK 830 PUT(XX+2,YY+2),ER,PSET:K=
       U(Y,X)+1:IF K=6 THEN K=5
MB 840 ON K GOTO 85Ø,86Ø,87Ø,88Ø
       ,89Ø,89Ø
NM 850 RETURN
JD 860 PUT(XX+BX(1,K-1),YY+BY(1,
       K-1)),BR:RETURN
FK 870 FOR J=1 TO K-1:PUT(XX+BX(
       2,J)+N(R,J),YY+BY(2,J)+N(
       R,J)),BR:NEXT:RETURN
KK 880 FOR J=1 TO K-1:PUT(XX+BX(
       3,J)+N(R,J),YY+BY(3,J)+N(
       R,J)),BR:NEXT:RETURN
PK 890 FOR J=1 TO K-1:PUT(XX+BX(
       4,J)+N(R,J),YY+BY(4,J)+N(
       R,J)),BR:NEXT:RETURN
AG 900 XT=Ø:FOR Y=Ø TO 4:FOR X=Ø
        TO 5:IF L(Y,X)=2 THEN 92
       Ø
OP 910 XT=XT+1:TY(XT)=Y:TX(XT)=X
IJ 920 NEXT X,Y
IB 930 LOCATE 23,15:PRINT "Think
       ing...";
FO 940 FOR I=1 TO XT:RT(I)=Ø:TR(
       I)=Ø:Y=TY(I):X=TX(I):GOSU
       B 61Ø
FK 950 IF FG=1 AND LP AND U(Y,X)
       >Ø THEN 116Ø
BM 960 IF U(Y,X)+1<>J(Y,X) THEN
       1ØØØ
GC 970 IF LP=1 AND U(AY,AX)+1=J(
       AY,AX) THEN RT(I)=6:GOTO
       111Ø
MM 980 IF LP=1 THEN RT(I)=2:GOTO
        111Ø
KL 990 IF LP=Ø THEN RT(I)=1:GOTO
        111Ø
JD 1000 IF J(Y,X)<>2 THEN 1Ø4Ø
NI 1010 IF LP=Ø AND U(Y,X)=1 THE
        N RT(I)=1:GOTO 111Ø
CE 1020 IF LP=Ø AND U(Y,X)=Ø THE
        N RT(I)=4:GOTO 111Ø
FM 1030 IF LP=1 AND U(Y,X)=1 THE
        N RT(I)=4:GOTO 111Ø
OF 1040 IF U(AY,AX)+1=J(AY,AX) T
        HEN RT(I)=1:GOTO 111Ø
MD 1050 IF U(Y,X)+2<J(Y,X) THEN
        1Ø9Ø
NN 1060 IF LP=1 AND U(AY,AX)+1<J
        (AY,AX) THEN RT(I)=5:GOT
        O 111Ø
ND 1070 IF LP=Ø THEN RT(I)=3:GOT
        O 111Ø
AD 1080 RT(I)=2:GOTO 111Ø
MA 1090 IF LP=Ø THEN RT(I)=2:GOT
        O 111Ø
RB 1100 RT(I)=1
OA 1110 NEXT:ZT=Ø:AB=6
OL 1120 FOR I=1 TO XT:IF RT(I)=A
        B THEN ZT=ZT+1:TR(ZT)=I
GK 1130 NEXT:IF ZT>Ø THEN 115Ø
NI 1140 AB=AB-1:GOTO 112Ø
BI 1150 DH=INT(ZT*RND(1))+1:HD=T
        R(DH):Y=TY(HD):X=TX(HD)
EE 1160 LOCATE 23,15:PRINT "
                  ";:FG=FG+1:RETURN
EH 1170 RESTORE 121Ø
HB 1180 READ BR(Ø),BR(1):FOR I=2
         TO 22:READ A$:BR(I)=VAL
        ("&H"+A$):NEXT
DA 1190 READ BG(Ø),BG(1):FOR I=2
         TO 22:READ A$:BG(I)=VAL
        ("&H"+A$):NEXT
IP 1200 RETURN
IH 1210 DATA 22,13,FØØ,Ø,3Ø,3ØØØ
        ,2ØØ,AA
DJ 1220 DATA AAØ2,AØØ,8ØAA,2Ø28,
        AAAØ,A822,8AAA,AAA8
OE 1230 DATA A822,2Ø28,AAØ,8ØAA,
        AAØ2,Ø,Ø
CN 1240 DATA 22,13,FØØ,Ø,3Ø,3ØØØ
        ,1ØØ,55
KF 1250 DATA 55Ø1,5ØØ,4Ø55,1Ø14,
        555Ø,5411,4555,5554
LH 1260 DATA 5411,1Ø14,55Ø,4Ø55,
        55Ø1,Ø,Ø
BC 1270 J1=J1+1:XX=X1-BX(1,1):YY
        =Y1-BY(1,1):S=1Ø87:IF CO
        =1 THEN 136Ø
PF 1280 PUT(XX+BX(K1,J1)+N(R,J1)
        ,YY+BY(K1,J1)+N(R,J1)),B
        R
GM 1290 IF DY<>Ø THEN 133Ø
AB 1300 X2=X1+35*DX:DX=DX*4:PUT(
        X1,Y1),BR
AE 1310 FOR I=X1 TO X2 STEP DX:S
        =S-4Ø:SOUND S,1:PUT(I,Y1
        ),BR:PUT(I+DX,Y1),BR:NEX
        T
GL 1320 PUT(XX+3,YY+3),ER:RETURN
CO 1330 Y2=Y1+31*DY:DY=DY*4:PUT(
        X1,Y1),BR
DD 1340 FOR I=Y1 TO Y2 STEP DY:S
        =S-4Ø:SOUND S,1:PUT(X1,I
        ),BR:PUT(X1,I+DY),BR:NEX
        T
GE 1350 PUT(XX+3,YY+3),ER:RETURN
KP 1360 PUT(XX+BX(K1,J1)+N(R,J1)
        ,YY+BY(K1,J1)+N(R,J1)),B
        G
EB 1370 IF DY<>Ø THEN 141Ø
HH 1380 X2=X1+35*DX:DX=DX*4:PUT(
        X1,Y1),BG
IG 1390 FOR I=X1 TO X2 STEP DX:S
        =S-4Ø:SOUND S,1:PUT(I,Y1
        ),BG:PUT(I+DX,Y1),BG:NEX
        T
FH 1400 PUT(XX+3,YY+3),ER:RETURN
II 1410 Y2=Y1+31*DY:DY=DY*4:PUT(
        X1,Y1),BG
KJ 1420 FOR I=Y1 TO Y2 STEP DY:S
        =S-4Ø:SOUND S,1:PUT(X1,I
        ),BG:PUT(X1,I+DY),BG:NEX
        T
GA 1430 PUT(XX+3,YY+3),ER:RETURN
```

©

Commodore 128 Machine Language

Part 6

Jim Butterfield, Associate Editor

In this final series installment on Commodore 128 machine language programming, Jim Butterfield looks at ways to build custom memory configurations.

Memory Banks

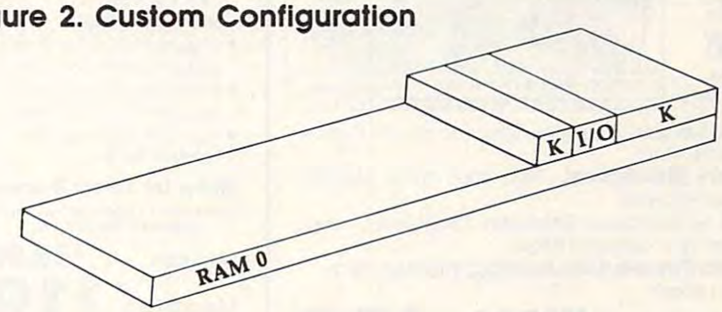
The 16 standard configurations that Commodore has defined as *banks* are useful, but limitations exist. In a standard 128—one without a cartridge, extra ROM, or extra RAM—only four bank configurations (0, 1, 14, and 15) are useful. While there are 16 standard configurations, you can actually create 256 different ones. You may store any value from 0–255 in the configuration register at address 65280 ($FF00) and each value will create a particular configuration.

Not all of the 256 combinations are useful. Some call for ROM or RAM that may not exist. If you eliminate such configurations, only about 24 remain. Of these, several others don't seem to be very helpful. For instance, it's hard to imagine a case in which you'd want only half of the BASIC ROM and none of the Kernal ROM. However, you can make your own configurations, and some of them are useful. There's at least one handy configuration missing from Commodore's bank list.

Figure 1. Configuration Register

	$C000 -$FFFF	$8000 -$BFFF	$4000 -$7FFF	
00 = RAM0 01 = RAM1	00 = Kernal 11 = RAM	00 = BASIC HI 11 = RAM	0 = BASIC LO 1 = RAM	0 = I/O 1 = ROM

Figure 2. Custom Configuration



The Configuration Register

Figure 1 shows the make-up of the configuration register. Only the standard memory elements are shown in the diagram; to simplify the discussion, we'll ignore elements like cartridges and RAM expansion.

This register is effectively split into five parts:

Bit 0. When bit 0 contains a zero, the I/O chips appear in locations $D000–$DFFF. When this bit contains a one, the 128 sees whatever is selected by bits 4 and 5. If it's the Kernal ROM, this part of memory contains character patterns.

Bit 1. This bit controls memory addresses $4000–$7FFF. Placing a one here puts RAM in that area; a zero causes the lower 16K of BASIC ROM to appear.

Bits 2 and 3. Together, these two bits control locations $8000–$BFFF. Setting both bits to 1 puts RAM in this area. Setting them both to 0 causes the upper 12K of BASIC

ROM and machine language monitor ROM to appear.

Bits 4 and 5. These two bits control locations $C000–$FFFF. If both bits are set to 1, RAM appears in this zone; when both contain 0, the Kernal ROM appears. Note that when Kernal ROM is selected, character pattern ROM appears at locations $D000–$DFFF. If bit 0 is set to 0, I/O chip registers will be seen at $D000–$DFFF regardless of the settings in bits 4 and 5.

Bits 6 and 7. These two bits control which block of RAM will be used in any of the areas selected as RAM in the other configuration register bits. When both bits are set to zero, block 0 is selected. The bit pattern 01 selects block 1. Note that locations $0002–$03FF will appear from block 0 no matter what value you place in these bits. (Locations $0000–$0001 are registers for the microprocessor's on-chip I/O port.)

Suppose that you want to select the bank 15 configuration. Let's work through it from the high end. All the RAM will be from block 0, so we set bits 6 and 7 of the configuration register to 0. We need Kernal ROM, so bits 4 and 5 must also be set to 0. We also want BASIC ROM, so bits 1, 2, and 3 are all set to 0 as well. To make the I/O chips visible, bit 0 is set to 0. Thus, to select bank 15, we simply store a zero in $FF00, setting all of its bits to 0.

Now let's select bank 1, which is almost entirely RAM from block 1. From the top again, we set bits 6 and 7 with the pattern 01 to select block 1 as the source of RAM. (Remember, however, that this doesn't affect locations $0002–$03FF.) Bits 2–5 are all set to 1 so that RAM is in place, and bit 1 also gets a one. Bit 0 must be set to 1 so that the I/O address space doesn't appear. Put all these bits together, and you get $7F, the value that selects bank 1.

A Custom Configuration

Many machine language programmers would like to have a configuration that provides as much RAM as possible but still retains the Kernal and I/O addresses. This can be done by eliminating BASIC ROM, which machine language programs usually don't need. We'll get 48K of RAM and all the I/O that's necessary.

How do we create it? Easy. Set bits 6 and 7 to 0 to select RAM from block 0. Set bits 4 and 5 to 0 to select Kernal ROM. Set bits 1, 2, and 3 to 1 to put RAM in place. And bit 0 is set to 0 to put the I/O chips in place. Add these values together, and you get $0E as the final value. We'll use this configuration soon in an example.

Fine Points

The MMU specifications reveal additional, intriguing configuration possibilities. You can expand shared RAM to protect more than 1K from reconfiguration. You can even relocate the processor's zero page or stack. For most of us, these are comparatively risky techniques, since BASIC and the Kernal assume a normal configuration.

Here's a handy piece of information, however. If a machine language program sets its own configuration, the calling BASIC program has a lot more latitude in the way it calls that program. To explain: Suppose there is a machine language program somewhere in RAM between $4000–$BFFF. We know that the program uses I/O and the Kernal. From BASIC, you would expect to precede any SYS with BANK 15 to insure that the ML program has access to the Kernal. But that's impossible: The program is above $4000 and can't be reached with BANK 15. BANK 0 would allow you to access it, but then the ML program would have no access to the Kernal ROM.

The solution is for the ML program itself to reconfigure the machine to the custom configuration shown in Figure 2. Everything will work fine, and the ML program won't even need to restore the original configuration before it returns to BASIC.

Now let's write a program to create the configuration.

Configuration Example

The machine language portion of the program will print a simple message. From direct mode, enter MONITOR to activate the 128's built-in machine language monitor; then enter these lines:

```
A A000  LDA  #$0E
A A002  STA  $FF00
A A005  LDX  #$00
A A007  LDA  $A013,X
A A00A  JSR  $FFD2
A A00D  INX
A A00E  CPX  #$1A
A A010  BCC  $A007
A A012  RTS
```

To enter the message, display memory with the command M A013 A02C. Next, type over the display so that the left portion of the screen looks like this:

```
>A013 47 52 45 45 54 49 4E 47
>A01B 53 20 46 52 4F 4D 20 48
>A023 59 50 45 52 53 50 41 43
>A02B 45 0D
```

This data will appear in slightly different form on an 80-column monitor. That doesn't matter—simply type these bytes in the addresses shown, and don't forget to press RETURN at the end of each line. In the final line, it doesn't matter what appears after the byte containing 0D. As you enter the bytes, you'll see the message appear in the ASCII display in the right part of the screen.

Debug Exercise

The above program is correct, but perhaps you'd like to try your hand at some of the new debugging features offered by the 128. If you want to try this, create a deliberate mistake by entering a wrong branch at location $A010. Enter this line:

A A010 BCC $A005

This instruction is the same size as the previous one, so it doesn't disturb the rest of the program. It causes a branch back to the LDX instruction, which prevents X from reaching its final value, and creates an endless loop. We'll print a lot of G characters. If you choose the bug option, continue with the rest of the exercise and we'll pick up on debugging in a moment.

The BASIC Part

The next step is to save the program to disk. Enter this command:

S "0:MSG",8,A000,A02D

The drive light comes on briefly as the monitor writes the file MSG to disk. Exit the monitor with X; then type NEW and enter this program:

```
MD 100 BANK 0
XP 110 BLOAD "MSG"
MX 120 PRINT "HERE IS A MESSAG
       E--":PRINT
SF 130 BANK 0
GQ 140 SYS 40960
JE 150 PRINT:PRINT:PRINT "ABOV
       E MESSAGE COURTESY OF .
       .."
CE 160 PRINT "..CONFIGURATION
       {SPACE}$0E."
```

Don't bother to add code to check the disk status following the BLOAD. A bad BLOAD causes the program to stop in any case. Note that the program repeats BANK 0. That's not necessary, but it's helpful as a reminder of what's going on.

Let's take stock. If the machine language program stayed in bank 0, it could perform no output, since bank 0 contains no ROM or I/O. If we had chosen bank 15, the program couldn't run at all: The SYS to 40960 would take us to ROM, not to the RAM where our program resides. But when we SYS to our bank 0 address, the machine language program switches the computer to a new configuration that has no official bank number. There will be lots of RAM plus Kernal ROM and I/O chips. Go ahead and run the program.

Debugging

If you chose the bug option, or somehow created a different bug, the program doesn't print the intended message. Compared to earlier computers, the 128 makes it easy to debug such problems.

If you are stuck in an endless machine language loop, hold down the RUN/STOP key and press the reset button. After you've released the button, the 128 puts you in the machine language monitor. Once you have regained control, you can disassemble the program with the command D A000. If you created the deliberate bug mentioned above, correct it by entering this line:

A A010 BCC $A007

Don't try to rerun the program at this point. Since the BASIC program loads the ML from disk, you must replace the old ML file with the correct version. Scratch the old MSG file with this command:

@,S0:MSG

The @ symbol indicates a disk command. It could be followed by a device number—in case you had a disk unit 9—but if none is supplied ahead of the comma, unit 8 is assumed. *S* stands for *scratch*. The characters *0:* indicate that you're using drive 0 (always a good idea, particularly on a 1541 drive, which is prone to save-with-replace problems). After those characters comes the filename itself.

If you're used to the Commodore 64 wedge supplied with the 1541 *Test/Demo* disk, note the difference in syntax for this monitor disk command. The comma after the @ sign is not optional. To confirm that the old MSG file has been scratched, type this command:

@

The computer prints the disk status. Now you can save the new version of MSG:

S "0:MSG",8,A000,A02D

Exit to BASIC and rerun the program to confirm that the fix succeeded. The 128 is a powerful and flexible machine. You can make use of plenty of memory, and there are many mechanisms to help you exploit the machine's potential. It takes a while to get comfortable with a new architecture, but it's all there and accessible. ©

Music Maker 64

Martin F. Staley

If you're interested in creating music on the Commodore 64, this program may provide the power you're looking for. Don't be deceived by its lack of fancy graphics and other frills—at the core of the program is a sophisticated machine language routine that can play complex, multi-part music. Yet you can use the program without being a machine language expert.

The Commodore 64's SID chip is one of the most advanced music chips in any personal computer. However, the 64's BASIC requires several POKE statements to play just a single note, much less an entire song. "Music Maker" vastly simplifies the process of making music on the Commodore 64. You're still responsible for telling the computer what. to play, but this program's system takes much of the drudgery out of entering music. It allows up to about 3000 notes in each voice and independent control of the 64's three voices (tone generators).

Type in and save Music Maker. Although you'll probably be tempted to run the program immediately, you can't run it until you add some notes for it to play. This is done by typing additional DATA statements at the end of the program (when you do this, be careful not to disturb the DATA statements already included in the program). Here's an explanation of what to type.

Entering Music

In Music Maker, each note is specified by two numbers. The first, which I'll call the *note number,* is any integer from 10–127. The first digit or digits of the number correspond to the location of that note in a chromatic scale starting at C and going up to B. Rests should be given note numbers of 0. The following table can be used as a reference.

Note	First digit(s) of note number
[rest]	0
C	1
C#	2
D	3
D#	4
E	5
F	6
F#	7
G	8
G#	9
A	10
A#	11
B	12

The last digit of the note number is the octave (0–7, inclusive) in which the note is located. As examples of note numbers, a D in the fifth octave has a note number of 35, a B in octave zero (the lowest octave) has a note number of 120, an F sharp in the fourth octave has a note number of 74, and a C in the seventh (highest) octave has a note number of 17. This system becomes quite easy to use after only a little practice.

The second number for each note, which I'll call the *length number,* is any integer (whole number) in the range 1–100 (the number can actually range up to 255—see below). The length number can be used in many different ways. One system is to let the length number equal three times the number of thirty-second notes that can fit in the note. When this system is used, a tempo of 950 equals approximately 120 beats per minute—a moderate tempo—and notes and rests have the length numbers shown here.

Note type	Length number
whole	96
half	48
quarter	24
eighth	12
sixteenth	6
thirty-second	3
dotted half	72
dotted quarter	36
dotted eighth	18
dotted sixteenth	9
eighth note triplet	8
sixteenth note triplet	4
thirty-second note triplet	2
sixty-fourth note triplet	1

The most important fact to remember about length numbers is that they must be correct *in relation to one another.* A half note should always be twice the length of a quarter note, and so on. If your musical composition doesn't use triplets, then it's acceptable to divide the length numbers of the other notes by three, since all their numbers are divisible by three. Or, if you need only half, quarter, eighth, and sixteenth notes, they can be given note numbers of eight, four, two, and one, respectively.

In short, the length numbers can be adjusted in various ways to get different kinds of notes. If you need quintuplets, you can use quarter notes with length numbers of ten; then each note in the quintuplet will have a length number of two. If you need a grace note after a quarter note, that particular quarter note can be given a value slightly

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less than the value given to other quarter notes, and the gap filled with the grace note. Just remember that the length numbers must be integers.

Tonguing and Slurring

In music, there are two basic ways to articulate notes: tonguing and slurring. To tongue a note means to place a short interval of silence between that note and the preceding one, whereas slurred notes are connected. The previous description of note numbers stated that the length number for each note must be in the range 1–100. Lengths in this range create tongued notes. If you want a note to be slurred to the next note, add 100 to the length number it would otherwise have. For instance, length 105 gives you a slurred note with the length 5. Note that some attack/decay/sustain/release (ADSR) settings cause notes to be tongued or slurred regardless of the length number.

Program lines 380, 500, and 620 control a staccato feature. In conventional music, staccato notes are more clear-cut and separated than most notes in the song. The amount of staccato for each voice can be from zero (least) to 255 (most), and it remains in effect throughout the entire song. This feature has little effect all by itself, but serves as an enhancement to the ADSR settings and should be used in conjunction with them.

Multiple Voices

If your musical composition uses more than one voice, enter the music data in sequential order. That is, all the music data (a note number and length number for each note or rest) for voice one comes first. All the music data for voice two should come next, followed by the data for voice three.

At the end of the data for each voice, include a value of −1. The negative value serves as a flag to Music Maker that it has reached the end of the data for a voice. When it reaches the third −1 value, Music Maker knows it has read all the data and can begin playing the song.

After you've entered all the music data, save the program using a different filename to distinguish it from the original Music Maker.

Running Music Maker

Once the music data has been entered, you can run Music Maker to hear it play the song. When you do so, the computer spends a short time READing and POKEing the machine language routine into memory. Then it READs the music data at the end of the program and POKEs that into memory as well. After all the data is in place, it transfers control to the machine language routine, which actually plays the music. When the song is finished, the familiar READY prompt appears.

Program lines 120–570 allow you to set the sound parameters: volume, filtering, attack/decay/sustain/release (ADSR), high and low pulse width, and waveforms. These parameters are explained more fully in the 64 user's manual. Line 90 controls the tempo of the music, which can be any integer from 0–65535, with 65535 being the slowest speed. The variable S$ in line 100 controls a special effect known as synchronization. If you set S$ equal to "Y," voices two and three are synchronized with voice one whenever there is a rest in those voices. The result is an enriched sound in voice one.

When it's first run, Music Maker needs to read both the machine language data and the music data. The machine language subroutine modifies itself, so its data must be read and POKEd in every time you run the program. However, the music data does not need to be read each time, and it would be a waste of time to do so, especially if your song is long. If R$="Y" in line 110, the music data will be read. To tell the program to skip the music data, set R$ to some string value other than Y. Do this only after having read the music data at least once. Keep in mind, too, that if you modify this data or add more notes, you must read the data again to hear the new version of the song.

The machine language subroutine that plays the music starts at location 49152 ($C000) and is not relocatable. Since Music Maker uses other addresses in the area $C000–$CFFF and the computer's zero page of memory, you should not attempt to use Music Maker while any other machine language program is running.

Music Maker 64

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

```
RA 10 POKE 53281,15:POKE 53280
      ,12:PRINT"{CLR}{BLK}
      {7 DOWN}{14 RIGHT}PLEASE
      WAIT"
MG 20 FOR N=54272 TO 54296:POK
      E N,0:NEXT
SF 30 :
KK 40 FOR N=49152 TO 49595
CG 50 : READ B:POKE N,B:T=T+B
GJ 60 NEXT
MJ 70 :
FP 80 REM********** ALL VOICES
      **********
HB 90 TP=1000:REM* TEMPO
      {10 SPACES}0-65535
DK 100 S$="Y" :REM* SPECIAL EF
       FECT?{3 SPACES}Y/N
FF 110 R$="Y" :REM* READ MUSIC
        DATA?{2 SPACES}Y/N
CK 120 VO=15{2 SPACES}:REM* VO
       LUME:{11 SPACES}0-15
AA 130 FV=0{3 SPACES}:REM* FIL
       TER OFF/ON: 0/1,2,4
XF 140 HP=64{2 SPACES}:REM* HI
       GH PASS:{6 SPACES}0,64
DR 150 BP=0{3 SPACES}:REM* BAN
       D PASS:{6 SPACES}0,32
JA 160 LP=0{3 SPACES}:REM* LOW
        PASS:{7 SPACES}0,16
EE 170 LC=2{3 SPACES}:REM* LO
       {SPACE}CUTOFF FREQ.: 0-
       7
QB 180 HC=128 :REM* HI CUTOFF
       {SPACE}FREQ.: 0-255
QR 190 RS=240 :REM* RESONANCE:
        16,32,64,128
AS 200 POKE 54295,FV+RS
HA 210 POKE 54296,VO+HP+LP+BP
RX 220 POKE 54293,LC:POKE 5429
       4,HC
FC 230 POKE 53225,TP/256
XF 240 POKE 53224,256*(TP/256-
       INT(TP/256))
RA 250 :
KB 260 :
JF 270 REM********** VOICE 1 *
       ***********
JX 280 AD=85 :REM** ATTACK/DEC
       AY:{4 SPACES}0-255
BF 290 SR=100:REM** SUSTAIN/RE
       LEASE: 0-255
KK 300 SC=50 :REM** STACCATO:
       {8 SPACES}0-255
EA 310 HI=8{2 SPACES}:REM** HI
        PULSE WIDTH:{2 SPACES}
       0-15
HS 320 LO=0{2 SPACES}:REM** LO
        PULSE WIDTH:{2 SPACES}
       0-255
BC 330 W1=65 :REM** WAVEFORM:
       {5 SPACES}17,33,65
RQ 340 POKE 54277,AD:POKE 5427
       8,SR
GP 350 POKE 54275,HI:POKE 5427
       4,LO
RS 360 POKE 53240,W1:POKE 4954
       3,SC
JJ 370 :
EK 380 :
FP 390 REM********** VOICE 2 *
       ***********
CG 400 AD=85 :REM** ATTACK/DEC
```

```
     AY:{4 SPACES}Ø-255
JQ 41Ø SR=1ØØ:REM** SUSTAIN/RE
     LEASE: Ø-255
PB 42Ø SC=5Ø :REM** STACCATO:
     {8 SPACES}Ø-255
BJ 43Ø HI=8{2 SPACES}:REM** HI
      PULSE WIDTH:{2 SPACES}
     Ø-15
MG 44Ø LO=2ØØ:REM** LO PULSE W
     IDTH:{2 SPACES}Ø-255
XM 45Ø W2=65 :REM** WAVEFORM:
     {5 SPACES}17,33,65
SP 46Ø POKE 54284,AD:POKE 5428
     5,SR
CG 47Ø POKE 54282,HI:POKE 5428
     1,LO
XR 48Ø POKE 53241,W2:POKE 4955
     8,SC
QA 49Ø :
FA 5ØØ :
MD 51Ø REM********** VOICE 3 *
     ************
SR 52Ø AD=85 :REM** ATTACK/DEC
     AY:{4 SPACES}Ø-255
FH 53Ø SR=1ØØ:REM** SUSTAIN/RE
     LEASE: Ø-255
GK 54Ø SC=5Ø :REM** STACCATO:
     {8 SPACES}Ø-255
JB 55Ø HI=5{2 SPACES}:REM** HI
      PULSE WIDTH:{2 SPACES}
     Ø-15
CB 56Ø LO=9Ø :REM** LO PULSE W
     IDTH:{2 SPACES}Ø-255
BE 57Ø W3=33 :REM** WAVEFORM:
     {5 SPACES}17,33,65
SG 58Ø POKE 54291,AD:POKE 5429
     2,SR
DS 59Ø POKE 54289,HI:POKE 5428
     8,LO
HK 6ØØ POKE 53242,W3:POKE 4957
     3,SC
GH 61Ø :
MH 62Ø :
XR 63Ø IF S$<>"Y" THEN66Ø
JC 64Ø POKE 492Ø3,173:POKE 492
     Ø4,247:POKE 492Ø5,2Ø7
JX 65Ø POKE 49239,173:POKE 492
     4Ø,245:POKE 49241,2Ø7
ED 66Ø FOR N=5323Ø TO 53232:PO
     KE N,1:NEXT
SE 67Ø POKE 53222,Ø:POKE 53223
     ,Ø
MS 68Ø POKE 53226,Ø:POKE 53227
     ,Ø
GR 69Ø :
PG 7ØØ N=Ø
RC 71Ø IF R$<>"Y" THEN D=256*P
     EEK(53221)+PEEK(5322Ø):
     GOTO92Ø
BS 72Ø FOR C=31998 TO 37998 ST
     EP 3ØØØ
EQ 73Ø : POKE C,Ø:POKE C+1,Ø
FB 74Ø NEXT C
MA 75Ø POKE 5ØØØØ,Ø:POKE 5ØØØ1
     ,Ø
QP 76Ø FOR A=1 TO 12
AE 77Ø : FOR B=Ø TO 15
RQ 78Ø :{3 SPACES}READ C:T=T+C
GK 79Ø :{3 SPACES}POKE 5ØØØØ+2
     Ø*A+B,C
BM 8ØØ : NEXT B
QR 81Ø NEXT A:IF T<>87973 THEN
      PRINT "ERROR IN ML DAT
     A":STOP
MK 82Ø READ A:IF A=-1 THEN N=Ø
     :GOTO85Ø
BG 83Ø READ B:POKE 32ØØØ+N,A:P
     OKE 32ØØ1+N,B:IF B>1ØØ
     {SPACE}THEN B=B-1ØØ
DH 84Ø N=N+2:D=D+B:GOTO82Ø
PD 85Ø READ A:IF A=-1 THEN N=Ø
     :GOTO87Ø
KX 86Ø READ B:POKE 35ØØØ+N,A:P
     OKE 35ØØ1+N,B:N=N+2:GOT
     O85Ø
DR 87Ø READ A:IF A=-1 THEN N=Ø
     :GOTO9ØØ
QX 88Ø READ B:POKE 38ØØØ+N,A:P
     OKE 38ØØ1+N,B:N=N+2:GOT
     O87Ø
KK 89Ø :
ED 9ØØ POKE 53221,D/256
RC 91Ø POKE 5322Ø,256*(D/256-I
     NT(D/256))
QD 92Ø PRINT"{CLR}{BLK}
     {7 DOWN}{16 RIGHT}PLAYI
     NG":SYS49152
JC 93Ø FOR N=54272 TO 54296:PO
     KE N,Ø:NEXT
GA 94Ø END
ER 95Ø :
JR 96Ø :
AJ 97Ø REM**** MACHINE LANGUAG
     E DATA ****
XX 98Ø DATA173,254,124,1Ø,17Ø,
     189,8Ø,195,141,243,2Ø7,
     189,81,195,141,242,2Ø7,
     173
AE 99Ø DATA182,136,1Ø,17Ø,189,
     8Ø,195,141,245,2Ø7,189,
     81,195,141,244,2Ø7,173,
     11Ø
SP 1ØØØ DATA148,1Ø,17Ø,189,8Ø,
     195,141,247,2Ø7,189,81
     ,195,141,246,2Ø7,76,75
     ,192,2Ø8
RJ 1Ø1Ø DATA19,173,243,2Ø7,24Ø
     ,14,141,15,212,173,242
     ,2Ø7,1Ø5,8,141,14,212,
     76,87
SA 1Ø2Ø DATA192,173,247,2Ø7,14
     1,15,212,173,246,2Ø7,1
     41,14,212,76,111,192,2
     Ø8,19
SE 1Ø3Ø DATA173,243,2Ø7,24Ø,14
     ,141,8,212,173,242,2Ø7
     ,233,8,141,7,212,76,12
     3,192
KC 1Ø4Ø DATA173,245,2Ø7,141,8,
     212,173,244,2Ø7,141,7,
     212,173,243,2Ø7,141,1,
     212,173
CK 1Ø5Ø DATA242,2Ø7,141,Ø,212,
     173,248,2Ø7,141,4,212,
     133,251,173,249,2Ø7,14
     1,11,212
JE 1Ø6Ø DATA133,252,173,25Ø,2Ø
     7,141,18,212,133,253,2
     Ø6,238,2Ø7,173,238,2Ø7
     ,2Ø1,1ØØ
HE 1Ø7Ø DATA24Ø,8,2Ø1,Ø,2Ø8,42
     ,162,16,134,251,238,19
     4,192,2Ø8,3,238,195,19
     2,238
DA 1Ø8Ø DATA194,192,2Ø8,3,238,
     195,192,173,255,124,14
     1,238,2Ø7,238,1,192,2Ø
     8,3,238
QQ 1Ø9Ø DATA2,192,238,1,192,2Ø
     8,3,238,2,192,2Ø6,239,
     2Ø7,173,239,2Ø7,2Ø1,1Ø
     Ø,24Ø,8
RC 11ØØ DATA2Ø1,Ø,2Ø8,42,162,1
     6,134,252,238,25Ø,192,
     2Ø8,3,238,251,192,238,
     25Ø,192
BD 111Ø DATA2Ø8,3,238,251,192,
     173,183,136,141,239,2Ø
     7,238,18,192,2Ø8,3,238
     ,19,192
MP 112Ø DATA238,18,192,2Ø8,3,2
     38,19,192,2Ø6,24Ø,2Ø7,
     173,24Ø,2Ø7,2Ø1,1ØØ,24
     Ø,8,2Ø1
EF 113Ø DATA Ø,2Ø8,42,162,16,1
     34,253,238,5Ø,193,2Ø8,
     3,238,51,193,238,5Ø,19
     3,2Ø8,3
CE 114Ø DATA238,51,193,173,111
     ,148,141,24Ø,2Ø7,238,3
     5,192,2Ø8,3,238,36,192
     ,238,35
JF 115Ø DATA192,2Ø8,3,238,36,1
     92,174,232,2Ø7,172,233
     ,2Ø7,236,234,2Ø7,2Ø8,5
     ,2Ø4,235
JG 116Ø DATA2Ø7,24Ø,11,238,234
     ,2Ø7,2Ø8,3,238,235,2Ø7
     ,76,77,193,238,23Ø,2Ø7
     ,2Ø8,3
DK 117Ø DATA238,231,2Ø7,173,23
     Ø,2Ø7,2Ø5,228,2Ø7,2Ø8,
     9,173,231,2Ø7,2Ø5,229,
     2Ø7,2Ø8
KQ 118Ø DATA1,96,32,234,255,32
     ,225,255,2Ø8,1,96,162,
     Ø,224,Ø,24Ø,9,165,251,
     141,4
KG 119Ø DATA212,232,76,134,193
     ,162,Ø,224,Ø,24Ø,9,165
     ,252,141,11,212,232,76
     ,149,193
SD 12ØØ DATA162,Ø,224,Ø,24Ø,9,
     165,253,141,18,212,232
     ,76,164,193,169,Ø,141,
     234,2Ø7
PC 121Ø DATA141,235,2Ø7,76,Ø,1
     92
PJ 122Ø DATA1,12,2,24,4,49,8,9
     8,16,195,33,134,67,12,
     134,24
RC 123Ø DATA1,28,2,56,4,113,8,
     225,17,194,35,132,71,9
     ,142,18
XP 124Ø DATA1,45,2,9Ø,4,18Ø,9,
     1Ø4,18,2Ø9,37,161,75,6
     6,15Ø,132
AR 125Ø DATA1,63,2,126,4,252,9
     ,247,19,239,39,222,79,
     188,159,12Ø
EA 126Ø DATA1,82,2,162,5,72,1Ø
     ,143,21,3Ø,42,61,84,12
     2,168,243
FD 127Ø DATA1,1Ø2,2,2Ø4,5,152,
     11,48,22,96,44,192,89,
     127,178,255
PF 128Ø DATA1,123,2,247,5,237,
     11,218,23,18Ø,47,1Ø5,9
     4,21Ø,189,164
JX 129Ø DATA1,146,3,36,6,71,12
     ,143,25,29,5Ø,59,1ØØ,1
     17,2ØØ,235
QR 13ØØ DATA1,17Ø,3,83,6,167,1
     3,78,26,156,53,55,1Ø6,
     11Ø,212,221
HJ 131Ø DATA1,195,3,134,7,12,1
     4,24,28,49,56,97,112,1
     95,225,133
CC 132Ø DATA1,222,3,188,7,119,
     14,239,29,222,59,188,1
     19,119,238,238
DK 133Ø DATA1,25Ø,3,245,7,233,
     15,21Ø,31,164,63,73,12
     6,146,253,35
KF 134Ø :
RJ 135Ø REM** ENTER MUSIC DATA
       BELOW
```

©

Printer Master

David Stanton

While the dot matrix printer is a wonderfully flexible device, accessing its many features can sometimes be confusing. This convenient, menu-driven program helps you get the most out of your printer by simplifying the process of choosing special printer features. For all Apple II series computers with a dot matrix printer.

Buying a printer has always been a bit complicated. Should it have a serial or a parallel interface? What printers will be compatible with your brand of computer? What is a reasonable price? Which printers offer the best value for the money? Should you select a dot matrix machine for its speed and its graphics capability, or opt for the letter-quality print of the daisy wheel?

Many magazines have run articles comparing printers of all types, feature for feature. After some investigation, most of us end up with a printer that suits our needs. For many, that means a medium-priced dot matrix printer.

Except for the most demanding purchaser, the near-letter-quality font of modern dot matrix machines can sometimes even prove acceptable for occasional business use. As a bonus, the programmability of these inexpensive workhorses provides a flexibility unmatched by the best daisy wheel printers. Unfortunately, a new purchaser's elation is too often dampened after discovering the pages in the user's manual that explain all the control characters required to implement those fancy fonts, foreign alphabets, and optional character sets.

Enter "Printer Master." This menu-driven program remembers those optional features along with their confusing control characters and allows you to configure your printer exactly the way you want it without the necessity of understanding all the details outlined in your printer's manual.

While Printer Master does not access some of the more obscure printer functions, it does allow easy access to foreign alphabets and special character set combinations. Simply run Printer Master, selecting your desired font. Then use your word processor to print old or new text files. With a bit of experimentation, you should be able to achieve exactly the desired results for every occasion.

Type in Printer Master and save the the program to disk before you run it. Since Printer Master is menu-driven and completely self-prompting, you won't need elaborate instructions to use it. Just follow the onscreen prompts and respond to the questions as indicated.

When you run the program it divides the screen into two parts. The upper section displays a series of menus listing the available features. As you select those items, the bottom portion will display the current status of each option. Occasionally the status will not change when an item is selected. This occurs either because the printer cannot use that feature or the status of a different selection precludes the use of that option. For example, Okidata printers prohibit the use of near-letter-quality print in condensed mode.

To check the appearance of a font selection, choose "Print Test" from the main menu. Printer Master prints a short message to help you diagnose any problems. If anything is not as it should be, the most likely reason is improper variable values; in the next section, we'll learn how to change them.

Making Adjustments

As published, the program is designed to work with the following popular printers:

Apple Imagewriter
Okidata Microline series
Epson FX series
C. Itoh 8510 series
BMC dot matrix printer

Some models from these manufacturers offer different options. As a rule, Printer Master is compatible with the most versatile printer from each manufacturer. For models that lack some of those advanced features, you may want to replace the appropriate variable values with zeros so you'll have an accurate indication of the printer's capabilities in the configuration display at the bottom of the screen. If you attempt to use a feature that is unavailable on your printer, Printer Master could produce unpredictable results.

For example, the Microline 182 lacks near-letter-quality (NLQ) print mode. By placing a zero in the variable NL, you can assure that the program will not attempt a nonexistent NLQ mode. Don't be afraid to experiment. Turning the printer off and on again always resets it to its original state no matter what commands the program may have sent.

For those who have a different printer, the explanation of the relevant variables should allow you to configure the program to fit your machine. Find the section in your manual that lists the decimal values needed to control each function, and insert those values in the appropriate variables listed in lines 450–460. Table 1 explains the functions of all the relevant variables.

Using this method, you should have little trouble creating a version for any dot matrix printer to which you may have access. Be sure to use proper values, though, or be prepared for strange results. No harm will be done to the printer, but the printout can look very peculiar.

Interfaces, Dip Switches, And Power-Up Defaults

Those who own a printer may already know something about interfaces. Third party interfaces offer a vast array of programmable and switch-selectable configurations. Printer Master does not affect your interface at all.

Printers, too, can be programmed and modified. Internal dip switches control the power-up default conditions that determine how your printer works when you first turn it on. Printer Master assumes that your printer's switches are set in the standard mode established at the factory. If this is not the case, you may need to change the string variable values listed below to conform to your machine's power-up condition. This is neither as technical nor as difficult as it may sound. These variables are defined in line 2140 of the program.

Once you have the minor adjustments necessary, Printer Master will help you show off all the powerful features of your dot matrix printer. Now you can print in a wide range of font sizes and print quality. And foreign language printing becomes simple as well. To print longer and wider spreadsheets, simply choose a smaller print size. With Printer Master you are likely to enjoy using your printer much more.

Variables

Each of the following variables must be the decimal number that sets the mode indicated. While the values vary, each printer's manual has a chart that shows the proper values for its available features. If your printer does not have a particular feature, simply set that value to 0.

A1	ASCII (U) character set
A2	ASCII (S) character set
BG	block graphics character set (when available)
BR	British character set
CS	prepares character set for new selection
DA	Danish character set
DQ	sets print quality to data (low quality/high speed)
DS	enhanced mode off
DU	Dutch character set
DW	sets double width (elongated)
EL	sets elite mode (12 CPI)
EM	sets emphasized print mode
EN	sets enhanced print mode
EO	turns off emphasized print mode
FC	French/Canadian character set
FI	sets condensed mode (17 CPI)
FR	French character set
G1	sets graphic density to single density graphics
G2	sets graphic density to double density graphics
GA	Greek character set (C. Itoh)
GE	German character set
IO	Italic mode off
IB	IBM character set code (when available)
IL	Italian character set
JA	Japanese language set
L1	sets lines per inch to 6
L2	sets line per inch to 8
LS	Temporarily holds selected language code. This value is used by the language routine. It is not set in the printer parameter lines.
NL	sets printer to near letter quality (Bold, if no NLQ)
NO	establishes standard (normal) character set
NW	Norwegian character set
PC	informs printer that next value is a printer command
PI	sets pica mode (10 CPI)
RE	resets printer defaults
SL	sets italic (slant) mode
SP	Spanish character set
SW	Swedish character set

String Variables

CS$	current character set selection
EM$	Y or N condition of emphasized print
EN$	Y or N condition of enhanced print
GD$	current graphic density selection
LI$	current line spacing selection (6 LPI/8 LPI)
LS$	current language set selection
PQ$	current print quality selection
PR$	number of printer type (not user modifiable)
PS$	current print size selection

Printer Master

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
96 100 PØ$ = CHR$ (4) + "PR#Ø":P
       1$ = CHR$ (4) + "PR#1"
12 14Ø HOME : VTAB 5: PRINT TAB(
        12)"PRINTER MASTER"
25 15Ø VTAB 9: PRINT TAB( 5)"1.
       APPLE IMAGEWRITER OR COMP
       ATIBLE": PRINT TAB( 5)"2.
        BMC DOT-MATRIX"
D3 155 PRINT TAB( 5)"3. C. ITOH
       851Ø OR PROWRITER": PRINT
        TAB( 5)"4. EPSON FX OR C
       OMPATIBLE": PRINT TAB( 5)
       "5. OKIDATA PARALLEL": PR
       INT TAB( 5)"6. CUSTOM PRI
       NTER"
71 16Ø VTAB 18: HTAB 1Ø: PRINT "
       SELECT YOUR PRINTER:";: G
       ET PR$: IF PR$ < "1" OR P
       R$ > "6" THEN 16Ø
F7 17Ø PRINT PR$
7B 18Ø VTAB 2Ø: HTAB 1: INVERSE
       : PRINT "BE SURE YOUR PRI
       NTER IS ON AND SELECTED!"
       : NORMAL
58 19Ø HTAB 23: PRINT TAB( 2Ø)"P
       RESS ANY KEY:";: GET K$:
       IF K$ = "" THEN 19Ø
Ø7 195 PRINT
83 2ØØ REM
56 21Ø REM  PRINTER SETUPS
87 22Ø REM
CC 23Ø ON VAL (PR$) GOTO 24Ø,28Ø
       ,32Ø,36Ø,4ØØ,44Ø
E1 24Ø REM  PRINTER CONTROL VARI
       ABLES--APPLE IMAGEWRITER-
       -FOREIGN LANGUAGES ARE AV
       AILABLE BUT NOT IMPLEMENT
       ED HERE
B4 25Ø A1 = ØØ:A2 = ØØ:BG = ØØ:B
       R = ØØ:CS = ØØ:DA = ØØ:DQ
        = ØØ:DS = 34:DU = ØØ:DW
       = 14:EL = 69:EM = 33:EN =
        ØØ:EO = ØØ:FC = ØØ:FI =
       81:FR = ØØ:G1 = ØØ:G2 = Ø
       Ø
B6 26Ø GD = ØØ:GE = ØØ:IO = ØØ:I
       B = ØØ:IL = ØØ:L1 = 65:L2
        = 66:NL = ØØ:NO = 36:NW
       = ØØ:PC = 27:PI = 78:RE =
        99:SL = ØØ:SP = ØØ:SW =
       ØØ
22 27Ø GOTO 47Ø
F2 28Ø REM --BMC MODELS
```

```
79 290 A1 = 00:A2 = 00:BG = 00:BR = 00:CS = 00:DA = 00:DQ = 53:DS = 72:DU = 00:DW = 49:EL = 00:EM = 69:EN = 71:EO = 70:FC = 00:FI = 15:FR = 00:G1 = 75:G2 = 76
7A 300 GD = 1:GE = 00:IO = 00:IB = 00:IL = 00:L1 = 50:L2 = 48:NL = 00:NO = 00:NW = 00:PC = 27:PI = 18:RE = 64:SL = 52:SP = 00:SW = 00
17 310 GOTO 470
AC 320 REM --C.ITOH 8510A AND OTHER C.ITOH
4B 330 A1 = 2:A2 = 00:BG = 35:BR = 3:CS = 15:DA = 8:DQ = 34:DS = 34:DU = 10:DW = 14:EL = 69:EM = 33:EN = 00:EO = 34:FC = 14:FI = 81:FR = 1:G1 = 78:G2 = 80:GA = 38
CA 340 GD = 1:GE = 4:IO = 00:IB = 00:IL = 6:L1 = 65:L2 = 66:NL = 00:NO = 36:NW = 9:PC = 27:PI = 78:RE = 00:SL = 00:SP = 7:SW = 5
1F 350 GOTO 470
EB 360 REM --EPSON FX SERIES
1C 370 A1 = 00:A2 = 53:BG = 00:BR = 3:CS = 82:DA = 4:DQ = 53:DS = 72:DU = 00:DW = 49:EL = 77:EM = 69:EN = 71:EO = 70:FC = 00:FI = 15:FR = 1:G1 = 75:G2 = 76:JA = 8
15 380 GD = 00:GE = 2:IO = 53:IB = 00:IL = 6:L1 = 50:L2 = 48:NL = 00:NO = 0:NW = 00:PC = 27:PI = 80:RE = 64:SL = 52:SP = 7:SW = 5
27 390 GOTO 470
B0 400 REM --OKIDATA MICROLINE (STANDARD PARALLEL MODELS)
29 410 A1 = 65:A2 = 64:BG = 49:BR = 66:CS = 33:DA = 70:DQ = 48:DS = 0:DU = 72:DW = 31:EL = 28:EM = 84:EN = 72:EO = 73:FC = 74:FI = 29:FR = 68:G1 = 80:G2 = 82
DA 420 GD = 1:GE = 67:IO = 0:IB = 50:IL = 73:L1 = 54:L2 = 56:NL = 49:NO = 48:NW = 71:PC = 27:PI = 30:RE = 24:SL = 47:SP = 75:SW = 69
1C 430 GOTO 470
3C 440 REM --CUSTOM PRINTER: SEE DOCUMENTATION
A7 450 A1 = 00:A2 = 00:BG = 00:BR = 00:CS = 00:DA = 00:DQ = 00:DS = 00:DU = 00:DW = 00:EL = 00:EM = 00:EN = 00:EO = 00:FC = 00:FI = 00:FR = 00:G1 = 00:G2 = 00
8D 460 GD = 00:GE = 00:IO = 00:IB = 00:IL = 00:L1 = 00:L2 = 00:NL = 00:NO = 00:NW = 00:PC = 00:PI = 00:RE = 00:SL = 00:SP = 00:SW = 00
1E 470 GOSUB 2140: REM RESET PRINTER TO POWER-UP DEFAULTS
95 480 REM
12 490 REM    DISPLAY MENUS
86 500 REM
DD 510 GOSUB 1730
F3 515 GOSUB 1260
F4 520 VTAB 1: PRINT TAB( 12)"MAIN MENU": PRINT : PRINT TAB( 5)"1. CHARACTER SETS": PRINT TAB( 5)"2. LANGUAGE SETS": PRINT TAB( 5)"3. PRINT STYLES"
49 530 PRINT TAB( 5)"4. SPECIAL FEATURES": PRINT TAB( 5)"5. RESET PRINTER TO DEFAULTS": PRINT TAB( 5)"6. PRINT TEST": PRINT TAB( 5)"7. SELECT PRINT QUALITY"
B8 540 PRINT TAB( 5)"8. EXIT"
21 550 VTAB 14: HTAB 15: INPUT "ENTER YOUR SELECTION:";S$: IF VAL (S$) < 1 OR VAL (S$) > 8 THEN 550
9C 560 ON VAL (S$) GOSUB 590,650,1040,1110,1730,1240,1180,580
A9 570 GOTO 515
66 580 POKE 35,24: HOME : END
AA 585 REM
DD 590 REM  CHARACTER SETS
AC 595 REM
8B 600 HOME : PRINT TAB( 12)"CHARACTER SETS": PRINT : PRINT TAB( 5)"1. IBM CHARACTER SET": PRINT TAB( 5)"2. BLOCK GRAPHICS SET"
77 610 PRINT TAB( 5)"3. NORMAL CHARACTER SET": PRINT TAB( 5)"4. DOWNLOADABLE CHARACTER SET"
D2 620 PRINT TAB( 5)"5. GREEK CHARACTER SET (C.ITOH)"
E7 630 VTAB 14: HTAB 15: INPUT "ENTER YOUR SELECTION:";S$: IF VAL (S$) < 1 OR VAL (S$) > 5 THEN 630
4C 640 PRINT P1$: ON VAL (S$) GOSUB 1740,1770,1830,1880,1890: PRINT P0$: RETURN
A3 645 REM
E5 650 REM SELECT LANGUAGE SET
A5 655 REM
C4 660 LS = 0: HOME : PRINT TAB( 12)"LANGUAGE SETS": PRINT : PRINT TAB( 2)"1. ASCII(S)";: PRINT TAB( 20)"7. DANISH"
74 670 PRINT TAB( 2)"2. ASCII(U)";: PRINT TAB( 20)"8. NORWEGIAN"
07 680 PRINT TAB( 2)"3. BRITISH";: PRINT TAB( 20)"9. DUTCH"
65 690 PRINT TAB( 2)"4. GERMAN";: PRINT TAB( 20)"10.ITALIAN"
74 700 PRINT TAB( 2)"5. FRENCH";: PRINT TAB( 20)"11.FR/CAN."
87 710 PRINT TAB( 2)"6. SWEDISH";: PRINT TAB( 20)"12.SPANISH": PRINT TAB( 20)"13.JAPANESE"
59 720 VTAB 14: HTAB 15: INPUT "ENTER YOUR SELECTION:";S$: IF VAL (S$) < 1 OR VAL (S$) > 13 THEN 720
0E 730 IF PR$ = "3" THEN PRINT P1$: PRINT CHR$ (PC); CHR$ (68); CHR$ (15): PRINT P0$:CT = CS:CS = 90
6B 740 ON VAL (S$) GOTO 750,770,790,810,830,850,870,890,910,930,950,970,990
47 750 IF A2 > 0 THEN LS$ = "ASCII(S)":LS = A2: GOTO 1010
63 760 GOTO 1020
0C 770 IF A1 > 0 THEN LS$ = "ASCII(U)":LS = A1: GOTO 1010
67 780 GOTO 1020
4E 790 IF BR > 0 THEN LS$ = "BRITISH":LS = BR: GOTO 1010
58 800 GOTO 1020
A8 810 IF GE > 0 THEN LS$ = "GERMAN":LS = GE: GOTO 1010
5C 820 GOTO 1020
24 830 IF FR > 0 THEN LS$ = "FRENCH":LS = FR: GOTO 1010
60 840 GOTO 1020
9B 850 IF SW > 0 THEN LS$ = "SWEDISH":LS = SW: GOTO 1010
64 860 GOTO 1020
86 870 IF DA > 0 THEN LS$ = "DANISH":LS = DA: GOTO 1010
68 880 GOTO 1020
F3 890 IF NW > 0 THEN LS$ = "NORW.":LS = NW: GOTO 1010
59 900 GOTO 1020
6E 910 IF DU > 0 THEN LS$ = "DUTCH":LS = DU: GOTO 1010
5D 920 GOTO 1020
75 930 IF IL > 0 THEN LS$ = "ITAL.":LS = IL: GOTO 1010
61 940 GOTO 1020
61 950 IF FC > 0 THEN LS$ = "FR/CAN":LS = FC: GOTO 1010
65 960 GOTO 1020
24 970 IF SP > 0 THEN LS$ = "SPANISH":LS = SP: GOTO 1010
69 980 GOTO 1020
35 990 IF JA > 0 THEN LS$ = "JAPANESE":LS = JA: GOTO 1010
52 1000 GOTO 1020
23 1010 PRINT P1$: PRINT CHR$ (PC); CHR$ (CS); CHR$ (LS): PRINT P0$
03 1020 IF PR$ = "3" THEN CS = CT
DD 1030 RETURN
E8 1035 REM
C8 1040 REM  PRINT SIZE MENU
EC 1045 REM
18 1050 HOME : VTAB 1: HTAB 12: PRINT "PRINT STYLES"
E4 1060 PRINT : PRINT TAB( 5)"1. PICA"
67 1070 PRINT TAB( 5)"2. ELITE": PRINT TAB( 5)"3. FINE": PRINT TAB( 5)"4. PICA D.W.": PRINT TAB( 5)"5. ELITE D.W.": PRINT TAB( 5)"6. FINE D.W."
14 1080 VTAB 14: HTAB 15: INPUT "ENTER YOUR SELECTION:"; S$: IF VAL (S$) < 1 OR VAL (S$) > 6 THEN 1080
E4 1090 PRINT P1$: ON VAL (S$) GOSUB 1680,1620,1560,1500,1440,1380: PRINT P0$
D3 1100 RETURN
DE 1105 REM
D8 1110 REM SPECIAL FEATURES
E2 1115 REM
0F 1120 HOME : PRINT TAB( 12)"GRAPHICS OPTIONS": PRINT : PRINT TAB( 5)"1. EMPHASIZED PRINT": PRINT TAB( 5)"2. ENHANCED PRINT"
07 1130 PRINT TAB( 5)"3. GRAPHIC DENSITY (SINGLE/DOUBLE)": PRINT TAB( 5)"4. LINES PER INCH (6/8)  ": PRINT TAB( 5)"5. RETURN TO MAIN MENU"
AD 1140 VTAB 14: HTAB 15: INPUT "ENTER YOUR SELECTION:"; S$: IF VAL (S$) < 1 OR VAL (S$) > 5 THEN 1140
```

```
C3 1150 IF S$ = "5" THEN RETURN
A6 1160 IF PQ$ = "NLQ" AND (S$ = "1" OR S$ = "2") THEN RETURN
0D 1170 PRINT P1$: ON VAL (S$) GOSUB 2010,2030,2070,2100 : PRINT P0$: GOSUB 1260: GOTO 1110
FA 1175 REM
11 1180 REM PRINT QUALITY
FE 1185 REM
87 1190 HOME : PRINT TAB( 12)"PRINT QUALITY": PRINT : PRINT TAB( 5)"1. DATA QUALITY": PRINT : PRINT TAB( 5)"2. SLANT MODE": PRINT : PRINT TAB( 5)"3. NEAR LETTER QUALITY"
27 1200 VTAB 14: HTAB 15: INPUT "ENTER YOUR SELECTION:";S$: IF VAL (S$) < 1 OR VAL (S$) > 3 THEN 1200
FE 1210 IF PR$ < > "5" THEN 1230
F6 1220 PRINT P1$: PRINT CHR$ (27); CHR$ (33); CHR$ (42) : PRINT CHR$ (27); CHR$ (48):PQ$ = "DATA": PRINT P0$
39 1230 PRINT P1$: ON VAL (S$) GOSUB 1910,1960,1930: PRINT P0$: RETURN
EC 1235 REM
DE 1240 REM  PRINT TEST
F0 1245 REM
8D 1250 PRINT P1$: PRINT "This is ";LS$;", ";PS$;", ";PQ$;" QUALITY.{}|!0#$%^&[]\@--ENHANCED=";EN$;"-EMPHASIZED=";EM$;".": PRINT P0$: RETURN
F4 1255 REM
1C 1260 REM OPTION SCREEN UPDATE
F8 1265 REM
3F 1270 POKE 35,24: HOME : VTAB 17: INVERSE : PRINT SPC( 40): NORMAL
08 1280 VTAB 19: PRINT TAB( 2)"CHAR. SET:";CS$;: PRINT TAB( 22)"LANG. SET: ";LS$
F1 1290 PRINT TAB( 22)"LINES/INCH:";LI$
BE 1300 PRINT TAB( 2)"PR.SIZE: ";PS$;: PRINT TAB( 22)"GRAPHIC DENS.: ";GD$
1D 1310 PRINT TAB( 22)"EMPHASIZED:";EM$
AD 1320 PRINT TAB( 2)"PR.QUALITY: ";PQ$;: PRINT TAB( 22)"ENHANCED:"EN$;
46 1330 POKE 35,16: RETURN
CA 1340 REM
2F 1350 REM  CONTROL ROUTINES
D2 1360 REM
5C 1370 REM SET FINE DW
28 1380 IF FI = 0 OR DW = 0 OR PQ$ = "SLANT" THEN GOTO 1420
44 1390 IF PR$ = "5" THEN PRINT CHR$ (FI); CHR$ (DW): GOTO 1410: REM    FINE DW: OKI
54 1400 GOSUB 2150: PRINT CHR$ (PC); CHR$ (FI): REM SET DW AND FINE PRINT
01 1410 PS$ = "FINE DW"
E1 1420 RETURN
82 1430 REM SET ELITE DW
CF 1440 IF EL = 0 OR DW = 0 THEN GOTO 1480
51 1450 IF PR$ = "5" THEN PRINT CHR$ (EL); CHR$ (DW): GOTO 1470: REM    ELITE DW
63 1460 GOSUB 2150: PRINT CHR$ (27); CHR$ (EL)
84 1470 PS$ = "ELITE DW"
F9 1480 RETURN
5D 1490 REM SET PICA DW
F4 1500 IF PI = 0 OR DW = 0 THEN GOTO 1540
95 1510 IF PR$ = "5" THEN PRINT CHR$ (PI); CHR$ (DW): GOTO 1530: REM    PICA DW
95 1520 GOSUB 2150: PRINT CHR$ (PC); CHR$ (PI)
86 1530 PS$ = "PICA DW"
EB 1540 RETURN
3B 1550 REM SET FINE
01 1560 IF FI = 0 OR PQ$ = "SLANT" THEN GOTO 1600
64 1570 IF PR$ = "5" THEN PRINT CHR$ (FI): GOTO 1590: REM OKI   FINE
B9 1580 GOSUB 2190: PRINT CHR$ (PC); CHR$ (FI)
97 1590 PS$ = "FINE"
DD 1600 RETURN
44 1610 REM SET ELITE
F7 1620 IF EL = 0 THEN GOTO 1660
7F 1630 IF PR$ = "5" THEN PRINT CHR$ (EL): GOTO 1650: REM   OKI ELITE
B5 1640 GOSUB 2190: PRINT CHR$ (PC); CHR$ (EL)
69 1650 PS$ = "ELITE"
F5 1660 RETURN
3C 1670 REM SET PICA
19 1680 IF PI = 0 THEN GOTO 1720
4D 1690 IF PR$ = "5" THEN PRINT CHR$ (PI): GOTO 1710: REM OKI PICA
B1 1700 GOSUB 2190: PRINT CHR$ (PC); CHR$ (PI)
F6 1710 PS$ = "PICA"
E7 1720 RETURN
97 1730 PRINT P1$: PRINT CHR$ (PC); CHR$ (RE): PRINT P0$ : GOSUB 2140: RETURN
EA 1740 IF IB > 0 THEN PRINT CHR$ (PC); CHR$ (CS); CHR$ (IB):CS$ = "IBM"
F3 1750 RETURN
4D 1760 REM BLOCK GRAPHICS CHARACTER SET
8A 1770 IF BG = 0 THEN GOTO 1810
8C 1780 IF PR$ = "5" THEN PRINT CHR$ (PC); CHR$ (CS); CHR$ (BG): GOTO 1800
39 1790 PRINT CHR$ (PC); CHR$ (BG)
FE 1800 CS$ = "B.GRAPHICS"
E5 1810 RETURN
B6 1820 REM NORMAL CHARACTER SET
E3 1830 IF NO = 0 THEN GOTO 1870
05 1840 IF PR$ = "5" THEN PRINT CHR$ (PC); CHR$ (CS); CHR$ (NO): GOTO 1860
39 1850 PRINT CHR$ (PC); CHR$ (NO)
B3 1860 CS$ = "NORM."
FD 1870 RETURN
06 1875 REM DOWNLOADABLE CHARACTER SET
02 1880 RETURN
A0 1890 IF GA > 0 THEN PRINT CHR$ (PC); CHR$ (GA):CS$ = "GREEK": REM GREEK SET (C.ITOH)
E3 1900 RETURN
37 1910 IF DQ > 0 THEN PRINT CHR$ (PC); CHR$ (DQ):PQ$ = "DATA": REM DATA QUALITY
EB 1920 RETURN
14 1930 IF NL > 0 THEN PRINT CHR$ (PC); CHR$ (NL):PQ$ = "NLQ": REM SET NL QUALITY
F3 1940 RETURN
6C 1950 REM SET SLANT MODE
EB 1960 IF SL = 0 OR PS$ = "FINE" OR PS$ = "FINE DW" THEN 2000
B4 1970 IF PR$ = "5" THEN PRINT CHR$ (PC); CHR$ (CS); CHR$ (SL): GOTO 1990
C6 1980 PRINT CHR$ (PC); CHR$ (SL)
9C 1990 PQ$ = "SLANT"
D2 2000 RETURN
FB 2010 IF EM > 0 AND EM$ = "N" THEN PRINT CHR$ (PC); CHR$ (EM):EM$ = "Y": RETURN : REM EMPHASIZED PRINT ON
64 2020 GOTO 2040
B5 2030 IF EN > 0 AND EN$ = "N" THEN PRINT CHR$ (PC); CHR$ (EN):EN$ = "Y": RETURN : REM  ENHANCED PRINT ON
F6 2040 IF EM$ = "Y" OR EN$ = "Y" THEN PRINT CHR$ (PC); CHR$ (EO): IF DS > 0 THEN PRINT CHR$ (PC); CHR$ (DS)
74 2050 EN$ = "N":EM$ = "N": RETURN : REM  EMPHASIZED/ENHANCED PRINT OFF
B7 2060 REM GRAPHIC DENSITY TOGGLE
CA 2070 IF G2 > 0 AND GD$ = "1" THEN PRINT CHR$ (PC); CHR$ (G2):GD$ = "2": GOTO 2090
6A 2080 IF GD$ = "2" THEN PRINT CHR$ (PC); CHR$ (G1):GD$ = "1"
F6 2090 RETURN
A2 2100 REM  TOGGLE LINE SPACING
4B 2110 IF L2 > 0 AND LI$ = "6" THEN PRINT CHR$ (PC); CHR$ (L2):LI$ = "8": GOTO 2130
4B 2120 IF LI$ = "8" THEN PRINT CHR$ (PC); CHR$ (L1):LI$ = "6"
E0 2130 RETURN
80 2140 PS$ = "PICA":GD$ = "1":CS$ = "NORM.":LS$ = "ASCII(S)":PQ$ = "DATA":EN$ = "N":EM$ = "N":LI$ = "6" : RETURN : REM SET DEFAULTS
0A 2150 REM SET DOUBLE WIDTH MODE
95 2160 IF PR$ = "1" OR PR$ = "3" THEN PRINT CHR$ (DW): GOTO 2180
8F 2170 PRINT CHR$ (PC);"W"; CHR$ (1)
F4 2180 RETURN
04 2190 REM RESET DOUBLE WIDTH MODE
A8 2200 IF PR$ = "1" OR PR$ = "3" THEN PRINT CHR$ (15): GOTO 2220
71 2210 PRINT CHR$ (PC);"W"; CHR$ (0)
DE 2220 RETURN
```

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ML Write For Atari

Danny Maupin

Though it's designed particularly for machine language (ML) programmers, this program may come in handy even if you're not an ML expert. It converts any ML program into DATA statements for use in a BASIC program. "ML Write" runs on any eight-bit Atari computer.

If you're a machine language (ML) programmer, you've probably faced the task of incorporating an ML routine into a BASIC program. The usual method is to include the ML in the form of DATA values which the BASIC program READs and POKEs into memory. Performing this conversion is a tedious task, since you must determine the numeric value of every byte in the ML program and manually type in all the necessary DATA statements. "ML Write" automates the entire process, reading the ML data from disk or tape and creating a series of DATA statements which can easily be merged with any BASIC program. The resulting series of BASIC lines also includes commands to READ the DATA and POKE it into memory.

Type in the program and save it to disk or tape. When you run ML Write, it asks you to enter the line number increment for the DATA statements. This value determines how much the line number increases for each new DATA line. The next prompt asks for the filename of the object code: This is the file that contains the machine language. Answer this prompt by entering the correct device specifier, followed by the filename. For instance, you would convert the file GAME by entering D:GAME for disk or C: for tape.

The last prompt asks for the starting line number. For instance, if you choose a line increment of 10 and a starting line number of 200, the first DATA line is 200, the second is line 210, and so on. The program does not allow you to enter a starting line number greater than 32767, the largest legal line number. Be careful not to set a line increment and starting line number that cause the program to exceed the value 32767 while it runs.

When the program finishes reading the ML data, it deletes itself, leaving the DATA statements in memory, together with program lines that READ the DATA and POKE it into memory. To complete the process, LIST these lines to disk or tape so that they can later be merged with another program.

ML Write For Atari

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

```
FD 10  DIM A$(20)
PP 20  GRAPHICS 0:SETCOLOR 2,
       0,0:SETCOLOR 1,0,15:?
       "{10 SPACES}<<<<ML WRIT
       E>>>>"
LP 30  TRAP 30:? :? "ENTER IN
       CREMENT ";:INPUT N:IF
       N=0 THEN 30
OF 40  TRAP 40:? "ENTER FILEN
       AME ";:INPUT A$
BG 50  TRAP 50:? "ENTER START
       ING LINE ";:INPUT A
PK 60  IF A<200 OR A>32767 TH
       EN GOTO 50
IB 70  TRAP 20:CLOSE #2:OPEN
       #2,4,0,A$:GET #2,D:GET
        #2,D:GET #2,SLB:GET #
       2,SHB:GET #2,ELB:GET #
       2,EHB:ST=A:A=A+10
BD 80  TRAP 130:POKE 842,12:G
       RAPHICS 0:SETCOLOR 2,0
       ,0:POKE 752,1:? :? :FO
       R C=1 TO 5
GO 90  ? A;" DATA ";:FOR I=1
       TO 21:GET #2,B:? B;
CB 100 IF I<21 THEN ? ",";
HP 110 NEXT I:? :? :A=A+N:NE
       XT C:? "CONT":POSITIO
       N 2,0:POKE 842,13:STO
       P
DE 120 GOTO 80
GM 130 ? "{LEFT} ":? :? :? "
       CONT":POSITION 2,0:PO
       KE 842,13:STOP
PL 140 GRAPHICS 0:SETCOLOR 2
       ,0,0:POKE 752,1:? :?
LO 150 FOR I=10 TO 150 STEP
       10:? I:NEXT I
BH 160 ? ST;" FOR A=";SLB+25
       6*SHB;" TO ";ELB+256*
       EHB;":READ B:POKE A,B
       :NEXT A":? "CONT"
LC 170 POSITION 2,0:POKE 842
       ,13:STOP
AA 180 ? "{CLEAR}":? :? :FOR
        I=160 TO 190 STEP 10
       :? I:NEXT I:? "POKE 8
       42,12:GRAPHICS 0:SETC
       OLOR 2,0,0:LIST"
DE 190 POSITION 2,0:POKE 842
       ,13
```

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QuickScreen For The IBM PC/PCjr

Paul W. Carlson

The short machine language routine created by this program allows you to display BSAVEd graphics screens from DOS without booting BASIC. No machine language knowledge is required to use the program. It requires BASICA with a color/graphics card for the PC or cartridge BASIC for the PCjr.

Imagine this scene: You want to show someone a high-resolution graphics display that you've saved on disk with a BSAVE command from BASIC. After waiting for BASIC to load, you must then load and run a program to set the desired graphics mode and BLOAD your file. As that program runs, the display slowly appears on the screen in two passes, lessening its visual impact.

This program creates a machine language routine, SHOWIT.COM, which both simplifies and speeds up the process of displaying such screens on your PC or PCjr. With this program, you can enter a single command at the DOS prompt: The graphics information is read rapidly from disk and appears on the screen instantaneously.

To get started, type in, save, and run the BASIC program below. This program writes the machine language routine contained in the DATA statements into a file on the disk named SHOWIT.COM. Unless you made typing errors while entering the program, a message appears indicating that SHOWIT .COM has been successfully created. SHOWIT.COM is the name used for the file created by this program; be sure you *do not* use that name for the BASIC program itself.

Using The Routine

The SHOWIT.COM routine will display graphics screens that were saved from a BASIC program with a statement such as this:

DEF SEG=&HB800:BSAVE *"filename"* ,0,16192

Don't worry if you used 16384 or &H4000 instead of 16192 in this statement. SHOWIT.COM will still work properly.

Like other machine language programs, SHOWIT.COM is run by typing its name at the DOS prompt (without the .COM extension). Here's the syntax you should use:

SHOWIT *filename/resolution*

After the command SHOWIT, you must type two additional items of information. The *filename* identifies the graphics file you wish to display. Next comes a slash character (/) and a resolution identifier. Here are the resolution identifiers to use:

M0 medium resolution with palette 0
M1 medium resolution with palette 1
H high resolution

SHOWIT.COM allows you to display a medium-resolution screen with a different color palette from the one used when creating the screen. For example, suppose you had a program that contained the statements SCREEN 1:COLOR 0,0 and you BSAVEd the display with a filename of DAZZLE. The original display uses color palette 0 (the number following the comma in the COLOR statement), which produced the colors green, red, and brown. If you enter the command SHOWIT DAZZLE/M1 from the DOS prompt, you get the same display except in cyan, magenta, and white. The H identifier is used only for displays BSAVEd from a program that uses the SCREEN 2 statement.

You can precede the filename with a drive designation or with a drive designation and a pathname. All of the following are legal commands:

SHOWIT DAZZLE/M1
SHOWIT B:DAZZLE/M1
SHOWIT B:\BAS\PICS\DAZZLE/M1

You would normally use a pathname only if you had a hard disk with files stored in separate subdirectories. As is the case with all DOS commands, either upper- or lowercase letters may be used for any part of the command. You may have noticed that when a display is BSAVEd, the file is saved on disk with an extension of .BAS. To save you some typing, SHOWIT.COM automatically adds the .BAS extension to the filename you supply. In fact, you'll get an error message if you include the extension. After SHOWIT.COM has displayed the picture, press any key to clear the screen, exit the program, and return to DOS.

Batch File Slide Show

Like any other DOS command, SHOWIT.COM can be used in batch files. Among other things, this permits you to create a slide-show display of several graphic screens. To illustrate, this short batch file displays the screens PIC1, PIC2, and PIC3 in sequence:

```
ECHO OFF
SHOWIT A:PIC1/M0
SHOWIT A:PIC2/M1
SHOWIT B:PIC3/H
```

After each screen is shown, you press any key to clear the screen, load the next display, and flash it on the screen.

Error Messages

SHOWIT.COM produces three different error messages. The first is the usage message, which appears as a reminder if you type a SHOWIT command with incorrect syntax. It consists of the word *Usage* followed by a model of correct syntax. The second error message is *File not found*, which means that SHOWIT.COM was not able to locate the specified graphics file. If you don't specify a drive, this program always uses the currently active drive.

The third error message is *File not BSAVED with DEF SEG= &HB800*. This means that the program found a file with the specified name, opened it, read the first seven bytes, and determined either that it had not been BSAVEd or that it had been BSAVEd with the wrong segment address. Finally, DOS itself might display the message *Bad command or filename* in cases where you misspell SHOWIT or the disk in the active drive does not contain SHOWIT.COM. In all cases, you return to the DOS prompt after the error message.

SHOWIT.COM Filemaker

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

```
AD 1Ø ' Program to create SHOWIT
      .COM
JO 2Ø '
OH 3Ø OPEN "SHOWIT.COM" FOR OUTP
      UT AS 1
FE 4Ø PRINT#1,CHR$(&HE9);CHR$(&H
      9F);CHR$(&H4Ø);
EG 5Ø FOR N=1 TO 16432:PRINT#1,C
      HR$(Ø);:NEXT
OG 6Ø T=Ø:FOR J=1 TO 377:READ A$
      :N=VAL("&H"+A$)
FE 7Ø T=T+N:PRINT#1,CHR$(N);:NEX
      T:CLOSE 1
LC 8Ø IF T=33221! THEN PRINT"SHO
      WIT.COM SUCCESSFULLY CREAT
      ED!":END
LA 9Ø PRINT CHR$(7);"***** ERROR
       IN DATA STATEMENTS *****"
      :END
DB 1ØØ DATA ØØ,ØØ,ØØ,55,73,61,67
       ,65,3A,2Ø
OH 11Ø DATA 73,68,6F,77,69,74,2Ø
       ,5B,64,3A
LH 12Ø DATA 5D,5B,7Ø,61,74,68,6E
       ,61,6D,65
KI 13Ø DATA 5D,3C,66,69,6C,65,6E
       ,61,6D,65
DH 14Ø DATA 3E,7B,2F,6D,7B,3Ø,2Ø
       ,31,7D,2Ø
FE 15Ø DATA 2F,68,7D,ØA,ØD,24,46
       ,69,6C,65
HM 16Ø DATA 2Ø,6E,6F,74,2Ø,66,6F
       ,75,6E,64
DD 17Ø DATA ØA,ØD,24,46,69,6C,65
       ,2Ø,6E,6F
IO 18Ø DATA 74,2Ø,42,53,41,56,45
       ,44,2Ø,77
MM 19Ø DATA 69,74,68,2Ø,44,45,46
       ,2Ø,53,45
ND 2ØØ DATA 47,3D,26,48,42,38,3Ø
       ,3Ø,ØA,ØD
AB 21Ø DATA 24,BE,8Ø,ØØ,8D,3E,ØA
       ,41,32,ED
MD 22Ø DATA 8A,ØC,E3,ØE,FC,46,8A
       ,Ø4,3C,2F
JN 23Ø DATA 74,ØD,88,Ø5,46,47,E2
       ,F4,8D,16
CP 24Ø DATA 36,41,EB,5F,9Ø,C6,Ø5
       ,2E,47,C6
FM 25Ø DATA Ø5,42,47,C6,Ø5,41,47
       ,C6,Ø5,53
PJ 26Ø DATA 47,C6,Ø5,ØØ,46,8A,Ø4
       ,3C,6D,74
LE 27Ø DATA Ø4,3C,4D,75,1A,C7,Ø6
       ,32,41,Ø4
CH 28Ø DATA ØØ,46,8A,Ø4,3C,3Ø,74
       ,Ø4,3C,31
HF 29Ø DATA 75,CA,2C,3Ø,32,E4,A3
       ,34,41,EB
ON 3ØØ DATA 15,3C,68,74,ØB,3C,48
       ,74,Ø7,8D
NG 31Ø DATA 16,36,41,EB,18,9Ø,C7
       ,Ø6,32,41
MF 32Ø DATA Ø6,ØØ,8D,16,ØA,41,42
       ,BØ,ØØ,B4
FC 33Ø DATA 3D,CD,21,73,Ø9,8D,16
       ,6B,41,B4
AF 34Ø DATA Ø9,CD,21,C3,8B,D8,8D
       ,16,Ø3,Ø1
MA 35Ø DATA B9,Ø7,ØØ,B4,3F,CD,21
       ,8D,36,Ø3
DN 36Ø DATA Ø1,8A,Ø4,3C,FD,74,Ø6
       ,8D,16,7C
DN 37Ø DATA 41,EB,DE,46,8B,Ø4,3D
       ,ØØ,B8,74
CF 38Ø DATA Ø2,EB,FØ,8D,16,ØA,Ø1
       ,B9,ØØ,4Ø
PC 39Ø DATA B4,3F,CD,21,B8,ØØ,Ø6
       ,B7,Ø7,33
PD 4ØØ DATA C9,BA,4F,18,CD,1Ø,A1
       ,32,41,CD
NB 41Ø DATA 1Ø,A1,32,41,3D,Ø4,ØØ
       ,75,ØA,8B
KN 42Ø DATA 1E,34,41,B7,Ø1,B4,ØB
       ,CD,1Ø,B8
HB 43Ø DATA ØØ,B8,8E,CØ,8D,36,ØA
       ,Ø1,33,FF
MB 44Ø DATA B9,ØØ,2Ø,FC,F3,A5,B4
       ,Ø7,CD,21
LM 45Ø DATA B8,ØØ,Ø6,32,FF,33,C9
       ,BA,4F,18
NA 46Ø DATA CD,1Ø,B8,ØØ,Ø2,33,DB
       ,33,D2,CD
ME 47Ø DATA 1Ø,B8,Ø2,ØØ,CD,1Ø,C3
```

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Apple DOS 3.3 Wildcards

Mark Russinovich

By permitting wildcard pattern matching in filenames, this short utility adds power and flexibility to DOS 3.3 for the Apple II.

Unlike the DOS (Disk Operating System) found on the IBM PC and other computers, DOS 3.3 for Apple II computers does not allow wildcard pattern matching. A wildcard is a special character that can match any one or more characters in a filename. The question mark (?) character can match any single character, while the asterisk (*) can match any combination of characters. For instance, in an operating system that accepts wildcards, all of these commands would load the file HELLO from disk:

```
LOAD HELLO
LOAD HE?LO
LOAD HEL*
```

In the second command, the question mark matches the first *L* in HELLO. In the third, the asterisk matches the characters *LLO*. Wildcards not only save typing time but can speed disk operations such as the deletion of a group of files with similar filenames.

This article includes a BASIC program which creates a short machine language routine that will modify DOS 3.3 to allow the use of the ? and * wildcards. Type in and save the program; then run it. The program reads the machine language routine from DATA statements and stores it on the current disk in a binary file, WILDCARD. Because the program creates a file named WILDCARD, you *must not* use that name for the BASIC program. Use any name other than WILDCARD for the BASIC program.

To install the wildcard machine language routine, load the HELLO program on the disk containing the WILDCARD file and add this line:

```
10 PRINT CHR$(4)"BRUN WILDCARD"
```

(If the current HELLO program already includes a line 10, you can change the line above to any unused line number.) Don't forget to resave the HELLO program after you have made the change. Once this has been done, reboot the computer. Once you boot up with a disk that installs the wildcard program, you should not use INIT to initialize new disks. If you want to initialize new disks, reboot using a disk that does not install the wildcard option.

Wildcards With Filenames

After you have booted a disk containing the WILDCARD file and the modified HELLO progam, you can use two wildcard characters in filename specifications. The asterisk can match the endings of filenames. This is extremely useful when you wish to do something with a file with a long name such as HELPER.FILE.1. Using the asterisk, you need to type in only a few characters plus the wildcard, rather than the whole name. If more than one file on the disk has the same beginning as the one you type, DOS matches the *first* one on the disk (except for the DELETE command; see below).

Because the asterisk can match a group of characters, it's important to give DOS enough information to locate the file you want. For example, say that your disk contains the files HELLO and HELPER.FILE.1. If your HELLO appears first in the disk catalog, then the command LOAD HEL* loads HELLO rather than HELPER.FILE.1. The command LOAD HELP* loads HELPER.FILE.1 unless some other file beginning with HELP precedes that file in the catalog. To avoid unwanted results, make sure that the filename contains enough characters to uniquely identify the desired file.

This wildcard differs somewhat from the standard * wildcard found on other versions of DOS. It must be the *last* character in a filename, and you cannot use the wildcard by itself. (The commands LOAD *ELP and LOAD * are both illegal.)

The asterisk works somewhat differently with a delete command. If you type in DELETE HEL*, DOS deletes *all* files beginning with HEL, not only the first file. This feature permits you to delete a group of related filenames. For instance, DELETE HEL* deletes HELP, HELPER, HELPER.FILE.1, and any other file on the same disk beginning with HEL. Since this command can have drastic consequences, use it with extreme care.

The second wildcard character is the question mark (?), which can replace any single character. This symbol may appear anywhere in a filename. To understand how it works, suppose that you wish to load HELPER.FILE.1 from a disk that also contains the file HELLO. The command LOAD ???P* loads HELPER.FILE.1 (assuming the disk contains no other files with a P as the fourth character). Again, when the wildcard character is used with DELETE, every file matching the pattern will be deleted.

Wildcards With Commands

The asterisk wildcard can be used to match DOS commands as well as filenames. Instead of matching the first filename in a disk directory, the asterisk finds the first matching command in the DOS command table. The table lists the order of DOS commands. At least one character must precede the asterisk, which must also be the last character in the command. Both command and filename wildcards can be used in the same line. For instance, the command L* HELP* loads HELPER.FILE.1. These features can also be used with the command PRINT CHR$(4) from BASIC.

Order Of DOS Commands

1. INIT	14. OPEN
2. LOAD	15. APPEND
3. SAVE	16. RENAME
4. RUN	17. CATALOG
5. CHAIN	18. MON
6. DELETE	19. NOMON
7. LOCK	20. PR#
8. UNLOCK	21. IN#
9. CLOSE	22. MAXFILES
10. READ	23. BSAVE
11. EXEC	24. BLOAD
12. WRITE	25. BRUN
13. POSITION	26. VERIFY

WILDCARD Filemaker

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

```
E4 10 FOR I = 38016 TO 38121: RE
      AD A: POKE I,A:X = X + A:
      NEXT
AC 20 IF X < > 14283 THEN PRINT
      "ERROR IN DATA STATEMENTS.
      ": STOP
3F 30 D$ = CHR$ (4): PRINT CHR$
      (4)"BSAVE WILDCARD,A$9480,
      L$6A"
12 40 DATA 160,2,185,162,148,153
      ,249,177
01 50 DATA 136,16,247,160,2,185,
      165,148
C8 60 DATA 153,110,162,136,16,24
      7,160,4
61 70 DATA 185,168,148,153,235,1
      59,136,16
68 80 DATA 247,96,76,173,148,76,
      193,148
45 90 DATA 76,206,148,234,234,23
      2,177,66
8B 100 DATA 201,170,208,3,76,6,1
       78,201
6E 110 DATA 191,208,3,76,1,178,7
       6,252
CD 120 DATA 177,145,64,32,201,17
       7,144,1
71 130 DATA 96,104,104,32,205,15
       9,41,127
C7 140 DATA 201,42,208,16,185,13
       2,168,48
EB 150 DATA 4,200,76,212,148,169
       ,42,73
CA 160 DATA 170,76,240,159,89,13
       2,168,76
73 170 DATA 240,159
```

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XMODEM

File Transfer For Commodore 64 And 128

Bert Kerkhof

By adding XMODEM capabilities to telecommunications, you can increase the reliability of file transfers. The program included with this article lets you upload or download files with the XMODEM protocol.

One of the most popular uses for computer telecommunications is the exchange of programs. Commercial information services offer thousands of public domain programs which can be yours simply for the cost of downloading (capturing) them over the telephone lines. Or, you may wish to upload (send) a copy of a program you have written to a friend in some distant city.

The simplest way to send a program is in the form of a sequential series of characters, without any error checking. However, if you're communicating over long distances, noise on the phone line may cause characters to be dropped or garbled in the transmission. When you're transmitting text, a garbled character here and there probably won't cause serious problems, but when you're transferring programs, even a single incorrect character may prevent the program from working.

XMODEM is the name of a file-transfer protocol devised by Ward Christensen (who also set up the first computer bulletin board). The XMODEM scheme allows you to send any kind of data—executable programs as well as plain ASCII text—and includes error checking which guarantees a reliability rate in excess of 99 percent. There are other, more sophisticated protocols, but XMODEM is by far the most popular. Nearly every commercial information service and many bulletin boards give you the option of transferring files in this reliable format.

Getting Started

The program below is a simple terminal (telecommunications) program with the ability to upload and download files using the XMODEM protocol. If you have a Commodore 64, type in and save Program 1 as listed. If you have a 128, type in Program 1, but add or change the following lines:

```
DB 116 KEY 1,CHR$(133):KEY 3,C
       HR$(134)
JE 117 KEY 5,CHR$(135):KEY 7,C
       HR$(136)
SK 130 PRINT CHR$(11);SPC(10);
BX 495 DO:GET#2,B$:GOSUB 730
MG 500 LOOP UNTIL W AND 8:RETU
       RN
PX 620 GET#2,B$:GOSUB 730:IF W
        THEN 630
BX 655 GET#2,B$:GOSUB 730:IF W
       <>8 THEN 650
PR 725 REM ** GET RS-232 STATU
       S **
PQ 730 W=PEEK(2580):POKE 2580,
       0:RETURN
```

If you have an 80-column monitor for your 128, also change the following lines to create a version for 80-column mode:

```
DS 105 FAST:COLOR 6,16
QG 185 PRINT CHR$(5);CHR$(27);
       "U";
KH 230 PRINT:PRINT CHR$(144);
SC 250 PRINT CHR$(R(B));:RETUR
       N
```

For either the 128 or 64, add this line if you have a Commodore 1660 modem. This line causes the modem to receive the call when the modem is in answer mode:

```
GD 112 POKE56579,PEEK(56579)OR
       32:POKE56577,PEEK(56577
       )AND223
```

Be sure that your modem is connected and turned on before you run the program. The program begins in *terminal mode*, which is very easy to understand. Every character that you type on the keyboard is sent out through the modem, and every character received from the modem is displayed on the screen.

Each of the four function keys has a purpose in this program. The f1 key turns *local echo* on and off. If you are communicating with a computer that does not echo what you send, press the f1 function key to turn on local echo. In this mode, your computer displays each character as you type it. When the program begins, echo is turned off, meaning that the computer doesn't automatically print characters that you type. Instead, it relies on the computer at the other end of the line to send an *echo*, or copy, of each character you send. Most commercial information services and computer bulletin boards provide an echo, which is compatible with this mode. Note that the echo feature affects what you see on the screen, but does not change what you send or receive from the modem.

The f7 key displays a list of the function-key actions in case you forget what the function keys do. The f3 and f5 keys are used, respectively, to initiate the reception or transmission of a file with XMODEM error checking.

Downloading With XMODEM

Once you're ready to download (receive) a file, simply press the f3 key. The program prompts you to enter the name and file type you wish the resulting disk file to have. For the file type, enter a *P* for a program (PRG) file, an *S* for a sequential (SEQ) file, or a *U* for a user (USR) file. This program does not support the transfer of relative (REL) files. You must type the filename and file type on the same line, separated by a comma. For instance, this command tells the program to store the incoming file in a PRG type file named MYPROG:

MYPROG,P

You have 60 seconds in which to respond to this prompt. If you don't type anything, the program assumes that you've changed your mind, and it aborts the transfer and returns to terminal mode. After you enter the filename and file type, the program begins to receive the file and store it on disk.

To upload (send) a file, press the f5 key and enter the filename and type of the file you wish to send. Again, you have 60 seconds in which to respond to the prompt before the program aborts the transfer and returns to terminal mode.

Monitor The Transmission

Once the transfer begins, the program keeps you informed about its progress. It prints a plus sign (+) for every block (see below) that is transferred without any errors. If a block is rejected, the program prints an *O*. If nothing is received within the allotted time, the program prints a period (.) to signal a timeout.

If a disk error occurs on your end during the transfer, the program prints the disk-error message on the screen and automatically cancels the transfer. Under some circumstances (very noisy phone lines, a disk error at the other end of the link, or whatever), the program may have no choice but to give up on the transfer. When this occurs, it prints the message *Timeout* on the screen. If the entire transfer is successful, the program prints the message *Complete.*

ACK Or NAK

In the XMODEM protocol, files are always sent in *blocks*, or packages, containing 128 bytes of data. The sender sends 128 bytes at a time, along with a header, block numbers, and a checksum. When the receiving computer gets the block, it checks to make sure that the header, block numbers, and checksum match up correctly. If no errors are found, the receiver sends an ACK character (ACKnowledge, ASCII 6) to signal "All is well; send the next block." If an error occurs, the receiver sends a NAK character (Negative AcKnowledge, ASCII 21) to say "That block was not received correctly; send it again." At the end of the transmission, the sender transmits an EOT character (End Of Text, ASCII 4) to signal that the transfer is complete.

Each block has a maximum of ten chances to get through. After ten failed attempts, the receiver sends a CAN character (CANcel, ASCII 26) to inform the sender that the transfer has failed. A timeout (excessive delay) also counts as an error. By these simple means, XMODEM achieves a very high reliability rate. The 128 data bytes can contain any eight-bit values, so this method can be used to transmit machine language programs, tokenized BASIC programs, or any other eight-bit data.

This program includes several features that help insure error-free transmissions. One important point involves flushing the RS-232 line at appropriate spots. This is done to prevent data bytes from being mistaken as control signals (ACK, NAK, or whatever). Thus, before it sends an ACK or NAK, the receiver gets characters until no more characters are waiting to be received. Likewise, the sender waits until no characters are incoming before it sends each new block.

In many XMODEM implementations, the sending computer automatically resends a block if a timeout occurs without any response from the receiver. In this program, the sender retransmits only when it receives a NAK from the receiver. This program is designed to operate at 300 bps (bits per second, often termed *baud*). Due to the slowness of BASIC, it will not work correctly at higher transmission speeds.

XMODEM File Transfer

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

```
BA 100 REM ++ XMODEM FILE TRAN
       SFER ++
QQ 105 POKE 53280,11:POKE 5328
       1,11
EC 110 OPEN 2,2,0,CHR$(6)+CHR$
       (0):M=255
CE 115 G$=CHR$(20):U$=CHR$(175
       )
FB 120 Z$=CHR$(0):OPEN 15,8,15
XE 125 PRINT CHR$(144);CHR$(14
       7);CHR$(14);
GG 130 PRINT CHR$(8);SPC(10);
CQ 135 PRINT "XMODEM FILE TRAN
       SFER":PRINT
EQ 140 GOSUB 275:DIM R(255),S(
       255)
SE 145 FOR B=0 TO 31:S(B)=B:NE
       XT:R(8)=20
DK 150 R(13)=13:S(20)=8:FOR B=
       32 TO 64
EJ 155 R(B)=B:S(B)=B:NEXT:S(16
       0)=32
RF 160 FOR B=65 TO 90:I=B+128:
       R(B)=I
ED 165 S(I)=B:NEXT:FOR B=91 TO
        96:R(B)=B
ER 170 S(B)=B:NEXT:FOR B=97 TO
        122:I=B-32
AK 175 R(B)=I:S(I)=B:NEXT:FOR
       {SPACE}B=123 TO 127
EB 180 I=B+96:R(B)=I:S(I)=B:NE
       XT
HE 185 PRINT CHR$(152);U$;
CQ 190 GET#2,B$:IF B$="" THEN
       {SPACE}200
EB 195 B=ASC(B$):GOSUB 245:GOT
       O 190
BS 200 GET B$:IF B$="" THEN 19
       0
XK 205 B=ASC(B$)
MQ 210 IF B>132 AND B<137 THEN
        230
KF 215 B=S(B):PRINT#2,CHR$(B);
HK 220 IF H THEN GOSUB 250
KE 225 GOTO 190
FM 230 PRINT G$:PRINT CHR$(144
       );
KG 235 ON B-132 GOSUB 260,415,
       290,275
MH 240 GOTO 185
HC 245 REM ++ PRINT BYTE ++
DB 250 PRINT G$;CHR$(R(B));U$;
       :RETURN
FB 255 REM ++ F1, ECHO ++
RD 260 PRINT "ECHO: ";MID$("ON
        OFF",H+1,3)
MS 265 H=3-H:RETURN
CR 270 REM ++ F7, HELP ++
HX 275 PRINT "{RVS}F1{OFF}=ECH
       O {RVS}F3{OFF}=RECEIVE
       {SPACE}{RVS}F5{OFF}=TRA
       NSMIT {RVS}F7{OFF}=HELP
       "
MJ 280 RETURN
```

```
JF 285 REM ++ F5, TRANSMIT FIL
       E ++
AH 290 PRINT "NAME OF FILE TO
       {SPACE}UPLOAD:":B$="R"
EM 295 GOSUB 675:IF F THEN RET
       URN
FE 300 C$=CHR$(21):GOSUB 395:C
       $=C$+CHR$(6)
JA 305 FOR K=1 TO M+1:K=K AND
       {SPACE}M
QM 310 IF F THEN 370
MF 315 S=0:D$="":FOR I=1 TO 12
       8:GET#8,B$
FA 320 B=ASC(B$+Z$):D$=D$+CHR$
       (B):S=S+B
GC 325 IF ST THEN A=4:F=1:GOTO
        335
KG 330 NEXT
EG 335 IF LEN(D$)=128 THEN 345
HJ 340 D$=D$+Z$:GOTO 335
FX 345 GOSUB 495
BG 350 PRINT#2,CHR$(1);CHR$(K)
       ;CHR$(M-K);D$;CHR$(S AN
       D M);
CS 355 GOSUB 395:PRINT MID$("O
       +",C,1);
FR 360 IF C=1 THEN 345
PX 365 NEXT K
AR 370 PRINT:CLOSE 8:GOSUB 700
BR 375 GOSUB 485:IF F>1 THEN 7
       15
GC 380 GOSUB 395:IF C=2 THEN 7
       15
PC 385 GOTO 375
GQ 390 REM ++ GET CONTROL BYTE
        100 SEC ++
SB 395 FOR J=1 TO 10:GOSUB 510
DC 400 IF E THEN NEXT:A=24:F=2
RA 405 RETURN
CG 410 REM ++ F3, RECEIVE FILE
        ++
XX 415 PRINT "FILENAME FOR DOW
       NLOADED DATA:":B$="W":A
       =21
DA 420 GOSUB 675:IF F THEN RET
       URN
RK 425 C$=CHR$(1)+CHR$(4)
FJ 430 FOR K=1 TO M+1:K=K AND
       {SPACE}M
XE 435 IF F THEN 470
SP 440 FOR J=1 TO 10:GOSUB 485
       :A=21
MR 445 GOSUB 510
AH 450 IF C=1 THEN GOSUB 550:P
       RINT MID$("+O",E+1,1);
GJ 455 IF C=2 THEN A=6:F=1
EP 460 IF E AND F=0 THEN NEXT:
       A=24:F=2
KF 465 NEXT K
FP 470 PRINT:CLOSE 8:GOSUB 700
RR 475 GOSUB 485:GOTO 715
FM 480 REM ++ SEND ANSWER BYTE
        ++
DX 485 GOSUB 495:PRINT#2,CHR$(
       A);:RETURN
BB 490 REM ++ CLEAR INPUT BUFF
       ER ++
XD 495 GET#2,B$:IF (ST AND 8)=
       0 THEN 495
QF 500 RETURN
EC 505 REM ++ GET CONTROL BYTE
        10 SEC ++
XE 510 E=0:P=600:T=TI
PK 515 C=3:GOSUB 620
MH 520 IF E THEN PRINT ".";:RE
       TURN
AK 525 IF B$=CHR$(24) THEN A=2
       4:F=4:RETURN
KD 530 FOR C=1 TO LEN(C$)
EX 535 IF B$=MID$(C$,C,1) THEN
        RETURN
BH 540 NEXT:GOSUB 650:GOTO 515
MM 545 REM ++ GET DATA ++
HB 550 P=60:T=TI:GOSUB 620:IF
       {SPACE}E THEN RETURN
PH 555 N=B:T=TI:GOSUB 620:IF E
        THEN RETURN
BB 560 IF N+B<>M THEN E=1:GOTO
        650
BJ 565 S=0:D$="":FOR I=1 TO 12
       8
AF 570 T=TI:GOSUB 620:IF E THE
       N RETURN
FE 575 D$=D$+CHR$(B):S=S+B:NEX
       T
EG 580 T=TI:GOSUB 620:IF E THE
       N RETURN
CS 585 IF B<>(S AND M) THEN E=
       1:GOTO 650
SK 590 A=6:D=K-N AND M
XF 595 IF D>1 THEN A=24:F=3
SQ 600 IF D THEN E=1:RETURN
FJ 605 PRINT#8,D$;:IF ST THEN
       {SPACE}A=24:F=5
PQ 610 RETURN
DA 615 REM ++ GET BYTE ++
QP 620 GET#2,B$:W=ST:IF W THEN
        630
KD 625 B=ASC(B$+Z$):RETURN
SF 630 IF W AND 247 THEN GOSUB
        650
GC 635 IF TI>T+P THEN E=1:RETU
       RN
HQ 640 GOTO 620
ME 645 REM ++ SKIP UNTIL SILEN
       CE ++
QD 650 U=TI
GK 655 GET#2,B$:IF ST<>8 THEN
       {SPACE}650
SG 660 IF TI>U+60 THEN RETURN
BF 665 GOTO 655
PJ 670 REM ++ TRANSFER BEGIN +
       +
KM 675 F=0:N$="*":T$="P"
ED 680 N$="":T$="":INPUT "[ NA
       ME, TYPE ]";N$,T$
DS 685 IF N$="" OR (T$<>"P" AN
       D T$<>"S" AND T$<>"U")
       {SPACE}THEN 680
DB 690 OPEN 8,8,8,"0:"+N$+","+
       T$+","+B$
BK 695 REM ++ READ ERROR CHANN
       EL ++
RK 700 INPUT#15,I,M$:IF I=0 TH
       EN RETURN
MA 705 PRINT"{RVS}";M$:A=24:F=
       5:CLOSE 8:RETURN
MJ 710 REM ++ TRANSFER END ++
HR 715 M$="COMPLETETIMEOUT DIS
       ORDERCANCEL "
KF 720 PRINT MID$(M$,F*8-7,8):
       RETURN
```

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Disk Fix

For IBM PC/PCjr

Bradley Franklin

Virtually every computer user has suffered the consequences of deleting an important file by accident. This convenient utility can recover such a file as long as it hasn't been overwritten by other disk operations.

Regardless of experience and interest level, nearly every computer user has suffered the same unpleasant feeling: After pressing Enter, you realize that you just accidentally deleted an important disk file. In the case of commercial software, such accidents can be costly as well as embarrassing. "Disk Fix" makes it possible to recover accidentally deleted files. Type in and save the program; then run it to create a machine language file named DISKFIX.COM. (Don't use that name for the BASIC program that creates the file.) The filemaker program also creates a backup copy of the file with the name DISK-FIX.BKP (to use this file, change the extension .BKP to .COM).

Using DISKFIX.COM

DISKFIX.COM is a machine language program that runs from the DOS prompt; you needn't be a machine language expert to use this program, however. To recover the lost data, go to the DOS command level (A> or B>). If you are currently in BASIC, the SYSTEM command takes you to the DOS command level. Insert the disk that contains Disk Fix; then type DISKFIX and press Enter. The drive lights for an instant as the computer loads Disk Fix into memory. When the light goes out, insert the disk that contains the file you want to recover. Press any key to begin the recovery process. The drive will light for a second time, then stop.

At this point, the lost file has been recovered. If you perform DIR from the DOS prompt, the filename should appear in the directory, with a dollar sign ($) where the first character of the filename previously appeared. (The dollar sign replaces a marker which DOS placed there when deleting the file.) Now that the file is restored, you can rename it and perform any other operation you wish. Since it searches for all deleted files, Disk Fix also works in cases where you have deleted a group of related files with a wild-card command.

It's important that you understand which files Disk Fix cannot recover. If you accidentally delete a file, Disk Fix can restore it only if you act *before* you write any additional files to the same disk. As long as no new files have been written to that disk, all the information in the deleted file is still intact and can be restored. If you save a new program on the disk, however, it may write over the deleted file's data, destroying it forever.

Disk Fix does not harm any other files on the disk. However, if you have deleted a file with a name like FFILE.BAS and the disk still contains the file $FILE.BAS, Disk Fix cannot work correctly. Since the recovered program is renamed from FFILE.BAS to $FILE.BAS, the disk now contains two programs of the same name. For this reason, you should avoid the practice of beginning filenames with a dollar sign.

This program takes advantage of the fact that deleting a file doesn't erase its data from disk. Instead, DOS changes the first character of the filename to a marker which indicates the file is deleted. As a result, DOS skips over the file whenever it searches the disk, making it impossible to use the file in a normal way. Disk Fix simply searches the disk's FAT (File Allocation Table) and replaces all deletion markers with dollar signs. The effect is to restore all previously deleted files.

DISKFIX.COM Filemaker

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

```
MN 10 CLEAR ,50000!
HM 20 CLS
OI 30 READ A$:IF A$="BF" THEN 50
AE 40 PRINT CHR$(7):PRINT "THE F
      IRST NUMBER IS BF,NOT ";A$
      :END
LF 50 FOR X=1 TO 19
DO 60 FOR Y=1 TO 10
LL 70 READ A$
AG 80 NEXT Y
CA 90 READ A$:G=G+VAL("&h"+A$)
GN 100 NEXT X
BL 110 IF HEX$(G)="4D1C" THEN RE
       STORE:GOTO 130
KO 120 PRINT CHR$(7):PRINT "ERRO
       R:CHECK END NUMBERS" :END
NI 130 G=0
QO 140 READ A$
IF 150 FOR X=1 TO 19
PH 160 FOR Y=1 TO 10
AE 170 READ A$
NC 180 G=G+VAL("&h"+A$)
IJ 190 NEXT Y
PH 200 READ A$
KM 210 IF G<>VAL("&H"+A$) THEN 2
       50
MH 220 G=0
GE 230 NEXT X
FB 240 GOTO 260
NC 250 PRINT CHR$(7):PRINT "ERRO
       R:CHECK DATA STATEMENTS I
       N LINE:";X*10+430:END
BN 260 READ A$:IF A$<>"13" THEN
       X=20:GOTO 250
JJ 270 READ A$:IF A$<>"C3" THEN
       X=20:GOTO 250
   280 PRINT "CONGRATULATIONS!!
       DATA IS OKAY!!(WHEW!)"
MD 290 RESTORE
FL 300 XX=50000!
CA 310 READ A$:POKE XX,VAL("&h"+
       A$)
IB 320 FOR X=1 TO 19
PD 330 FOR Y=1 TO 10
MP 340 XX=XX+1
AC 350 READ A$
BF 360 POKE XX,VAL("&h"+A$)
HH 370 NEXT Y
DE 380 READ A$:NEXT X
KM 390 READ A$:XX=XX+1:POKE XX,V
       AL("&h"+A$)
JL 400 READ A$:XX=XX+1:POKE XX,V
       AL("&h"+A$)
AD 410 OPEN "DISKFIX.COM" AS #1
       LEN=1
QN 420 OPEN "DISKFIX.BKP" AS #2
       LEN=1
LC 430 FIELD #1,1 AS A$
QI 440 FIELD #2,1 AS AA$
GH 450 FOR Q=0 TO XX-50000!:LSET
        A$=CHR$(PEEK(Q+50000!)):
       AA$=A$:PUT #2:PUT #1:NEXT
        Q
FM 460 CLOSE:END
JG 470 DATA BF
EM 480 DATA B4,0,CD,16,B8,0,17,8
       E,D8,B8,484
LK 490 DATA 0,17,8E,C0,B9,3,0,51
       ,BB,0,32D
DN 500 DATA 4,B2,0,B6,0,B5,0,B1,
       6,B0,388
KI 510 DATA 4,B4,2,CD,13,59,E8,9
       2,0,80,3ED
MF 520 DATA FC,0,74,7,B4,0,CD,13
       ,E2,DF,4CC
OD 530 DATA C3,B9,3,0,51,BB,0,8,
       B2,0,345
DE 540 DATA B6,1,B5,0,B1,1,B0,3,
       B4,2,387
NF 550 DATA CD,13,59,E8,6D,0,80,
       FC,0,74,47E
QK 560 DATA 7,B4,0,CD,13,E2,DF,C
       3,B9,48,520
GL 570 DATA 20,BB,0,4,80,3F,E5,7
       4,7,83,381
FL 580 DATA C3,1,E2,F6,EB,5,C6,7
       ,24,EB,568
KF 590 DATA F4,B9,3,0,51,BB,0,4,
       B2,0,372
LB 600 DATA B6,0,B5,0,B1,6,B0,4,
       B4,3,38D
HK 610 DATA CD,13,59,E8,31,0,80,
       FC,0,74,442
HC 620 DATA 7,B4,0,CD,13,E2,DF,C
       3,B9,3,4DB
FD 630 DATA 0,51,BB,0,8,B2,0,B6,
       1,B5,332
PL 640 DATA 0,B1,1,B0,3,B4,3,CD,
       13,59,355
MH 650 DATA E8,C,0,80,FC,0,74,6,
       B4,0,39E
KC 660 DATA CD,13,E2,DF,C3,B4,1,
       B0,0,CD,596
GO 670 DATA 13,C3
```

©

FastKey

Ronald Carnell

Efficiency experts have long believed that as you reduce the number of keystrokes needed to perform a given operation, productivity goes up and the risk of errors goes down. "FastKey" for the Commodore 64 allows you to create abbreviated commands that perform an entire line of BASIC commands with just a few keystrokes. FastKey abbreviations can be used in either direct mode or in a BASIC program. A disk drive is required.

I hate to type. That's why, for over a year, each time I sat down to my 64, the first program I loaded into my 64 was a utility that allowed me to program the computer's function keys. The program has changed from time to time, but the concept has remained constant: commands that can be activated by a single key. The problem, of course, is that the 64 has only eight function keys, but I have a multitude of commands I'd like to automate. That's why I wrote "FastKey."

FastKey allows you to abbreviate virtually any command that will fit into a normal (80-character) BASIC line. You select your own abbreviations, so they're easy to remember. The commands can be executed either in direct mode or in a BASIC program. Best of all, you can have over 8000 bytes of abbreviations in memory at once, while stealing only 437 bytes from BASIC program space.

Entering FastKey Generator

Program 1, "FastKey Generator," creates FastKey programs and definition files for later use. Since this is a machine language program, type it in using the "MLX" machine language entry program found elsewhere in this issue. Read the MLX instructions carefully before you type and save this program. When you run MLX, you'll be asked for the starting and ending addresses of the data you'll be entering. Here are the addresses you need for FastKey:

Starting address: 0801
Ending address: 0BA8

After you type and save all the data from Program 1, load it into your computer and list it. Although it's written in machine language, you can load, save, and run FastKey Generator just like any BASIC program. When you run FastKey Generator, it moves itself to the top of memory and prints a reminder of its SYS address.

FastKey Definition Program

The next step is to write a short pseudo-BASIC program to define your key abbreviations and definitions. The first line of the definition program will always consist of a SYS command which activates FastKey Generator. It's also the only line of the program that actually runs in the normal sense. The remainder of the definition program is simply information which FastKey Generator processes to create a FastKey program or definition file. Here's what the first line should look like:

```
100 SYS 40110
```

The second line of the definition program tells FastKey Generator what to name the resulting FastKey file. This line should begin with a REM followed by a special character and the filename you wish to use. The special character will be either an *at* sign (@) or an English pound character (£).

The @ sign tells FastKey Generator to create a FastKey program complete with key definitions. This is what you'll want most of the time, and certainly what you'll need the first time you run FastKey Generator. The £ sign, on the other hand, tells FastKey Generator to create only a FastKey definition file. This isn't a program, but a file containing definitions that a FastKey program can load directly into memory (more on this later).

So far, your definition program should look like this:

100 SYS 40110
110 REM @*filename*

The remainder of the program contains nothing but key definitions. As an example, let's set up a definition to change all the screen colors. The first thing to do is to select an abbreviation. It can be as short as one character or as long as 80 (which, of course, wouldn't be very abbreviated). Let's choose the abbreviation *c* to represent *color.*

```
120 *C
```

The asterisk (*) at the beginning of this line tells the program that everything else on the line is a key abbreviation. It also indicates that the next line in the file contains the key definition for the abbreviation:

```
130 POKE 53280,6:POKE 53281,6:POKE
    646,1
```

That's all there is to it. Of course, you'll want to define a few more abbreviations. Program 2 is a complete example of a FastKey definition program. You may want to use the same definitions it contains, or you can simply use it as a model in creating your own definitions. When you're finished typing the definition program, save a copy to disk.

At this point, you should have FastKey Generator installed in memory and a definition program residing in BASIC memory. When you run the definition program, the SYS in the first line transfers control to FastKey Generator. As it reads and defines each abbreviation, FastKey Generator prints the current line number on the screen. When the conversion is complete, FastKey Generator writes a FastKey program to disk.

If you load the resulting FastKey program and list it, you'll see that it loads like a normal BASIC program. To install the new abbreviations, run the program as you would any BASIC program.

Wedging Into BASIC

FastKey wedges the new commands into BASIC via the error vector. Whenever it encounters a BASIC statement that would otherwise cause an error, the computer checks to see whether the first character in the command is a period (.), the marker that precedes every FastKey command. If the period is present, FastKey reads further and performs the abbreviated command. If not, it passes control to BASIC's normal error-processing routine. For instance, after you activate the example FastKey program, enter the following command:

```
.C
```

This command performs the color changes you defined in line 130 of the definition program. After it performs the command, FastKey prints the command definition on the next screen line as a reminder of what's happening.

It's also possible to perform FastKey commands within a BASIC program. Enter NEW; then type this line and press RETURN:

```
.100,C
```

Again, the leading period signals that this line is intended for FastKey— it's not an error. But this time the period is followed immediately by a line number. When it detects a line number, FastKey knows that you want to add the command as a program line rather than execute it immediately. FastKey prints the line to indicate that it has been added to memory. If you perform a LIST, you'll see that line 100 has been added to the current BASIC program.

Definition Files

The quotation mark (") is the only character that can't come at the beginning of a key definition. The reason for this limitation concerns FastKey definition files. If you write a definition program that generates more than 8K (8192 bytes) of abbreviations, FastKey Generator will abort the generating process, tell you that it ran out of memory, and write as much of the FastKey program as it can. You'll know where it stopped because the current definition line number is printed on the screen.

At this point, you would have to write a second FastKey program to handle the remaining definitions. Or, even if size isn't a factor, you may decide that you'd rather have different versions of FastKey for different purposes. In either case, it would be inconvenient to stop what you're doing, save whatever is in BASIC, and load a new version of FastKey.

FastKey definition files eliminate this inconvenience. Whenever FastKey evaluates an abbreviated command, it checks the first character following the period. If this character is a quotation mark, FastKey expects the remainder of the command to be the filename of a FastKey definition file. This file is loaded directly into memory, and the new abbreviations instantly replace the old ones. For instance, this command loads the file MYDEFS from disk and installs its definitions in memory:

```
."MYDEFS"
```

I still hate to type, but FastKey has turned torment into a minor irritation. I hope it can perform the same service for you.

Program 1: FastKey Generator

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

```
0801:63 9C 00 00 9E 32 30 36 3E
0809:33 3A A2 00 00 00 A9 57 40
0811:85 FB A9 08 85 FC A9 AE BA
0819:85 FD 85 37 A9 9C 85 FE 59
0821:85 38 A2 04 A0 00 B1 FB FA
0829:91 FD C8 D0 F9 E6 FC E6 F3
0831:FE CA D0 F2 A9 3D A0 08 48
0839:20 1E AB 60 93 11 27 53 DE
0841:59 53 20 34 30 31 31 30 F2
0849:27 20 54 4F 20 41 43 54 55
0851:49 56 41 54 45 00 20 73 E6
0859:00 C9 40 F0 04 C9 5C D0 C3
0861:F5 E6 7A D0 02 E6 7B A2 C7
0869:00 8E 87 9D C9 40 F0 03 1C
0871:EE 87 9D A0 00 B1 7A F0 45
0879:03 C8 D0 F9 8C 86 9D A5 56
0881:7A 8D 84 9D A5 7B 8D 85 58
0889:9D A9 00 85 F9 A9 A8 85 78
0891:FA A9 00 85 F7 A9 A0 85 0F
0899:F8 A0 FF D0 0B A0 00 B1 E7
08A1:7A 91 F9 F0 03 C8 D0 F7 76
08A9:C8 98 18 65 F9 85 F9 90 08
08B1:02 E6 FA A5 FA C9 BF 90 45
08B9:09 A5 F9 C9 A5 90 03 4C 55
08C1:D7 9D 20 73 00 AA D0 FA A7
08C9:20 73 00 8D 3A 03 20 73 31
08D1:00 18 6D 3A 03 D0 03 4C E6
08D9:88 9D 20 73 00 20 73 00 38
08E1:20 73 00 C9 AC D0 F9 20 38
08E9:73 00 A0 00 B1 7A 91 F7 5A
08F1:AA F0 03 C8 D0 F6 A5 F9 28
08F9:C8 91 F7 A5 FA C8 91 F7 42
0901:C8 98 18 65 F7 85 F7 90 4D
0909:02 E6 F8 20 73 00 AA D0 B8
0911:FA 20 73 00 20 73 00 20 06
0919:73 00 AA 20 73 00 20 CD E5
0921:BD A9 0D 20 D2 FF 20 73 6A
0929:00 4C F5 9C 00 00 00 00 D6
0931:A0 00 98 91 F7 38 A5 7A 26
0939:E9 02 85 7A B0 02 C6 7B AF
0941:78 A9 36 85 01 58 A9 02 D7
0949:A8 A2 08 20 BA FF AE 84 13
0951:9D AC 85 9D AD 86 9D 20 CA
0959:BD FF A9 EE 85 FB A9 9D 7B
0961:85 FC AD 87 9D F0 08 A9 0E
0969:00 85 FB A9 A0 85 FC A6 B2
0971:F9 A4 FA A9 FB 20 D8 FF B5
0979:78 A9 37 85 01 58 60 A9 45
0981:E1 A0 9D 20 1E AB 4C 88 23
```

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```
Ø989:9D 4D 45 4D 4F 52 59 2Ø D1
Ø991:46 55 4C 4C ØD ØØ F9 9D 64
Ø999:ØØ ØØ 9E 32 3Ø 36 33 3A 9D
Ø9A1:A2 ØØ ØØ ØØ AD ØØ Ø3 48 CØ
Ø9A9:AD Ø1 Ø3 48 A9 5D 85 FB 81
Ø9B1:A9 Ø8 85 FC A9 4A 85 FD 9A
Ø9B9:85 37 8D ØØ Ø3 A9 9E 85 8F
Ø9C1:FE 85 38 8D Ø1 Ø3 A2 22 1Ø
Ø9C9:AØ ØØ B1 FB 91 FD C8 DØ Ø9
Ø9D1:F9 E6 FC E6 FE CA DØ F2 6Ø
Ø9D9:68 8D 5E 9E 68 8D 5D 9E ØC
Ø9E1:A9 53 AØ Ø8 2Ø 1E AB 6Ø 63
Ø9E9:93 11 46 41 53 54 4B 45 AE
Ø9F1:59 ØØ 8E 34 Ø3 AD ØØ Ø2 96
Ø9F9:C9 2E FØ ØB DØ Ø6 2Ø C9 F3
ØAØ1:9F AE 34 Ø3 4C 8B E3 AD 4D
ØAØ9:Ø1 Ø2 C9 22 DØ Ø3 4C DØ 75
ØA11:9F AØ 5Ø A9 ØØ 99 3E Ø3 A7
ØA19:88 1Ø FA 8D 35 Ø3 AA AD 66
ØA21:Ø1 Ø2 C9 3Ø 9Ø 2E C9 3A 7D
ØA29:BØ 2A 2Ø 73 ØØ 2Ø 9E AD C6
ØA31:2Ø F7 B7 A6 14 8E 36 Ø3 FE
ØA39:A5 15 8D 37 Ø3 2Ø CD BD 7C
ØA41:A9 ØD 2Ø D2 FF EE 35 Ø3 C7
ØA49:A2 FF E8 BD ØØ Ø2 FØ AE 4Ø
ØA51:C9 2C DØ F6 AØ ØØ E8 BD 73
ØA59:ØØ Ø2 FØ Ø6 99 3E Ø3 C8 Ø1
ØA61:DØ F4 8C 38 Ø3 A9 ØØ 85 74
ØA69:F7 A9 AØ 85 F8 2Ø C2 9F BD
ØA71:AØ ØØ 8C 39 Ø3 B1 F7 FØ BA
ØA79:ØB D9 3E Ø3 DØ Ø3 EE 39 2B
ØA81:Ø3 C8 DØ F1 AD 38 Ø3 CD A4
ØA89:39 Ø3 DØ Ø5 CC 38 Ø3 FØ A3
ØA91:17 C8 C8 C8 B1 F7 DØ Ø3 1B
ØA99:4C 56 9E 98 18 65 F7 85 92
ØAA1:F7 9Ø Ø2 E6 F8 4C C8 9E AD
ØAA9:C8 B1 F7 85 F9 C8 B1 F7 34
ØAB1:85 FA A9 8Ø 8D 34 Ø3 AD 75
ØAB9:35 Ø3 FØ 22 AD 36 Ø3 85 3B
ØAC1:14 AD 37 Ø3 85 15 AØ ØØ 24
ØAC9:B1 F9 99 ØØ Ø2 AA FØ Ø3 Ø8
ØAD1:C8 DØ F5 2Ø C9 9F 98 18 55
ØAD9:69 Ø5 A8 4C A2 A4 AØ ØØ A6
ØAE1:A2 ØØ B1 F9 3Ø ØE 9D ØØ 12
ØAE9:Ø2 C9 ØØ FØ 62 2Ø D2 FF B9
ØAF1:C8 E8 DØ EE 8C 3A Ø3 8E 8F
ØAF9:3B Ø3 8D 3D Ø3 A9 8Ø 8D 3F
ØBØ1:3C Ø3 A9 9E 85 F7 A9 AØ 15
ØBØ9:85 F8 2Ø C9 9F AØ ØØ AD ED
ØB11:3D Ø3 CD 3C Ø3 FØ 17 B1 BF
ØB19:F7 3Ø Ø3 C8 DØ F1 C8 98 9C
ØB21:18 65 F7 85 F7 9Ø Ø2 E6 EØ
ØB29:F8 EE 3C Ø3 DØ DF AE 3B CD
ØB31:Ø3 B1 F7 3Ø ØA 9D ØØ Ø2 FF
ØB39:2Ø D2 FF E8 C8 DØ F2 49 5B
ØB41:8Ø 9D ØØ Ø2 48 2Ø C2 9F Ø7
ØB49:68 AC 3A Ø3 4C 45 9F 2Ø ØD
ØB51:C9 9F A9 ØD 2Ø D2 FF A9 3Ø
ØB59:ØØ 85 7A A9 Ø2 85 7B 98 7Ø
ØB61:A2 FF 86 3A 2Ø 79 A5 4C BB
ØB69:E1 A7 78 A9 36 85 Ø1 58 26
ØB71:6Ø 78 A9 37 85 Ø1 58 6Ø BF
ØB79:AØ ØØ B9 Ø2 Ø2 FØ Ø7 C9 E2
ØB81:22 FØ Ø3 C8 DØ F4 98 A2 FF
ØB89:Ø2 AØ Ø2 2Ø BD FF A9 Ø2 4E
ØB91:AØ Ø1 A2 Ø8 2Ø BA FF A9 A2
ØB99:ØØ A2 FF AØ FF 2Ø D5 FF 8E
ØBA1:A2 8Ø 4C 5C 9E ØØ ØØ ØØ 6D
```

Program 2: Sample Definitions

Please refer to the typing instructions in the article before entering this listing.

```
RE 1000 SYS 40110
DR 1010 REM @FASTKEY PRG
CA 1020 :
MP 1030 REM{2 SPACES}CHANGE CO
        LOR DEFAULTS
KG 1040 *C
KM 1050 POKE 53280,6:POKE 5328
        1,6:POKE 646,1
QP 1060 REM{2 SPACES}PEEK ZERO
         PAGE
XQ 1070 *ZEEK
GX 1080 FOR I=251 TO 254:PRINT
         PEEK(I);:NEXT:PRINT
EJ 1090 REM LIST VECTORS
RA 1100 *VEC
KC 1110 FORI=768TO779STEP2:PRI
        NTPEEK(I)PEEK(I+1):NEX
        T:FORI=788TO819STEP2
QH 1115 PRINTPEEK(I)PEEK(I+1):
        NEXT
KF 1120 END
QB 1130 REM{2 SPACES}COLD STAR
        T
PP 1140 *COLD
DX 1150 SYS 64738
FD 1160 REM{2 SPACES}WARM STAR
        T
CG 1170 *WARM
GD 1180 SYS 64767
CB 1190 REM{2 SPACES}FIND TOP
        {SPACE}OF BASIC
XX 1200 *HIMEM
KP 1210 PRINT PEEK(55)+256*PEE
        K(56)
KF 1220 REM FIND SIZE OF BASIC
         PROGRAM
QM 1230 *SIZE
GS 1240 PRINT "PRG SIZE IS";(P
        EEK(45)+256*PEEK(46))-
        (PEEK(43)+256*PEEK(44)
        )
XC 1250 REM PRINT LAST FILE NA
        ME CALLED
FD 1260 *NAME
CA 1270 SYS 62913
RC 1280 REM LIST TO PRINTER
FP 1290 *P
RE 1300 OPEN4,4:CMD4:LIST
DF 1310 REM END LIST TO PRINTE
        R
BM 1320 *PE
BQ 1330 PRINT#4:CLOSE4
CD 1340 REM LOAD THE DIRECTORY
PD 1350 *DIR
GD 1360 LOAD"$",8:LIST
GE 1370 REM INITIALIZE THE DRI
        VE
CS 1380 *I
QF 1390 OPEN15,8,15:PRINT#15,"
        I0:":CLOSE15
XS 1400 REM FOR/NEXT FOR PROGR
        AMS
MA 1410 *FN
JH 1420 FOR I=1 TO 100:NEXT
SM 1430 REM GET FOR PROGRAMS
PB 1440 *G
HD 1450 GET K$:IF K$="" GOTO14
        50
PK 1460 REM DISK GET FOR PROGR
        AMS
PB 1470 *DG
PG 1480 GET#2,A$:S=ST:A$=A$+CH
        R$(0)
MM 1490 REM DATA STATEMENT
PD 1500 *D
RA 1510 DATA
SD 1520 REM ERROR STATUS FOR P
        ROGRAMS
DC 1530 *ERR
GC 1540 OPEN15,8,15:INPUT#15,E
        ,E$,T,S:PRINT E;E$:CLO
        SE15
AG 1550 REM CHANGE TEXT COLOR
        {SPACE}ON SCREEN
RB 1560 *HUE
GS 1570 FORI=55296TO56295:POKE
        I,0:NEXT
GR 1580 REM ML LOAD FOR PROGRA
        MS
MH 1590 *LOAD
XD 1600 IFA=0THENA=1:PRINT"
        {CLR}{DOWN}LOADING..."
        :LOAD"FILE NAME",8,1
JE 1610 REM RANDOM FUNCTION
JE 1620 *RND
PP 1630 R=INT(RND(0)*1000)+1
KE 1640 REM MEM FREE FUNCTION
GM 1650 *FREE
GM 1660 PRINT FRE(0)-(FRE(0)<0
        )*65536
JE 1670 REM STRIP NUMBER OF LE
        ADING SPACE
DX 1680 *STRIP
GB 1690 N$=MID$(STR$(N),2):PRI
        NT N$
JM 1700 REM LIST
BD 1710 *L
ER 1720 LIST
CC 1730 REM FORMATTED TIME FUN
        CTION
HH 1740 *TIME
AA 1750 A$=TI$:T$=LEFT$(A$,2)+
        " "+MID$(A$,2,2)+" "+R
        IGHT$(A$,2):PRINT"TIME
        ="T$
QE 1760 REM GO TO ML WORK SPAC
        E
SK 1770 *GO
GA 1780 SYS 49152
XM 1790 REM CLEAR ML WORK SPAC
        E
PP 1800 *CLRML
JA 1810 FORI=49152TO53247:POKE
        I,0:NEXT
QH 1820 REM CLEAR TOP OF SCREE
        N
DJ 1830 *TOP
JS 1840 FORI=1024TO1504:POKEI,
        32:NEXT
BS 1850 REM CLEAR BOTTOM OF SC
        REEN
SH 1860 *BOT
PA 1870 FORI=1505TO2023:POKEI,
        32:NEXT
PB 1880 REM PRINT ASCII CODE O
        F STRING
PS 1890 REM DEFINE A$ BEFORE C
        ALL
PG 1900 *CODE
HH 1910 L=LEN(A$):FORI=1TOL:PR
        INT ASC(MID$(A$,I,1));
        :NEXT
```

©

Unsplat

Ronald Carnell

Finding an asterisk (*) next to a file's entry in the disk directory is an unsettling experience for any Commodore computer user. The asterisk denotes an unclosed or splat *file, which can corrupt other files or even an entire disk if ignored. This Commodore 64 utility allows you recover all the readable information from a splat file—a feat that's otherwise very difficult to perform.*

Has this ever happened to you? You're listing a Commodore disk directory and notice an asterisk (*) next to the name of one of the files. A glance at the disk drive manual tells you that this is an unclosed file, commonly known as a *splat file* (after the asterisk's resemblance to a splat of ink or paint). Other people use the term *poison file*, referring to an unclosed file's nasty ability to corrupt other files on the same disk. The asterisk stands as a warning that something went wrong when you created or wrote to the file. A splat file confuses the disk's organization, so it's important not to write to any file on the disk until the unclosed file has been cleaned up. Even worse, the file is unreadable by normal means as long as it remains unclosed.

What can you do about a splat file? According to the disk drive manual, one course is to validate the disk immediately. Validation prevents damage to other files on the disk, but at the cost of losing everything contained in the splat file itself. If you list the directory after validation, you'll notice that the splat file has completely disappeared. Unless you had a backup copy of that file, its contents are lost.

Help Is On The Way

"Unsplat" serves those occasions when you need to recover the information in a splat file. It's a machine language program whose only function is to let you restore a splat file (no machine language expertise is needed to use the program). Notice the use of the term *you*. Unsplat can't recover a file without some direction from you; only a human has the intelligence to recognize the end of the file. But it does make the recovery process as painless as possible.

Type in and save Unsplat with the "MLX" machine language entry program listed elsewhere in this issue. Follow the MLX instructions carefully. When you run MLX, you'll be asked for the starting and ending addresses of the data you'll be entering. Here are the addresses you'll need to enter Unsplat:

Starting address: 0801
Ending address: 0C00

Although it's written in machine language, Unsplat is designed to load and run just like an ordinary BASIC program. When you run Unsplat, it begins by asking you to indicate the type of the file you wish to recover. This is the type which appears when you list the disk directory. Enter an S, P, or U to indicate a sequential (SEQ), program (PRG), or user (USR) file, respectively. Unsplat doesn't work with relative (REL) files; that's not a serious limitation, since relative files are rarely corrupted.

The second prompt asks you to enter the filename. If you omit the 0: in front of the filename, Unsplat adds it for you automatically.

Once Unsplat knows the file type and filename, it asks whether you wish to autocycle through the file or examine each sector of the file individually. If you don't know the file's size, look at each file individually (no autocycling). In this mode, Unsplat displays the contents of each file sector in turn and proceeds to the next sector only when you indicate that it has not yet reached the end of the file.

Autocycling is appropriate for large files which you believe to be mainly intact. When this option is selected, Unsplat reads automatically through a designated number of file sectors before asking you to look at an individual sector to determine whether it contains the file's end. Unsplat can autocycle through as many as 200 blocks (50715 bytes). Of course, to use this option you must have some idea of the file's length. The directory won't help, since it always shows zero blocks for a splat file. However, you may have some other means of guessing at the length (for instance, a file containing graphics bitmap data must be at least 8000 bytes long).

It's usually best to be conservative when estimating the file's length for autocycling. The major characteristic of a splat file is that it lacks the end-of-file marker that normally tells the drive not to read any more sectors. If you order the drive to read sectors past this point, it may interpret garbage bytes as track and sector information and attempt to access a nonexistent track or sector. If the disk drive locks up during an autocycle, you have probably overshot the file's end. No harm is done, since Unsplat does not write to the disk. Simply turn the drive off and on; then repeat the operation using a smaller number of sectors.

Human Brain Required

Sooner or later, you'll need to examine the contents of a sector to determine whether or not it contains the last sector in the file. Since the file's normal pointer system has been confused, there's no rational way for a program to do this for you. It's up to you to locate the file's end as best as you can, based on the file's contents.

Some files are easy to handle. In a word processing document which you created, look for the last sentence in the document. If the file contains a BASIC program, the task will be a bit more difficult, since BASIC keywords such as PRINT are compressed into one-byte tokens when you save the program to disk. However, characters in REM, DATA, and PRINT statements are stored exactly as they are typed in. Every BASIC program ends with a marker consisting of three zero bytes in a row. In Unsplat's display, this end-of-program marker appears as three @ characters in a row (@@@).

When you tell Unsplat that you've found the end, it asks whether you want to fine-tune the last file sector. In many cases, the final block will contain garbage beyond the spot where actual file data ends. Fine-tuning allows you to remove this garbage, one character at a time, until the last block holds only data from the original file. If you tell Unsplat to fine-tune, it displays the last two characters of the previous block and the first 254 characters of the final block. Just press N to remove a character from the end of the display. When the block looks right, press Y.

After the final block has been identified (and fine-tuned if necessary), Unsplat directs you to insert a fresh disk and press RETURN. When you do so, the recovered file is written to disk. You can breathe a sigh of relief at last.

In some cases, you simply won't be able to recover the entire file. Splat files are most commonly caused by failing to close a file properly. Under circumstances that create such a file, it's common for the drive to fail to write the final segment of data from its internal memory to the disk. Depending on what's happening at the time of the interruption, the drive buffer may contain anywhere from 1–255 characters. Thus, it's very common for the very last sector of the file to be incomplete. You can't recover data that was never put on the disk in the first place. In the most extreme case (for instance, if you lose power while saving a program), only a small part of the file may remain.

Data can also disappear as a result of disk operations performed after the splat file comes into existence. Each sector of a normal disk file begins with a pointer that tells the drive where to find the next sector in the file. If you write to a splat file, or write to other files on the same disk, one or more of these pointers may be corrupted. Dire results can occur when the disk's pointer system gets confused. Instead of saving new data on an unused part of the disk, the drive may put it in a sector that already contains data, destroying what was previously there. In the worst case, several files can become cross-linked, garbling large amounts of data.

Unsplat

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

```
0801:0C 08 0A 00 9E 20 32 30 64
0809:36 32 00 00 00 A9 01 8D F6
0811:86 02 A9 D0 A0 0A 20 1E B2
0819:AB 20 49 08 20 C7 09 A5 88
0821:03 C9 30 F0 0F A9 0D 20 93
0829:D2 FF A9 3C A0 03 20 1E 0B
0831:AB 4C 43 08 20 33 09 20 13
0839:08 0A A9 02 20 C3 FF 20 55
0841:6A 0A A9 02 20 C3 FF 60 CE
0849:A9 F3 A0 0A 20 1E AB 20 D0
0851:B3 09 C9 50 F0 0B C9 53 56
0859:F0 07 C9 55 F0 03 4C 50 AE
0861:08 20 D2 FF 8D 6A 0B A9 AD
0869:09 A0 0B 20 1E AB A0 00 6A
0871:84 F9 20 B3 09 20 D2 FF EF
0879:C9 0D F0 16 C9 14 D0 09 7A
0881:A4 F9 F0 EE C6 F9 4C 73 99
0889:08 A4 F9 99 55 0B E6 F9 3E
0891:D0 E0 A4 F9 C0 10 90 04 E1
0899:A0 10 84 F9 A2 00 BD 69 28
08A1:0B 99 55 0B C8 E8 E0 04 A8
08A9:D0 F4 C8 C8 84 F9 A9 00 64
08B1:85 06 85 F7 85 F8 85 04 55
08B9:A9 17 A0 0B 20 1E AB 20 1A
08C1:B3 09 20 D2 FF C9 4E F0 D3
08C9:68 C9 59 F0 14 A9 14 20 4A
08D1:D2 FF 4C C0 08 A6 04 F0 B4
08D9:0F C6 04 20 D2 FF 4C E9 BE
08E1:08 A9 2B A0 0B 20 1E AB 90
08E9:20 B3 09 C9 14 F0 E6 C9 B0
08F1:0D F0 14 C9 30 90 F1 C9 55
08F9:3A B0 ED 20 D2 FF A6 04 FA
0901:9D 1E 02 E6 04 D0 E1 20 5F
0909:D2 FF A9 00 A6 04 9D 1E 58
0911:02 A5 7A 48 A5 7B 48 A9 B6
0919:1D 85 7A A9 02 85 7B 20 42
0921:83 AE 20 AA B1 84 F7 85 64
0929:F8 E6 06 68 85 7B 68 85 29
0931:7A 60 A9 93 20 D2 FF A2 F5
0939:00 8A 9D 00 D8 E8 D0 FA A8
0941:A9 00 85 FB A9 0C 85 FC 1E
0949:A9 6D A0 0B 20 1E AB A2 C3
0951:02 20 C6 FF A2 02 A0 00 A3
0959:86 04 84 05 20 E4 FF A4 C9
0961:05 91 FB 48 29 80 4A 85 C3
0969:03 68 29 3F 05 03 A6 04 B5
0971:9D 00 04 E6 05 E6 04 D0 DD
0979:E3 20 CC FF A5 05 18 65 F5
0981:FB 85 FB 90 02 E6 FC A5 C6
0989:06 F0 15 38 A5 F7 E9 01 E2
0991:85 F7 B0 02 C6 F8 A5 F7 F7
0999:D0 AE A5 F8 D0 AA 85 06 46
09A1:A9 8A A0 0B 20 1E AB 20 E0
09A9:B3 09 20 D2 FF C9 59 D0 B3
09B1:97 60 A9 00 85 CC 20 E4 61
09B9:FF F0 FB A2 02 86 CD A6 1E
09C1:CF D0 FC E6 CC 60 A9 02 3B
09C9:A8 A2 08 20 BA FF A2 53 4A
09D1:A0 0B A5 F9 20 BD FF 20 63
09D9:C0 FF A0 00 A9 08 20 B4 C2
09E1:FF A9 6F 20 96 FF 20 A5 E8
09E9:FF 85 03 20 A5 FF 20 A5 D2
09F1:FF 20 A5 FF C9 2C F0 06 A7
09F9:99 3C 03 C8 D0 F3 A9 00 7E
0A01:99 3C 03 20 AB FF 60 A9 1B
0A09:A9 A0 0B 20 1E AB 20 B3 11
0A11:09 20 D2 FF C9 59 F0 0D AE
0A19:C9 4E F0 4C A9 14 20 D2 39
0A21:FF 4C 0F 0A 60 C6 FC A0 83
0A29:00 84 05 C6 05 A0 00 A9 BF
0A31:20 99 00 04 C8 D0 F8 B1 29
0A39:FB 48 29 80 4A 85 03 68 61
0A41:29 3F 05 03 99 00 04 C8 28
0A49:C4 05 D0 EB A9 8A A0 0B 9D
0A51:20 1E AB 20 B3 09 20 D2 49
0A59:FF C9 59 D0 CE 18 A5 FB 36
0A61:65 05 85 FB 90 02 E6 FC 31
0A69:60 A9 C8 A0 0B 20 1E AB FB
0A71:20 E4 FF C9 0D D0 F9 A4 AF
0A79:F9 88 A9 57 99 53 0B 20 A7
0A81:C7 09 A5 03 C9 30 D0 3F 90
0A89:A9 F0 A0 0B 20 1E AB 78 BC
0A91:A9 36 85 01 58 A2 02 20 3A
0A99:C9 FF A9 00 85 FD A9 0C 4B
0AA1:85 FE A0 00 B1 FD 20 D2 E4
0AA9:FF E6 FD D0 02 E6 FE A5 93
0AB1:FB C5 FD D0 ED A5 FC C5 C7
0AB9:FE D0 E7 20 CC FF 78 A9 81
0AC1:37 85 01 58 20 DB 09 A9 A4
0AC9:3C A0 03 20 1E AB 60 93 7A
0AD1:11 2A 55 4E 53 50 4C 41 3E
0AD9:54 2A 0D 11 12 49 4E 53 FA
0AE1:45 52 54 20 27 53 50 4C 2D
0AE9:41 54 27 20 44 49 53 4B D3
0AF1:20 00 0D 0D 46 49 4C 45 BD
0AF9:20 54 59 50 45 20 28 50 AE
0B01:2F 53 2F 55 29 3F 20 00 45
0B09:0D 0D 46 49 4C 45 20 4E 4C
0B11:41 4D 45 3F 20 00 0D 41 14
0B19:55 54 4F 2D 43 59 43 4C FD
0B21:45 20 28 59 2F 4E 29 3F C0
0B29:20 00 0D 0D 42 45 20 43 6C
0B31:41 52 45 46 55 4C 21 0D B4
0B39:48 4F 57 20 4D 41 4E 59 99
0B41:20 43 59 43 4C 45 53 20 D5
0B49:28 3C 3D 32 30 30 29 3F 21
0B51:20 00 30 3A 31 32 33 34 0E
0B59:35 36 37 38 39 30 31 32 21
0B61:33 34 35 36 37 38 39 30 65
0B69:2C 53 2C 4D 13 11 11 11 D4
0B71:11 11 11 11 11 52 45 41 25
0B79:44 49 4E 47 2E 2E 2E 20 E8
0B81:20 20 20 20 20 20 20 20 97
0B89:00 13 11 11 11 11 11 11 97
0B91:11 11 49 53 20 54 48 49 FE
0B99:53 20 54 48 45 20 45 4E F3
0BA1:44 3F 20 20 20 14 14 00 29
0BA9:13 11 11 11 11 11 11 11 C0
0BB1:11 46 49 4E 45 2D 54 55 CC
0BB9:4E 45 20 54 48 49 53 3F DE
0BC1:20 20 20 20 14 14 00 93 7A
0BC9:49 4E 53 45 52 54 20 44 3F
0BD1:45 53 54 49 4E 41 54 49 E7
0BD9:4F 4E 20 44 49 53 4B 0D AE
0BE1:50 52 45 53 53 20 52 45 97
0BE9:54 55 52 4E 0D 0D 00 57 A2
0BF1:52 49 54 49 4E 47 2E 2E BC
0BF9:2E 0D 00 00 00 00 00 00 6A
```

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Computers and Society

David D. Thornburg, Associate Editor

The Computerized Word

While there will always be some who will continue to resist technology to their dying day, many writers have finally realized that the computer is a powerful ally, not a demon to be cursed. The mystique surrounding the novelist sitting at the old Underwood like Angela Lansbury in "Murder, She Wrote" is being replaced by a practical reality: word processors.

As a professional writer, I know that I would have chosen another profession by now if it weren't for my access to a word processor. I like to prepare easy-to-read documents and to leave evidence of my more glaring errors in the trash bin where they belong.

A New Writing Medium

If we trace the development of writing implements from prehistoric times, most of the advances have been devoted to the improvement of the finished product, not to any fundamental change in the writing process itself. Even traditional word processors produce documents of the sort one would create with pen and paper or with a typewriter. The advantage of a word processor is that it allows the author greater flexibility in the arrangement, rearrangement, and correction of text. These features aside, the product is the same as it has been for hundreds of years—a paper document.

While this application for computers is quite appropriate, the computer has the capacity to do much more—to become a new writing medium. Rather than being just another tool for generating traditional paper documents, the computer can help facilitate the writer's creative process and can allow the creation of nonlinear documents that have no printed counterpart.

Rather than thinking of a document as a linear body of text, you can think of it as having many levels and views. Depending on the needs of the writer, different levels can be used to express different kinds of ideas. The reader can derive a new power as well—a document can be read in completely different sequences from the one in which it was written.

While my crystal ball is as cloudy as anyone's, I think that the next breakthrough in writing will come when we break free entirely from paper-based documents. Books can be published on disk as easily as on paper. This new medium of publication will let us create documents that can't be printed in the normal sense of the word. If a document can be expressed in a linear form, it probably should be put on paper just because this medium is still easier to handle.

Hypertext

The next breakthrough in writing will come through the use of a concept called *hypertext*. Imagine that you are at your computer and you've just loaded a historical novel about westward expansion. As you read, you come across the name of Charles Fremont. You decide you'd like to know more about Fremont, so you move the cursor to his name and press a key. You are immediately transported into another document that provides a brief description of this man. It may mention some of his activities, names of his principal associates, and so on. As you read about Fremont your eye is drawn to the name Kit Carson. You repeat the process and find yourself in a wonderful digression on this colorful character of the Old West.

Once you've rummaged for a while, you return to the original text and continue reading.

This hypothetical journey through a hypertext document reveals its basic structure: Any word in the document can point to other documents. In a well-designed system, these new documents are also written in hypertext so the process can go on indefinitely.

The reader of a hypertext document can move along in a linear manner at one level but can go deeper for descriptions of key words or concepts in the original.

In some sense we try to accomplish the same thing in traditional writing through the use of footnotes. Unfortunately, footnotes are viewed as clutter, and nested footnotes are nearly impossible to read.

The seeds for hypertext were firmly planted 40 years ago in an *Atlantic Monthly* article entitled "As We May Think," by Vannevar Bush. The computer as we know it had yet to be invented, but in this landmark article (reprinted in *CD/ROM: The New Papyrus*, Microsoft Press) Bush specified the design of hypertext word processors that have yet to be implemented.

Douglas Englebart had read Bush's article and, in 1962, proposed implementing his ideas on a computer. The word "hypertext" was coined by Ted Nelson, author of the underground computer classic, *Computer Lib*.

What Are We Waiting For?

There is no technological limitation to the creation of a hypertext processor; I have written one that runs on my 128K Apple IIe. The real challenge is one of the mind. We are so accustomed to thinking of a document as a linear string of text that it will take a lot of exposure and experimentation before we can break our bonds with paper.

As Marshall McLuhan once said, "The medium is the message." Hypertext is a new medium, and it will allow the expression of messages that cannot be dreamed of in a pencil and paper world—as soon as we are ready to read them. ©

Fred D'Ignazio, Associate Editor

Computers For Adult Literacy

In his book *Illiterate America* (Doubleday, 1985), Jonathan Kozol unleashes a bombshell: 25 million American adults cannot read the poison warnings on a can of pesticide, the front page of a newspaper, or a letter from their child's teacher. Another 35 million cannot read well enough to function successfully on their job. That's *60 million people—more than a third of all U.S. adults—who are functionally illiterate.* These figures cause the U.S. to be ranked 49th in literacy out of the U.N.'s 158 nations.

Among disadvantaged minorities the problem is even worse. Forty-seven percent of all black 17-year-olds are functionally illiterate. By 1990 that figure will be closer to 50 percent. More than 40 percent of all welfare mothers cannot read or write. In Boston, 40 percent adults are illiterate. And in Utah, which spends more on education, per capita, than any other state, 200,000 adults are unable to read well enough to find employment.

The numbers keep getting worse; we're turning out more and more illiterate children from our schools every year, and it's costing the U.S. an estimated $100 billion in lost income. According to a national study on adult illiteracy, we are "A Nation at Risk."

What Can Be Done?

I think we can use personal computers to fight illiteracy. As a computer enthusiast, I have long been impressed with the way a personal computer can transfer *power* to an individual. In this case, the computer needs to transfer the power of literacy to individuals.

One company cannot solve the problem of adult illiteracy on its own. The problem is too gigantic. An industry group must be created, along the lines of the High Sierra Group. The group should come up with an industry-wide:

- Design of a small, portable personal computer that can be put into the hands of millions of illiterate adults.
- Design of educational software that teaches these adults some fundamental reading and writing skills—in a practical, applied way relevant to these adults' daily lives.

At a superficial level, the problem looks easy. We design the computers and the software, and we put them into the hands of the needy individuals. Then they follow our programmed instruction, pull themselves up by their bootstraps, and learn to read and write on their own.

Nothing could be more naive.

Kozol warns against the quick, easy technological fix. "Those who market personal computers," he writes, "have begun to foster an insidious idea that individual learners, sheltered in the privacy of their own homes, may now at last be able to determine, shape, and supervise their own instruction. They can determine the pace, the pressure, or the necessary repetition of a predetermined sequence of ideas. However they cannot shape the content; nor can they subvert the passive stance which the computerized agenda has congealed ... People can press buttons. The buttons allow them the illusion of manipulation. It is a disarming substitute ... for anything like real control over their lives."

Gaining Personal Control

I have more faith in personal computers than Kozol, but I think he has identified the central problem: It is lack of control—personal control over one's life. If an army of technological do-gooders descended on adult illiterates promising "Literacy Today the Programmed Way," the effort would surely fail. Illiteracy is more than not knowing how to read or write. It's a dismal swamp of environment, schooling, family life, personal values, attitudes, and circumstances. And people are sinking deeper and deeper into that swamp. Simply handing them a personal computer would be a cruel trick. It would be like handing them an oar to save them from drowning, then forgetting to hold on at the other end.

To rescue people from illiteracy, we have to give people both hope and control. And we have to make sure that the learning process doesn't lie completely between the learner and the machine. Other human beings (fellow computer enthusiasts, that's you!) need to be involved. As Kozol says, "Mechanical means too frequently have mechanistic ends." It is important to design the software and the administration of the literacy program to make sure that we improve people's lives and well-being, not just improve their literacy score.

Adult illiteracy is a frightening, daunting problem. But it also can be a wonderful opportunity. We're moving quickly to a new era, a "post-Gutenberg" era, in which books must coexist with television, radio, movies, computers, videos, electronic music, and global telecommunications. With the maturation of compact disc technology, we'll be able to create interactive, multimedia books, complete with animations, Sesame Street–like dancing numbers and words, still photographs, and high-fidelity music. Like our own personal storyteller, our books will speak to us, show us pictures, and teach us.

Few *literate* adults are prepared for this new online, interactive, multimedia world. Perhaps there is a way to train the vast numbers of illiterate adults so that they can enter this world directly and be one step ahead of the rest of us. That's a goal worth shooting for. ©

The Beginner's Page

C. Regena

DATA Statements

Data items are numbers or words that the computer works with. One way to get information into the computer is to use assignment statements such as LET A=4 or simply A=6 (the word LET is optional on most computer versions of BASIC). Another way to get information into the computer is to use READ statements with associated DATA statements. A DATA statement is ignored until a READ statement is encountered in the program, but then the READ continues through any DATA statements in order, picking off the information on these lines.

Greater Efficiency

Here's an example of a DATA statement with a READ statement that could replace seven LET assignment statements.

```
10 READ A,B,C,X,Y,Z,N$
20 DATA 5,3,2,4,1,8,BOB
30 PRINT A*B+C
```

When the computer comes to a READ statement which contains a variable name, it starts from the beginning of the program and looks for the first DATA statement. The first item in the DATA statement is assigned to the first variable in the READ statement. In this example, the value of 5 will be assigned to the variable A. Data items are separated by commas. The next variable to be read, B, is given the very next data item, 3. The next variable, C, is given the very next data item, 2. This process continues. But you won't see any results of the READ statement until you actually PRINT something. Line 30 uses some of the variables assigned to print a mathematical calculation.

The data items are always separated by commas and read in order, assigning each item to the variable name in the READ statement. You can have one or any number of variables in the READ statement. You can use numbers or strings. But you do need to be especially careful that the data items match up with the variables exactly as you want them to be assigned.

You can have any number of items in a DATA statement. When the computer finishes picking off the data items in one DATA statement, it goes to the very next DATA statement in the program. The number of items in the DATA statement does not have to match exactly the number of items in the READ statement, but eventually there do have to be enough data items for all the variables to be read. For example:

```
10 DATA 10,3,4
20 READ A,B,C,D,E,F,G
30 DATA 7,2,6,5
```

It doesn't matter whether the READ statement comes before the DATA statement or vice versa. In fact, they do not even need to be consecutive lines. In the example above, some of the data items are in line 10 before the READ statement and some are in line 30 after the READ statement. It's important to remember that the program ignores the DATA statements until the READ statement needs to look for data, and then that the DATA statements are used in the order they appear in the program.

Quite often you'll see a READ statement inside a FOR-NEXT loop to perform repeated operations, perhaps using subscripted variables or variables in an array. Here's an example using strings:

```
10 FOR C=1 TO 9
20 READ PL$(C),BB$(C)
30 NEXT C
40 DATA QUISENBERRY,P,SUND-
   BERG,C
50 DATA BALBONI,1B,WHITE,2B,
   BRETT,3B
60 DATA BIANCALANA,SS,LAW,LF
70 DATA WILSON,CF,BJACKSON,RF
```

The variable C is used as a counter in the loop. With each pass through the loop a player name PL$ and a position BB$ are read from the data. The DATA statements in lines 40–70 are kept short for this example, but you could put all the data into one or two statements to save memory.

A Common Source Of Errors

For some programmers, DATA statements are the most common source of errors, especially if there are lots of items with commas or similar lines close together. If an error message refers to a line containing a READ statement, it's likely that an incorrect DATA statement is the real cause of the error. When you type DATA statements, you need to be especially careful with the placement of commas. If there are several commas together for null strings, be sure to type in the correct number of them. And avoid inadvertently typing a comma at the end of your data list. Also, period and comma keys are side-by-side on the keyboard, so it's easy to type a period in place of a comma, which may be difficult to spot in listings on the screen.

Note too that although your program might not always stop with an error message, something might not be working correctly. Again, a DATA statement could be at fault. For example, if you're reading in notes for music and the tune doesn't sound right, the numbers for the notes in the DATA statements would need to be checked. ©

Telecomputing Today

Arlan R. Levitan

The Year To Come

[Editor's Note: Readers should be advised that the predictions of columnist Levitan below are likely to prove more a source of humorous, than of prognostic, value.]

Astute readers who perused the last two issues of COMPUTE! are quite likely cognizant of the discussions generated by the November "Telecomputing Today" column dealing with the highly competitive nature of today's commercial information services. The public discussions, both online and offline, were often high-spirited and passionate. In fact, in the heat of one online discourse, one person semijokingly referred to the column in question as an example of *National Enquirer* journalism.

I wish that COMPUTE! columnists were paid a fraction of what the average supermarket-checkout-line-tabloid flack pulls down. Hmmm...maybe a minor format change could launch me into the major remuneration league. How about "I CUT OUT MY MODEM'S CLOCK CHIP AND STOMPED ON IT," "ALIENS LIVE IN MY HOME COMPUTER," or "THE HACKER'S DIET—LOSE TWENTY POUNDS IN THREE SLEEPLESS DAYS," all in bold 24-point type?

Rather tasty, but on second thought, a wee bit tacky. Wait a minute: This is January 1987, right? Why not a little telecomputing prognostication for the coming year, à la Jeanne Dixon? What the heck! Let's give it a shot:

• One of the top three consumer information services will be sold within the first three months of the year. Two of the current top ten will drop out of the business. General Electric's GEnie system will advance to the number 2 slot and force leader CompuServe to drop its 1200-bps rates below seven dollars an hour.

• A realtime multiplayer game (most likely in the Dungeons and Dragons genre) will be written for the Commodore Amiga that will be able to support four players connected together by modem via the Amiga's multitasking capability. Someone will claim that the program displays color graphics with occult significance if the program is decompiled and the code is reassembled in reverse order.

• The advent of home CD/ROM units makes a big dent in the business of info services that focus on specialized database search and retrieval. Music isn't the only thing that compact discs can store. A CD can store over 150 million bytes of information per disc. That's enough to hold entire encyclopedias, every automobile test report ever written, or the complete works of Shakespeare. PC SIG, a distributor of public domain software for the IBM PC, is already selling a home CD/ROM unit for less than a thousand bucks, and tosses in a single disc with its entire software library. The disc, which currently contains over a hundred megabytes of programs, can be returned to PC SIG for updates at a nominal fee.

• At least ten affordable 9600-bps modems that use standard telephone lines to bring down the cost of accessing commercial information services will be introduced by the end of Spring 1987. As independently owned and operated BBS systems move into the fast lane, most of the commercial services will be forced to drop their premiums for 2400-bps service.

• Notwithstanding their speed, the new 9600-bps modems will be the end of the line for modems utilizing analog transmission techniques. Pacific Bell will begin to market home service that allows concurrent voice and high-speed data transmission by the end of the year.

• In an effort to entice new computer owners to get into the telecomputing habit, the major players in the info service game will include free 300-bps modems with their introductory sign-up kits as well as free time.

• Single-chip modems will be readily available in speeds up to 2400 bps for less than a hundred dollars. Several new computers will include an empty socket on their motherboards into which users will simply plug the modem chip of their choice.

• The Cellular Phone system will embrace modems with a bear hug worthy of Hulk Hogan this year. Mobile phones with integrated modems will soon be standard equipment for the high-tech highway cruiser. High contrast, backlit, twisted element LCD displays will flip up from the dashboard, making it a snap to dial up your home or office computer. Don't worry about taking your hands off the wheel to key in data either. Speaker-independent voice-recognition systems that fire off prestored macros will eliminate the need for most manual entry.

• The IRS will introduce online filing of tax returns for businesses by the end of the year and for individuals by the end of 1988. Complete tax information and regulations will be available for perusal as well. The new process will have a major impact on the processing time required for returns, adding at least a month to the normal turnaround time. ©

Microscope

Sheldon Leemon

The personal computer industry exists in a peculiar state of schizophrenia because its two component parts, hardware and software, keep pulling in opposite directions. The frantic pace of hardware development brings us a new generation of more powerful machines every few months. But since one piece of hardware requires hundreds or thousands of pieces of software, each of which takes time to write or translate, software can never keep pace with hardware changes. As a general rule of thumb, any time a decent library of useful software has been developed for a computer, its hardware has become hopelessly outdated and a new model is on the way.

The industry tries every way it can to cope with this dilemma. Many new products are designed to be upwardly compatible with older ones. Like the Commodore 128 and the Apple IIGS, they add new features to an existing design, allowing them to run software written for the earlier machines. But the requirement that the new computer be compatible with the old one imposes restrictions on how much further advanced the new machine can be over the original. For example, to maintain compatibility with the 6502 processor family, the GS uses the 65816, which, though more powerful, still doesn't quite measure up to the 68000 used by the competing Atari ST and Commodore Amiga.

Another problem of upward compatibility is that software firms write programs for the least common denominator. If you sell a program for the Commodore 128, your potential audience is 100,000 or so users. But if you limit the program's power so it runs on the 64, you add 2,000,000 64 owners to that audience. It seems likely that this thinking has slowed the development of software that uses the extended memory and 80-column screen of the Commodore 128, and that the same logic may prevent software that takes full advantage of the Apple IIGS from appearing as quickly as it would otherwise.

Where two machines are so different that upward compatibility isn't a viable alternative, many manufacturers are using add-on emulators to allow their computers to run software designed for another. With IBM dominant in the industry, it's no surprise that the makers of all three big-name 68000 machines—Commodore's Amiga, Atari's ST, and Apple's Macintosh—are currently working on IBM compatibility, each in a slightly different way. Apple is rumored to be readying a Mac with slots that will support a plug-in PC. Atari plans a stand-alone box that plugs into the DMA port, with a PC motherboard and memory, but no 5¼-inch-disk drive or slots. Amiga's Sidecar is the most elaborate, with a PC motherboard, memory, a 5¼-inch drive, and PC-compatible slots. And the PC isn't the only target for emulation. Commodore is encouraging the development of a 64 emulator (priced at $140) for the Amiga, and third-party Data Pacific has come up with Magic in a Sack, a software Macintosh emulator for the Atari ST.

Whether any of these emulators will substantially boost computer sales remains to be seen. In order to get perfect compatibility, the emulator has to duplicate the hardware of the computer it's emulating, making it cost almost as much as the real thing. In the past nobody has shown much interest in buying an Atari 2600 emulator for the same price as an Atari 2600, or an Apple II emulator for the 64 that costs the same as an Apple clone, so will anybody be interested in a PC emulator that costs as much as a PC clone? The Amiga Sidecar may succeed because it offers an upgrade path for the Amiga itself, providing a cost-effective way of adding a hard disk and more memory. The Atari box, while a less complete emulation, boasts a low price. And the Mac can count on the fact that price never stopped anybody from buying Apple products. Whatever the outcome, the development of split-personality computers comes as no surprise to an industry that's always been pulled in two directions.

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As expected, Atari has taken the first step towards a public stock offering. Going public may mean big bucks for Tramiel and Co., but it's also forced them to reveal a lot of financial information. The Atari prospectus sheds some interesting light on its operations—some encouraging, some less so. On the bright side, the Tramiels have stemmed a tidal wave of red ink in a short time, taking a company that lost $60 million in '84 to a $12-million profit in the first half of '86. But ST sales figures turn out to be smaller than commonly assumed. As of September 15, 1986, about 150,000 were sold, with perhaps half of those going abroad. While some previous industry estimates had the ST outselling the Amiga by a considerable margin, it now seems likely that the two are close to even in U.S. sales, despite Atari's six-month head start. The prospectus also notes the company's intention to build two- and four-megabyte machines, a blitter chip for fast graphics, a laser printer, and possibly a 1280 × 960 display. Finally, it's interesting to see that almost a quarter of Atari's sales still come from video games. Maybe we'll see that 2600 emulator for the ST yet.... ©

Donald B. Trivette

QuickBASIC

If you like the IBM BASIC language, you're going to love Microsoft's new *QuickBASIC Compiler*. That is, once you get used to it. In the beginning, some IBM BASIC programmers may well find *QB* cumbersome and something of a bother to use.

The first bump in the road is *QuickBASIC*'s full-screen editor. Instead of typing line number 11 to insert something between lines 10 and 20, as you would in IBM BASIC, you have to move the cursor to the end of line 10 and then press the enter key. A space opens on the screen to allow statement 11 to be added in its proper place. This would be easy enough if only I could remember to put the cursor at the *end* of the previous line before pressing the enter key.

The next takes-getting-used-to item is deleting a line or parts of a line. *QuickBASIC* hasn't heard of CTRL-Backspace, instead it uses CTRL-D to delete everything to the right of the cursor, and CTRL-Y to delete a whole line. (Who can remember CTRL-Y?) On the other hand, I don't have type LIST 850–950 to look at a portion of my program; pressing the PgUp or PgDn keys instantly displays screens full of the program, and that's a nice feature.

Menu Troubles

While LIST and DELETE have their *QuickBASIC* counterparts in special keys, most of the IBM BASIC commands don't (for those *QB* uses menus). There are five menus: File, Edit, View, Search, and Run; and each menu has what Microsoft calls dialog boxes—which are really lists of commands. Want to save a program? You must press the ALT-F to drop down the files menu, select the SAVE command with the cursor keys, approve a file name from a dialog box, and finally press Enter. I could type SAVE "ABC" a dozen times by the time I go through all that, but you can't stand in the way of progress.

To make up for these annoyances, the *QuickBASIC* editor has some nice features that IBM BASIC doesn't. Want to move a whole block of statements from the top of the program to the end? Just call up the Edit menu and use the Cut/Copy/Paste commands. Need to change every occurrence of the variable INCOME to GROSS? Use the Change command on the Search menu. *QuickBASIC* supports a mouse for moving around the screen and selecting commands, and if I had one, menu-driven editing might make more sense—and be more fun.

Some Excellent Features

Fortunately, there's a lot more to *QB* than the editor. Since there's no need for BASIC to distinguish between commands and program statements, line numbers are optional. Instead of saying GOTO 60, you can say GOTO TOWN where TOWN replaces the line number 60 (i.e., TOWN: PRINT VALUE). *QB* also allows you to use real subprograms, called by a name, from which values may be passed back to a main program.

Best of all, *QB* supports structured logic statements. For those of you who have never used a structured language like PL/1 or Pascal, that means you can control as many statements as you want with an IF statement. For example the following is valid in *QuickBASIC*.

```
IF TIME1>10 THEN
A=5
B=10
C=20
...
ELSE
A=33.3
B=165.23
C=66
...
END IF
```

It's possible, as any computer science student will tell you, to write entire programs without ever using a GOTO statement. That may be carrying structured programming too far, but the structured IF is a much-needed addition to BASIC.

There are features for the advanced programmer too: separate compilation of modules, each up to 64K, and the ability to store modules in a library and link them together into programs; the ability to directly call assembly language routines; and support for IBM's Enhanced Graphics Adapter (EGA).

Compiler is a misnomer for *QuickBASIC*; it's really a complete BASIC language development system. You can write the program using the full-screen editor, test it using the compile and run command (from a menu of course), which is the equivalent of IBM BASIC's RUN, fix any errors, and then compile, link, and generate an executable program (.EXE). All that under the *QB* umbrella.

Or, if you dislike learning the new editing commands and using the pull-down menus, you may use the compiler functions of *QuickBASIC* in batch mode. Build the program using IBM BASIC—but no structured programming or other advanced features allowed—and then invoke the *QuickBASIC* compiler by command. The compiler switches are identical to the ones in the IBM COMPILER—for example, QB TEST /x/o/e; would compile the program named TEST. The truth is, the more I use *QB*, the less I return to IBM BASIC to fix errors and make small changes; eventually CTRL-D will become second nature and IBM BASIC will become a relic.

BASIC programs compiled by *QB* will execute on computers running either IBM DOS or Microsoft's version of DOS. And at just $99, *QuickBASIC* is a steal. ©

Philip I. Nelson, Assistant Editor

The Best ST BASIC?

Quick—which high-level language for the ST is as easy to program as BASIC, yet offers full access to system features and an execution speed that rivals assembly language? If you answered *Gfa BASIC*, you may be correct on all counts. This exciting new ST language is already on the market in West Germany. It offers everything found in conventional BASICs, plus much, much more.

Cosmetically, a *Gfa BASIC* program resembles Modula-2 or Pascal code. Line numbers are eliminated in favor of meaningful labels, and subroutines take the form of *procedures* which are called by name. A procedure can accept parameters from the main program and can use local variables as well. *Gfa BASIC* also allows recursion (a procedure which calls itself). The language includes a host of new keywords:

ADD, ALERT, ARRAYFILL, ARRPTR, BASEPAGE, BGET, BIN$, BIOS, BITBLT, BMOVE, BOX, BPUT, C:, CHDIR, CHDRIVE, CLS, CRSCOL, CRSLIN, DEC, DEFFILL, DEFLINE, DEFLIST, DEFMARK, DEFMOUSE, DEFNUM, DEFTEXT, DFREE, DIM?, DIR$, DIV, DO-LOOP, DPEEK, DPOKE, DRAW, EVEN, EXEC, EXIST, EXIT IF, FALSE, FATAL, FILES, FILESELECT, FORM INPUT, FRAC, GEMDOS, GET, GRAPHMODE, HARDCOPY, HIDEM, HIMEM, IF–ELSE–ENDIF, INC, INFOW, INKEY$, INP?, LOCAL, LPEEK, LPOKE, MAX, MENU menu$( ), MENU KILL, MENU OFF, MENU( ), MIN, MKDIR, MONITOR, MOUSE, MOUSEX, MOUSEY, MOUSEK, MUL, ODD, ON BREAK, ON MENU GOSUB, ON MENU BUTTON GOSUB, ON MENU KEY GOSUB, ON MENU MESSAGE GOSUB, ON MENU IBOX GOSUB, ON MENU OBOX GOSUB, ON MENU, OUT?, PAUSE, PBOX, PELLIPSE, PRBOX, PLOT, POINT, POLYLINE, POLYFILL, POLYMARK, PRINT AT, PROCEDURE, PUT, RANDOM, RBOX, RELSEEK, REPEAT–UNTIL, RESERVE, RMDIR, PSAVE, SEEK, SETCOLOR, SETTIME, SGET, SHOWM, SPOKE, SDPOKE, SLPOKE, SPRITE, SPUT, SUB, TEXT, TIME$, TITLEW, TRUE, TRUNC, TYPE, UPPER$, VAL?, VDIBASE, XBIOS

Note that these keywords are *in addition to* the keywords offered by ST BASIC. The various MENU commands let you handle GEM drop-down menus with ease and efficiency. New graphics commands (including BITBLT) are found in abundance, as are Unix-style DOS commands and many interesting functions. For system routines, XBIOS, BIOS, and GEMDOS are added to GEMSYS and VDISYS.

An Impressive Import System

Potentially most impressive are the new commands EXEC and C:. EXEC lets you load and execute a non-BASIC ST application from within a BASIC program. The C: command calls a routine written and compiled in C. Both commands purport to allow full parameter passing. *Gfa BASIC* also supports the unary * operator for C-style pointer operations. Together, these capabilities pave the way for an intriguing sort of program which efficiently blends BASIC code with program modules written in other languages.

Gfa BASIC consists of two programs: an interactive editor/interpreter, which you use to write and test programs, and a run-only interpreter, which runs only *Gfa BASIC* programs. Compiling is not a separate process, as in most compiled languages: To compile the program, you simply select Save from a menu in the editor/interpreter. The excellent, full-screen editor includes word processor-style features such as search and replace, block copy, move, delete, and so forth. A finished *Gfa BASIC* program can run only from within the editor/interpreter or the run-only interpreter. This inconvenience is compensated for by the fact that you can share the 40K run-only package freely. The editor/interpreter, by the way, is only about 55K.

What's The Catch?

Will *Gfa BASIC* take the ST world by storm? At this point, it's too early to tell. Written entirely in German, the user's manual is dated August 1986—scarcely six weeks old at this writing. I've been able to muddle through the manual aided by rusty college German and the fact that all *Gfa BASIC* keywords and menu titles are in English. But non-German speakers may want to wait for an English translation. Moreover, I haven't had *Gfa BASIC* long enough to evaluate its reliability. The demo programs (a graphics editor and a terminal program) are impressive, but you would expect demos to work well. Given the number of known bugs in GEM itself, it wouldn't be surprising to find a few bugs in *Gfa BASIC*.

Despite these reservations, *Gfa BASIC* is definitely worth notice, not only because it shows what BASIC *can be* on the ST, but also because it points the way to an entirely new sort of BASIC—one that's able to reach beyond its own confines and incorporate routines from other languages. By permitting a BASIC programmer to call C routines and even execute other ST applications, this BASIC stretches the definition of BASIC itself.

Gfa Systemtechnik
Am Hochhofen 108
D-4000 Dusseldorf 11
West Germany
$79 (U.S.)

©

Bill Wilkinson

Controlling Keyboard Input

One of the most powerful features of the BASIC language is the INPUT statement. Consider: This single statement allows you to ask the user for numbers or strings and allows the user to do full-screen editing as he or she enters data. Yet all this power has its price. The INPUT statement is extremely vulnerable and can easily cause programs to crash.

For example, if your program is expecting a number and the user types a string—KABLOOEY. Admittedly, you can (and should) TRAP this kind of error. But what about the user who delights in using the cursor-control keys to move all over the screen? Or the one who hits the CLEAR key after your program has gone to the trouble to put 20 lines of information on the screen? For a truly professional-looking program, you probably want the capability to restrict data entry to only those characters which you are expecting. And the INPUT statement just won't work for this.

BASIC Has The Answer

Fear not; good old BASIC has another answer. Most BASICs provide a way to get a single key from the keyboard, and Atari BASIC is no exception. You simply OPEN the K: device on some channel, and then GET characters (actually, bytes) one at a time from that channel. Since the characters you get this way are not even echoed on the screen, you have a chance to filter the user's keystrokes and ignore or alter those you don't want. For example, if you want only digits (for a numeric input), you could ignore all non-numeric characters.

Sidelight: This type of problem is not unique to BASIC programmers. Any programmer using a language which accepts input from a screen editor as is built into the Atari eight-bit machines will have to decide whether to go to the trouble to use methods similar to those I am about to describe.

The program here is an example which will help familiarize you with restricted keyboard input. Let's take a closer look at some of its inner workings.

First, because we're using Atari BASIC, I have violated my own rules and placed the major subroutine near the start of the program, with the mainline code following. I did this because this major subroutine is very speed-critical, and every little thing that can be done to make it run faster is a help. Anyway, line 1030 immediately sends us to the main code, which starts at line 1400. Notice the OPEN of the keyboard device in line 1430 and the allocation of some strings in line 1440.

Then, after clearing the screen, we begin the main loop of this little example. In line 1500 we simply READ from some DATA statements to find the position, size, and type of a field on the screen which is to receive our ministrations. We have two special cases to take care of here: First, if the type code is an asterisk, we have exhausted our DATA. (In a larger, real-world program, this would probably indicate that it's time to save the contents of our various fields to disk, and so on.) Second, if the length code is zero, the string which is the last item in each DATA statement is actually information to be displayed on the screen, so this particular DATA statement does *not* cause any input processing (see lines 1530 and 1540).

Assuming that we *do* have a field which requires formatted input processing, line 1520 causes the main subroutine at line 1100 to be called. This subroutine (in line 1100) displays a line of dots on the screen which is intended to tell the user the maximum size of the data he or she is supposed to input. Line 1110 is a bit of a trick: Since Atari BASIC does not allow us to PUT to channel 0 (the screen), we cheat and use nonexistent channel 16, which just happens to be translated by BASIC and the OS into (you guessed it) channel 0. And the two PUTs cause a cursor-right and then cursor-left movement to take place. (We do this because the POSITION statement does not actually move the cursor—the OS waits for a subsequent character output before moving it. These cursor movements get the cursor to the right location without actually changing the display.)

Special Cases

The CNT variable simply counts the characters we have passed so far. It can never be less than zero or more than the maximum length of the field we are currently working on. Then, within the loop, we get a single keystroke. Lines 1150 and 1160 combine to cause either an ESCape key or a RETURN key to force an exit from our formatted input routine. And line 1170 takes care of the special case of the backspace character (check any Atari BASIC or OS reference book to see which ATASCII codes normally perform various editing functions).

Finally, in line 1180 (where we convert lowercase letters into uppercase ones—certainly an optional process), we begin to start our testing. This rather simplistic example program provides for only three types of fields: All alphabetic fields (designated by an *A* type code), all numeric fields (designated by an *N* type code), and "everything goes" fields (designated by the *E* type code). Lines 1190 and 1200 validate the *A* and *N* types, respectively.

Note that we also restrict the number of characters to the maximum (line 1210—and PUT #16,253 simply sounds the bell on your Atari). If all is going well, we add the character the user typed to our collected field (line 1230) and go back for another character. Lines 1250–1290 are used to handle a backspace key. You should play with the PUTs a bit to figure out what they are doing. I will mention, however, that line 1260 serves to reduce the size of FIELD$ by a character.

And that's about it. You're welcome to type in this program and try it, but don't expect it to do much. It is intended solely to get you started in using formatted input, so it doesn't demonstrate what you can do with this nice formatted data once you have gotten it. (For example, once you have gotten a numeric-only field entered into FIELD$, how do you convert it to a number? Take a look at the VAL function.)

Also, the very simplistic nature of my three field types (*A*, *N*, and *E*) means that some desirable features are missing. For example, try typing in a name containing a space for that first NAME field. Or try entering a decimal point as part of the ZIP CODE. To be really flexible, this program should handle a dozen or so different data-entry formats. But now the sad truth comes out.

Atari BASIC is just too slow to do anything *really* fancy in the formatted entry subroutine. I have some much more exotic versions of this program written in BASIC XL and BASIC XE, but with Atari BASIC they tend to bog down way too soon. Still, for a particular program you should be able to develop four or five different types to be handled, and still maintain reasonable speed. And that is probably adequate.

So play with this program and these concepts; improve it and add features. I'll even give you a few hints on directions to take. For example, what happens when you add this line?

1165 IF KEY=125 THEN 1100

Or how about "normalizing" a numeric input which includes a possible decimal point? For example, suppose you have a dollars-and-cents field. What should your program do if the user enters just dollars, with no decimal point and no cents? Or suppose the user enters three or more digits after the decimal point—what should you do?

Formatted Screen Data Entry

```
KF 1000 REM
NM 1010 REM PROGRAM TO SHOW
        PROTECTED INPUT
KH 1020 REM
BK 1030 GOTO 1400:REM (TO MA
        KE SUBROUTINES FASTE
        R)
KJ 1040 REM
BJ 1050 REM MAIN SUBROUTINE:
LM 1060 REM .  X,Y ARE SCREE
        N POSITION OF FIELD
JL 1070 REM .  L IS MAXIMUM
        LENGTH OF FIELD
AN 1080 REM .  TYPE$ IS ONE
        CHARACTER FIELD TYPE
         CODE
KO 1090 REM
FL 1100 POSITION X,Y:PRINT F
        ILL$(1,L);
KO 1110 POSITION X,Y:PUT #16
        ,31:PUT #16,30
FJ 1120 CNT=0:FIELD$=""
FM 1130 REM MAJOR LOOP
AP 1140 GET #1,KEY
BN 1150 IF KEY>127 THEN KEY=
        KEY-128
PF 1160 IF KEY=27 THEN RETUR
        N
AO 1170 IF KEY=126 THEN 1250
DA 1180 IF KEY>96 THEN KEY=K
        EY-32:REM (LOWER CAS
        E GOES TO UPPER)
LB 1190 IF TYPE$="A" THEN IF
         KEY<65 OR KEY>90 TH
        EN PUT #16,253:GOTO
        1130
LK 1200 IF TYPE$="N" THEN IF
         KEY<48 OR KEY>57 TH
        EN PUT #16,253:GOTO
        1130
KP 1210 IF CNT>=L THEN PUT #
        16,253:GOTO 1130
FN 1220 PUT #16,KEY
JJ 1230 CNT=CNT+1:FIELD$(CNT
        )=CHR$(KEY)
MF 1240 GOTO 1130
FJ 1250 IF CNT=0 THEN PUT #1
        6,253:GOTO 1130
AI 1260 FIELD$(CNT)=""
AB 1270 PUT #16,KEY:CNT=CNT-
        1
DA 1280 PUT #16,46:PUT #16,3
        0
MK 1290 GOTO 1130
KI 1300 REM
MK 1310 REM THE MAIN CODE
KK 1320 REM
FP 1330 REM IN THIS SAMPLE P
        ROGRAM, WE DEFINE TH
        E FIELDS
KO 1340 REM VIA DATA STATEME
        NTS
KN 1350 REM
LP 1360 REM IN A MORE COMPLE
        X PROGRAM, THE INFO
        MIGHT COME
EE 1370 REM FROM A FILE
LA 1380 REM
LB 1390 REM
KJ 1400 REM
EA 1410 REM === INITIALIZATI
        ON ===
KL 1420 REM
PP 1430 OPEN #1,4,0,"K:"
CA 1440 DIM FIELD$(40),TYPE$
        (1),FILL$(40)
MG 1450 FILL$=".............
        ....................
        ......."
EM 1460 GRAPHICS 0
LA 1470 REM
IC 1480 REM NOW A SIMPLE LOO
        P TO GET DATA FOR FI
        ELDS ON SCREEN
LC 1490 REM
FA 1500 READ X,Y,L,FIELD$:TY
        PE$=FIELD$
EL 1510 IF TYPE$="*" THEN PO
        SITION 2,20:STOP
PH 1520 IF L<>0 THEN GOSUB 1
        100:GOTO 1500
KF 1530 POSITION X,Y:PRINT F
        IELD$;
MJ 1540 GOTO 1500
KP 1550 REM
AA 1560 REM IN A REAL PROGRA
        M, THE DATA FROM THE
GN 1570 REM FIELDS WOULD NOW
         BE MANIPULATED IN S
        OME
ND 1580 REM WAY (PERHAPS PLA
        CED IN A DISK FILE)
LD 1590 REM
NN 1600 REM ================
        =========
KM 1610 REM
IA 1620 REM DATA TO DEFINE T
        HE FIELDS FOLLOW
KO 1630 REM
CD 1640 DATA 7,2,0,NAME
AP 1650 DATA 3,4,0,ZIP CODE
HI 1660 DATA 2,7,0,MISCELLAN
        EOUS COMMENTS:
KE 1670 DATA 12,2,20,A
IH 1680 DATA 12,4,5,N
IC 1690 DATA 4,8,30,E
KE 1700 DATA 7,15,0,=== THAT
        'S ALL FOLKS ===
CB 1710 DATA 0,0,0,*
```

DEGAS Elite For The ST

Batteries Included has released the *DEGAS Elite* design and graphic arts program for the Atari ST computers. The $79.95 program includes all of the features of the earlier $39.95 *DEGAS* package, plus extensive new capabilities for producing a wide range of computer graphics.

Aimed at both the professional who uses computer graphics and those who enjoy recreational art production, *DEGAS Elite* has such advanced features as multiple work screens for cutting and pasting images, color cycling, enhanced text fonts and a font editor, plus Flip, Rotate, Distort, Airbrush, Shadow, and many other tools.

The program works with most popular graphics printers, color and dot-matrix, and is compatible with the *PaperClip Elite* word processor for the ST.

Batteries Included, 30 Mural St., Richmond Hill, Ontario, Canada L4B 1B5.

Circle Reader Service Number 203.

New Stickybear Apple Programs

Weekly Reader Family Software has introduced five new early-learning programs that use the popular Stickybear character and work on the Apple II–series computers. Included in the group are *Stickybear Reading Comprehension*, a multilevel reading program for ages 8 to 11; *Stickybear Drawing*, an easy-to-use drawing program for ages 7 and older; *Stickybear Music*, an introductory music program for ages 7 and older; *Stickybear Basic*, an easy introduction to the BASIC programming language, for ages 9 and up; and *Math Word Problems*, a program on learning to solve word problems, for ages 8 and up.

Each of these packages sells for $39.95 and works on an Apple II, II+, IIe, and IIc with a 48K minimum and DOS 3.3.

Weekly Reader Family Software, 245 Long Hill Rd., Middletown, CT 06457.

Circle Reader Service Number 204.

Pick Your Perfect College

Mindscape offers a program that lets you enter your criteria for the ideal college or university and then lists the matches. *The Perfect College* includes information on more than 1650 accredited four-year U.S. colleges and universities, with over 26 college-selection criteria such as cost, location, academic interest, and student/faculty ratio. The database is updated annually, and you can print out your results.

The Perfect College is available for the IBM PC or PCjr with 128K memory, the Commodore 64 and 128, the Apple II series with 64K, and the Macintosh with 128K memory. It requires a single disk drive.

Suggested retail price is $19.95; *The Perfect College* is free with a purchase of *The Perfect Score*, an SAT preparation program also from Mindscape.

Mindscape, Inc., 3444 Dundee Rd., Northbrook, IL 60062.

Circle Reader Service Number 205.

Commodore Video Digitizer

Eye-Scan is a video digitizer for the Commodore 64 and 128 that offers up to eight gray levels, 320 × 200 resolution, disk and 1525 printer support, image inversion, and pull-down windows. The Eye-Scan cartridge plugs into the user port.

The conversion time is approximately six seconds per gray level. Eye-Scan is compatible with *Koala*, *Doodle*, *Blazing Paddles*, and other popular graphics programs, and it comes with a programmer's utility package that allows programmers to use the image-capturing algorithms in their own programs.

Digital Engineering and Design, 2718 SW Kelly, Suite C165, Portland, OR 97201.

Circle Reader Service Number 206.

Space Battle Simulation

Star Fleet 1: The War Begins is a strategy space-battle game distributed by Electronic Arts for a variety of computer systems. As members of the Alliance, players must protect its outer regions against invading fleets of hostile aliens from the Krellan and Zaldron empires. Each player starts as a rookie cadet, with opportunities to role-play specific characters and experience both training and combat situations.

While competing with others, players can work their way through the ranks to the ultimate honorary rank of Admiral Emeritus. Players command one of 36 galactic heavy cruisers to defend the Alliance. Part of the challenge is to rescue starbases from enemy hands, capture and tow enemy vessels, lay mine fields, search for intruders, and repair damaged systems.

Star Fleet 1 was created by Interstel and is the first in a series of advanced space-battle simulations.

The program is available for $49.95 for IBM, Apple II–series, and Atari eight-bit computers; $39.95 for Commodore 64 and 128 computers; and $55 for Amiga, Atari ST, and Macintosh computers.

Electronic Arts, 1820 Gateway Dr., San Mateo, CA 94404.

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Biker Dave For Atari

The Atari version of this game from the November 1986 issue (Program 1, p. 42) has errors of two different types. First, the program contains a number of bugs that were not initially detected in testing. The program sometimes prints invisible ramps, prints ramps that interfere with the tubes, or omits ramps. It also generates occasional unexplained crashes, and neglects to clear the player/missile area to prevent player/missile shapes from interfering with the title and end-of-game screens. To correct these problems, make the following changes and additions:

```
DD 1140 FOR I=1 TO 20:POKE 705
        ,16*(RND(0)*15):POKE 7
        06,16*(RND(0)*15):IF P
        RO THEN POKE 707,16*(R
        ND(0)*15)
DM 1153 FOR I=0 TO 2
BE 1154 IF  NOT (PRO) AND I=2
        THEN 1156
IK 1155 IF PEEK(705+I)-INT(PEE
        K(705+I)/16)*16<4 THEN
         POKE (705+I),8
FF 1156 NEXT I
NG 1220 POSITION 14,13:? TCARS
        ;:CARS=CARS+1:TCARS=TC
        ARS+CARS:IF CARS>10 TH
        EN DONE=1:GOTO 1310
LF 1315 FOR PP=53248 TO 53251:
        POKE PP,0:NEXT PP
ME 1615 PP=ADR(P0$):FOR YY=PP+
        256 TO PP+1023:POKE YY
        ,0:NEXT YY
OF 2830 P0$(1,255)=BL$(1,255):
        POKE 53248,50:POKE 532
        49,139:POKE 707,0:POKE
         53251,120:POKE 53250,
        180
```

Second, a problem with our lister program caused all inverse-video characters in the listing to appear as solid inverse-video blocks. The following lines should be changed as shown:

```
MM 2950 POSITION 1,2:? "{A}
        {B}{C}{D}{E}{F}{G}{H}"
        :REM CONTROL A,B,C,D,E
        ,F,G,H
MG 2960 POSITION 1,3:? "{I}
        {J}{K}{L}{M}{N}{O}{P}_
        ______________________
        __mnrrr":REM CONTROL I
        ,J,K,L,M,N,O,P
DM 3000 IF PRO THEN POSITION 1
        5,5:? "SI":POSITION 15
        ,6:? "UV":POKE 707,152
OO 3040 POSITION 1,10:? "ouopq
        \\\\\\\\\\\\\\\\\\\\\\a
        bcdef\\\\\\"
```

COMPUTE! Disk For Atari

The October–December 1986 COMPUTE! Disk for Atari contains two programs that should not have been included, and is missing one that should have appeared. First, the program MLSTRING.SEP, which is on the disk, but does not appear on the menu, is an accidental repeat of the program for the "Stringing Atari Machine Language" article in the September 1986 issue. More significantly, when you select the menu item for the program from the October 1986 "INSIGHT: Atari" column, you get the program RAMDISK.SEP. This, unfortunately, is not the Atari 800XL RAMdisk program from the column, but instead is an accidental repeat of the "Atari 130XE Automated RAM Disk" program from the September 1986 issue, which will not work on the 800XL. Bill Wilkinson's 800XL RAMdisk program is not on the October–December disk. It will be included on the January–March 1987 COMPUTE! disk for Atari. ©

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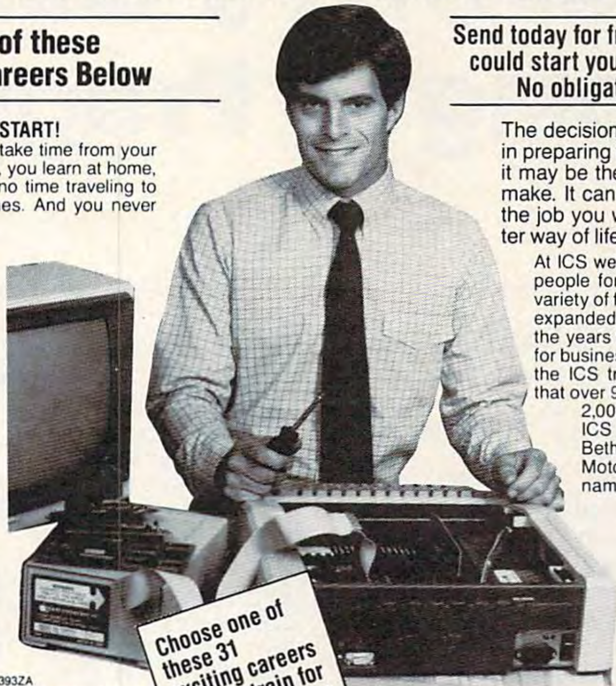

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COMPUTE!'s Guide To Typing In Programs

Computers are precise—type the program *exactly* as listed, including necessary punctuation and symbols, except for special characters noted below. We have provided a special listing convention as well as a program to check your typing—"The Automatic Proofreader."

Programs for the IBM, TI-99/4A, and Atari ST models should be typed exactly as listed; no special characters are used. Programs for Commodore, Apple, and Atari 400/800/XL/XE computers may contain some hard-to-read special characters, so we have a listing system that indicates these control characters. You will find these Commodore and Atari characters in curly braces; *do not type the braces*. For example, {CLEAR} or {CLR} instructs you to insert the symbol which clears the screen on the Atari or Commodore machines. A complete list of these symbols is shown in the tables below. For Commodore, Apple, and Atari, a single symbol by itself within curly braces is usually a control key or graphics key. If you see {A}, hold down the CONTROL key and press A. This will produce a reverse video character on the Commodore (in quote mode), a graphics character on the Atari, and an invisible control character on the Apple.

Graphics characters entered with the Commodore logo key are enclosed in a special bracket: [<A>]. In this case, you would hold down the Commodore logo key as you type A. Our Commodore listings are in uppercase, so shifted symbols are underlined. A graphics heart symbol (SHIFT-S) would be listed as S̲. One exception is {SHIFT-SPACE}. When you see this, hold down SHIFT and press the space bar. If a number precedes a symbol, such as {5 RIGHT}, {6 S̲}, or [<8 Q>], you would enter five cursor rights, six shifted S's, or eight Commodore-Q's. On the Atari, inverse characters (white on black) should be entered with the inverse video

Atari 400/800/XL/XE

When you see	Type	See	
{CLEAR}	ESC SHIFT <	↖	Clear Screen
{UP}	ESC CTRL -	↑	Cursor Up
{DOWN}	ESC CTRL =	↓	Cursor Down
{LEFT}	ESC CTRL +	←	Cursor Left
{RIGHT}	ESC CTRL *	→	Cursor Right
{BACK S}	ESC DELETE	◂	Backspace
{DELETE}	ESC CTRL DELETE		Delete character
{INSERT}	ESC CTRL INSERT		Insert character
{DEL LINE}	ESC SHIFT DELETE		Delete line
{INS LINE}	ESC SHIFT INSERT		Insert line
{TAB}	ESC TAB	▸	TAB key
{CLR TAB}	ESC CTRL TAB		Clear tab
{SET TAB}	ESC SHIFT TAB		Set tab stop
{BELL}	ESC CTRL 2		Ring buzzer
{ESC}	ESC ESC		ESCape key

Commodore PET/CBM/VIC/64/128/16/+4

When You Read:	Press:	See:	When You Read:	Press:	See:
{CLR}	SHIFT CLR/HOME		[<1>]	COMMODORE 1	
{HOME}	CLR/HOME		[<2>]	COMMODORE 2	
{UP}	SHIFT ↑ CRSR ↓		[<3>]	COMMODORE 3	
{DOWN}	↑ CRSR ↓		[<4>]	COMMODORE 4	
{LEFT}	SHIFT ← CRSR →		[<5>]	COMMODORE 5	
{RIGHT}	← CRSR →		[<6>]	COMMODORE 6	
{RVS}	CTRL 9		[<7>]	COMMODORE 7	
{OFF}	CTRL 0		[<8>]	COMMODORE 8	
{BLK}	CTRL 1		{ F1 }	f1	
{WHT}	CTRL 2		{ F2 }	SHIFT f1	
{RED}	CTRL 3		{ F3 }	f3	
{CYN}	CTRL 4		{ F4 }	SHIFT f3	
{PUR}	CTRL 5		{ F5 }	f5	
{GRN}	CTRL 6		{ F6 }	SHIFT f5	
{BLU}	CTRL 7		{ F7 }	f7	
{YEL}	CTRL 8		{ F8 }	SHIFT f7	
			←	←	

key (Atari logo key on 400/800 models).

Whenever more than two spaces appear in a row, they are listed in a special format. For example, {6 SPACES} means press the space bar six times. Our Commodore listings never leave a single space at the end of a line, instead moving it to the next printed line as {SPACE}.

Amiga program listings contain only one special character, the left arrow (←) symbol. This character marks the end of each program line. Wherever you see a left arrow, press RETURN or move the cursor off the line to enter that line into memory. Don't try to type in the left arrow symbol; it's there only as a marker to indicate where each program line ends.

The Automatic Proofreader

Type in the appropriate program listed below, then save it for future use. The Commodore Proofreader works on the Commodore 128, 64, Plus/4, 16, and VIC-20. Don't omit any lines, even if they contain unfamiliar commands or you think they don't apply to your computer. When you run the program, it installs a machine language program in memory and erases its BASIC portion automatically (so be sure to save several copies before running the program for the first time). If you're using a Commodore 128, Plus/4 or 16, do *not* use any GRAPHIC commands while the Proofreader is active. You should disable the Commodore Proofreader before running any other program. To do this, either turn the computer off and on or enter SYS 64738 (for the 64), SYS 65341 (128), SYS 64802 (VIC-20), or SYS 65526 (Plus/4 or 16). To reenable the Proofreader, reload the program and run it as usual. Unlike the original VIC/64 Proofreader, this version works the same with disk or tape.

On the Atari, run the Proofreader to activate it (the Proofreader remains active in memory as a machine language program); you must then enter NEW to erase the BASIC loader. Pressing SYSTEM RESET deactivates the Atari Proofreader; enter PRINT USR(1536) to reenable it.

The Apple Proofreader erases the BASIC portion of itself after you run it, leaving only the machine language portion in memory. It works with either DOS 3.3 or ProDOS. Disable the Apple Proofreader by pressing CTRL-RESET before running another BASIC program.

The IBM Proofreader is a BASIC program that simulates the IBM BASIC line editor, letting you enter, edit, list, save, and load programs that you type. Type RUN to activate. Be sure to leave Caps Lock on, except when typing lowercase characters.

Once the Proofreader is active, try typing in a line. As soon as you press RETURN, either a hexadecimal number (on the Apple) or a pair of letters (on the Commodore, Atari, or IBM) appears. The number or pair of letters is called a *checksum*.

Compare the value displayed on the screen by the Proofreader with the checksum printed in the program listing in the magazine. The checksum is given to the left of each line number. Just type in the program a line at a time (without the printed checksum), press RETURN or Enter, and compare the checksums. If they match, go on to the next line. If not, check your typing; you've made a mistake. Because of the checksum method used, do not type abbreviations, such as ? for PRINT. On the Atari and Apple Proofreaders, spaces are not counted as part of the checksum, so be sure you type the right number of spaces between quote marks. The Atari Proofreader does not check to see that you've typed the characters in the right order, so if characters are transposed, the checksum still matches the listing. The Commodore Proofreader catches transposition errors and ignores spaces unless they're enclosed in quotation marks. The IBM Proofreader detects errors in spacing and transposition.

IBM Proofreader Commands

Since the IBM Proofreader replaces the computer's normal BASIC line editor, it has to include many of the direct-mode IBM BASIC commands. The syntax is identical to IBM BASIC. Commands simulated are LIST, LLIST, NEW, FILES, SAVE, and LOAD. When listing your program, press any key (except Ctrl-Break) to stop the listing. If you enter NEW, the Proofreader prompts you to press Y to be especially sure you mean yes.

Two new commands are BASIC and CHECK. BASIC exits the Proofreader back to IBM BASIC, leaving the Proofreader in memory. CHECK works just like LIST, but shows the checksums along with the listing. After you have typed in a program, save it to disk. Then exit the Proofreader with the BASIC command, and load the program as usual (this replaces the Proofreader in memory). You can now run the program, but you may want to resave it to disk. This will shorten it on disk and make it load faster, but it can no longer be edited with the Proofreader. If you want to convert an existing BASIC program to Proofreader format, save it to disk with SAVE "*filename*",A.

Program 1: Atari Proofreader

By Charles Brannon, Program Editor

```
100 GRAPHICS 0
110 FOR I=1536 TO 1700:REA
    D A:POKE I,A:CK=CK+A:N
    EXT I
120 IF CK<>19072 THEN ? "E
    rror in DATA Statement
    s.  Check Typing.":END
130 A=USR(1536)
140 ? :? "Automatic Proofr
    eader Now Activated."
150 END
160 DATA 104,160,0,185,26,
    3,201,69,240,7
170 DATA 200,200,192,34,20
    8,243,96,200,169,74
180 DATA 153,26,3,200,169,
    6,153,26,3,162
190 DATA 0,189,0,228,157,7
    4,6,232,224,16
200 DATA 208,245,169,93,14
    1,78,6,169,6,141
210 DATA 79,6,24,173,4,228
    ,105,1,141,95
220 DATA 6,173,5,228,105,0
    ,141,96,6,169
230 DATA 0,133,203,96,247,
    238,125,241,93,6
240 DATA 244,241,115,241,1
    24,241,76,205,238
250 DATA 0,0,0,0,0,32,62,2
    46,8,201
260 DATA 155,240,13,201,32
    ,240,7,72,24,101
270 DATA 203,133,203,104,4
    0,96,72,152,72,138
280 DATA 72,160,0,169,128,
    145,88,200,192,40
290 DATA 208,249,165,203,7
    4,74,74,74,24,105
300 DATA 161,160,3,145,88,
    165,203,41,15,24
310 DATA 105,161,200,145,8
    8,169,0,133,203,104
320 DATA 170,104,168,104,4
    0,96
```

Program 2: IBM Proofreader

By Charles Brannon, Program Editor

```
10 'Automatic Proofreader Vers
   ion 3.0 (Lines 205,206 adde
   d/190 deleted/470,490 chang
   ed from V2.0)
100 DIM L$(500),LNUM(500):COLO
    R 0,7,7:KEY OFF:CLS:MAX=0:
    LNUM(0)=65536!
110 ON ERROR GOTO 120:KEY 15,C
    HR$(4)+CHR$(70):ON KEY(15)
     GOSUB 640:KEY (15) ON:GOT
    O 130
120 RESUME 130
130 DEF SEG=&H40:W=PEEK(&H4A)
140 ON ERROR GOTO 650:PRINT:PR
    INT"Proofreader Ready."
150 LINE INPUT L$:Y=CSRLIN-INT
    (LEN(L$)/W)-1:LOCATE Y,1
160 DEF SEG=0:POKE 1050,30:POK
    E 1052,34:POKE 1054,0:POKE
     1055,79:POKE 1056,13:POKE
     1057,28:LINE INPUT L$:DEF
     SEG:IF L$="" THEN 150
170 IF LEFT$(L$,1)=" " THEN L$
    =MID$(L$,2):GOTO 170
```

```
180 IF VAL(LEFT$(L$,2))=Ø AND
    MID$(L$,3,1)=" " THEN L$=M
    ID$(L$,4)
200 IF ASC(L$)>57 THEN 260 'no
     line number, therefore co
    mmand
205 BL=INSTR(L$," "):IF BL=Ø T
    HEN BL$=L$:GOTO 206 ELSE B
    L$=LEFT$(L$,BL-1)
206 LNUM=VAL(BL$):TEXT$=MID$(L
    $,LEN(STR$(LNUM))+1)
210 IF TEXT$="" THEN GOSUB 54Ø
    :IF LNUM=LNUM(P) THEN GOSU
    B 56Ø:GOTO 15Ø ELSE 15Ø
220 CKSUM=Ø:FOR I=1 TO LEN(L$)
    :CKSUM=(CKSUM+ASC(MID$(L$,
    I))*I) AND 255:NEXT:LOCATE
     Y,1:PRINT CHR$(65+CKSUM/1
    6)+CHR$(65+(CKSUM AND 15))
    +" "+L$
230 GOSUB 54Ø:IF LNUM(P)=LNUM
    THEN L$(P)=TEXT$:GOTO 15Ø
    'replace line
240 GOSUB 58Ø:GOTO 15Ø 'insert
     the line
260 TEXT$="":FOR I=1 TO LEN(L$
    ):A=ASC(MID$(L$,I)):TEXT$=
    TEXT$+CHR$(A+32*(A>96 AND
    A<123)):NEXT
270 DELIMITER=INSTR(TEXT$," ")
    :COMMAND$=TEXT$:ARG$="":IF
     DELIMITER THEN COMMAND$=L
    EFT$(TEXT$,DELIMITER-1):AR
    G$=MID$(TEXT$,DELIMITER+1)
     ELSE DELIMITER=INSTR(TEXT
    $,CHR$(34)):IF DELIMITER T
    HEN COMMAND$=LEFT$(TEXT$,D
    ELIMITER-1):ARG$=MID$(TEXT
    $,DELIMITER)
280 IF COMMAND$<>"LIST" THEN 4
    1Ø
290 OPEN "scrn:" FOR OUTPUT AS
     #1
300 IF ARG$="" THEN FIRST=Ø:P=
    MAX-1:GOTO 34Ø
310 DELIMITER=INSTR(ARG$,"-"):
    IF DELIMITER=Ø THEN LNUM=V
    AL(ARG$):GOSUB 54Ø:FIRST=P
    :GOTO 34Ø
320 FIRST=VAL(LEFT$(ARG$,DELIM
    ITER)):LAST=VAL(MID$(ARG$,
    DELIMITER+1))
330 LNUM=FIRST:GOSUB 54Ø:FIRST
    =P:LNUM=LAST:GOSUB 54Ø:IF
    P=Ø THEN P=MAX-1
340 FOR X=FIRST TO P:N$=MID$(S
    TR$(LNUM(X)),2)+" "
350 IF CKFLAG=Ø THEN A$="":GOT
    O 37Ø
360 CKSUM=Ø:A$=N$+L$(X):FOR I=
    1 TO LEN(A$):CKSUM=(CKSUM+
    ASC(MID$(A$,I))*I) AND 255
    :NEXT:A$=CHR$(65+CKSUM/16)
    +CHR$(65+(CKSUM AND 15))+"
    "
370 PRINT #1,A$+N$+L$(X)
380 IF INKEY$<>"" THEN X=P
390 NEXT :CLOSE #1:CKFLAG=Ø
400 GOTO 13Ø
410 IF COMMAND$="LLIST" THEN O
    PEN "lpt1:" FOR OUTPUT AS
    #1:GOTO 3ØØ
420 IF COMMAND$="CHECK" THEN C
    KFLAG=1:GOTO 29Ø
430 IF COMMAND$<>"SAVE" THEN 4
    5Ø
440 GOSUB 6ØØ:OPEN ARG$ FOR OU
    TPUT AS #1:ARG$="":GOTO 3Ø
    Ø
450 IF COMMAND$<>"LOAD" THEN 4
    9Ø
460 GOSUB 6ØØ:OPEN ARG$ FOR IN
    PUT AS #1:MAX=Ø:P=Ø
470 WHILE NOT EOF(1):LINE INPU
    T #1,L$:BL=INSTR(L$," "):B
    L$=LEFT$(L$,BL-1):LNUM(P)=
    VAL(BL$):L$(P)=MID$(L$,LEN
    (STR$(VAL(BL$)))+1):P=P+1:
    WEND
480 MAX=P:CLOSE #1:GOTO 13Ø
490 IF COMMAND$="NEW" THEN INP
    UT "Erase program - Are yo
    u sure";L$:IF LEFT$(L$,1)=
    "y" OR LEFT$(L$,1)="Y" THE
    N MAX=Ø:LNUM(Ø)=65536!:GOT
    O 13Ø:ELSE 13Ø
500 IF COMMAND$="BASIC" THEN C
    OLOR 7,Ø,Ø:ON ERROR GOTO Ø
    :CLS:END
510 IF COMMAND$<>"FILES" THEN
    52Ø
515 IF ARG$="" THEN ARG$="A:"
    ELSE SEL=1:GOSUB 6ØØ
517 FILES ARG$:GOTO 13Ø
520 PRINT"Syntax error":GOTO 1
    3Ø
540 P=Ø:WHILE LNUM>LNUM(P) AND
     P<MAX:P=P+1:WEND:RETURN
560 MAX=MAX-1:FOR X=P TO MAX:L
    NUM(X)=LNUM(X+1):L$(X)=L$(
    X+1):NEXT:RETURN
580 MAX=MAX+1:FOR X=MAX TO P+1
     STEP -1:LNUM(X)=LNUM(X-1)
    :L$(X)=L$(X-1):NEXT:L$(P)=
    TEXT$:LNUM(P)=LNUM:RETURN
600 IF LEFT$(ARG$,1)<>CHR$(34)
     THEN 52Ø ELSE ARG$=MID$(A
    RG$,2)
610 IF RIGHT$(ARG$,1)=CHR$(34)
     THEN ARG$=LEFT$(ARG$,LEN(
    ARG$)-1)
620 IF SEL=Ø AND INSTR(ARG$,".
    ")=Ø THEN ARG$=ARG$+".BAS"
630 SEL=Ø:RETURN
640 CLOSE #1:CKFLAG=Ø:PRINT"St
    opped.":RETURN 15Ø
650 PRINT "Error #";ERR:RESUME
     15Ø
```

Program 3: Commodore Proofreader

By Philip Nelson, Assistant Editor

```
10 VEC=PEEK(772)+256*PEEK(773)
   :LO=43:HI=44
20 PRINT "AUTOMATIC PROOFREADE
   R FOR ";:IF VEC=42364 THEN
   {SPACE}PRINT "C-64"
30 IF VEC=5Ø556 THEN PRINT "VI
   C-2Ø"
40 IF VEC=35158 THEN GRAPHIC C
   LR:PRINT "PLUS/4 & 16"
50 IF VEC=17165 THEN LO=45:HI=
   46:GRAPHIC CLR:PRINT"128"
60 SA=(PEEK(LO)+256*PEEK(HI))+
   6:ADR=SA
70 FOR J=Ø TO 166:READ BYT:POK
   E ADR,BYT:ADR=ADR+1:CHK=CHK
   +BYT:NEXT
80 IF CHK<>2Ø57Ø THEN PRINT "*
   ERROR* CHECK TYPING IN DATA
   STATEMENTS":END
90 FOR J=1 TO 5:READ RF,LF,HF:
   RS=SA+RF:HB=INT(RS/256):LB=
   RS-(256*HB)
100 CHK=CHK+RF+LF+HF:POKE SA+L
    F,LB:POKE SA+HF,HB:NEXT
110 IF CHK<>22Ø54 THEN PRINT "
    *ERROR* RELOAD PROGRAM AND
    {SPACE}CHECK FINAL LINE":EN
    D
120 POKE SA+149,PEEK(772):POKE
     SA+15Ø,PEEK(773)
130 IF VEC=17165 THEN POKE SA+
    14,22:POKE SA+18,23:POKESA+
    29,224:POKESA+139,224
140 PRINT CHR$(147);CHR$(17);"
    PROOFREADER ACTIVE":SYS SA.
150 POKE HI,PEEK(HI)+1:POKE (P
    EEK(LO)+256*PEEK(HI))-1,Ø:N
    EW
160 DATA 12Ø,169,73,141,4,3,16
    9,3,141,5,3
170 DATA 88,96,165,2Ø,133,167,
    165,21,133,168,169
180 DATA Ø,141,Ø,255,162,31,18
    1,199,157,227,3
190 DATA 2Ø2,16,248,169,19,32,
    21Ø,255,169,18,32
200 DATA 21Ø,255,16Ø,Ø,132,18Ø
    ,132,176,136,23Ø,18Ø
210 DATA 2ØØ,185,Ø,2,24Ø,46,2Ø
    1,34,2Ø8,8,72
220 DATA 165,176,73,255,133,17
    6,1Ø4,72,2Ø1,32,2Ø8
230 DATA 7,165,176,2Ø8,3,1Ø4,2
    Ø8,226,1Ø4,166,18Ø
240 DATA 24,165,167,121,Ø,2,13
    3,167,165,168,1Ø5
250 DATA Ø,133,168,2Ø2,2Ø8,239
    ,24Ø,2Ø2,165,167,69
260 DATA 168,72,41,15,168,185,
    211,3,32,21Ø,255
270 DATA 1Ø4,74,74,74,74,168,1
    85,211,3,32,21Ø
280 DATA 255,162,31,189,227,3,
    149,199,2Ø2,16,248
290 DATA 169,146,32,21Ø,255,76
    ,86,137,65,66,67
300 DATA 68,69,7Ø,71,72,74,75,
    77,8Ø,81,82,83,88
310 DATA 13,2,7,167,31,32,151,
    116,117,151,128,129,167,136
    ,137
```

Program 4: Apple Proofreader

By Tim Victor, Editorial Programmer

```
10 C = Ø: FOR I = 768 TO 768 +
   68: READ A:C = C + A: POKE I
   ,A: NEXT
20 IF C < > 7258 THEN PRINT "ER
   ROR IN PROOFREADER DATA STAT
   EMENTS": END
30 IF PEEK (19Ø * 256) < > 76 T
   HEN POKE 56,Ø: POKE 57,3: CA
   LL 1ØØ2: GOTO 5Ø
40 PRINT CHR$ (4);"IN#A$3ØØ"
50 POKE 34,Ø: HOME : POKE 34,1:
    VTAB 2: PRINT "PROOFREADER
   INSTALLED"
60 NEW
100 DATA 216,32,27,253,2Ø1,141
110 DATA 2Ø8,6Ø,138,72,169,Ø
120 DATA 72,189,255,1,2Ø1,16Ø
130 DATA 24Ø,8,1Ø4,1Ø,125,255
140 DATA 1,1Ø5,Ø,72,2Ø2,2Ø8
150 DATA 238,1Ø4,17Ø,41,15,9
160 DATA 48,2Ø1,58,144,2,233
170 DATA 57,141,1,4,138,74
180 DATA 74,74,74,41,15,9
190 DATA 48,2Ø1,58,144,2,233
200 DATA 57,141,Ø,4,1Ø4,17Ø
210 DATA 169,141,96
```

MLX Machine Language Entry Program For Commodore 64

Ottis Cowper, Technical Editor

"MLX" is a labor-saving utility that allows almost fail-safe entry of Commodore 64 machine language programs.

Type in and save some copies of MLX—you'll want to use it to enter future machine langauge (ML) programs from COMPUTE!. When you're ready to enter an ML program, load and run MLX. It asks you for a starting address and an ending address. These addresses appear in the article accompanying the MLX-format program listing you're typing.

If you're unfamiliar with machine language, the addresses (and all other values you enter in MLX) may appear strange. Instead of the usual decimal numbers you're accustomed to, these numbers are in *hexadecimal*—a base 16 numbering system commonly used by ML programmers. Hexadecimal—hex for short—includes the numerals 0–9 and the letters A–F. But don't worry—even if you know nothing about ML or hex, you should have no trouble using MLX.

After you enter the starting and ending addresses, you'll be offered the option of clearing the workspace. Choose this option if you're starting to enter a new listing. If you're continuing a listing that's partially typed from a previous session, don't choose this option.

A functions menu will appear. The first option in the menu is ENTER DATA. If you're just starting to type in a program, pick this. Press the E key, and type the first number in the first line of the program listing. If you've already typed in part of a program, type the line number where you left off typing at the end of the previous session (be sure to load the partially completed program before you resume entry). In any case, make sure the address you enter corresponds to the address of a line in the listing you are entering. Otherwise, you'll be unable to enter the data correctly. If you pressed E by mistake, you can return to the command menu by pressing RETURN alone when asked for the address. (You can get back to the menu from most options by pressing RETURN with no other input.)

Entering A Listing

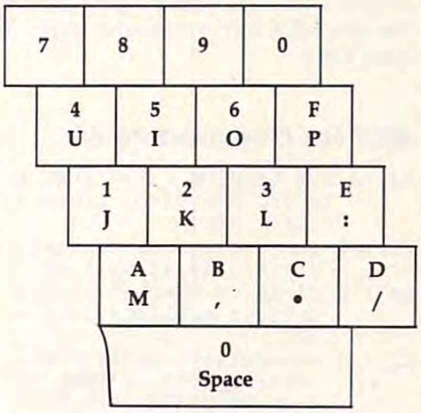
Once you're in Enter mode, MLX prints the address for each program line for you. You then type in all nine numbers on that line, beginning with the first two-digit number after the colon (:). Each line represents eight data bytes and a checksum. Although an MLX-format listing appears similar to the "hex dump" listings from a machine language monitor program, the extra checksum number on the end allows MLX to check your typing.

When you enter a line, MLX recalculates the checksum from the eight bytes and the address and compares this value to the number from the ninth column. If the values match, you'll hear a bell tone, the data will be added to the workspace area, and the prompt for the next line of data will appear. But if MLX detects a typing error, you'll hear a low buzz and see an error message. The line will then be redisplayed for editing.

Invalid Characters Banned

Only a few keys are active while you're entering data, so you may have to unlearn some habits. You *do not* type spaces between the columns; MLX automatically inserts these for you. You *do not* press RETURN after typing the last number in a line; MLX automatically enters and checks the line after you type the last digit.

Only the numerals 0–9 and the letters A–F can be typed in. If you press any other key (with some exceptions noted below), you'll hear a warning buzz. To simplify typing, a numeric keypad is now incorporated in the listing. The keypad is active only while entering data. Addresses must be entered with the normal letter and number keys. The figure below shows the keypad configuration:



MLX checks for transposed characters. If you're supposed to type in A0 and instead enter 0A, MLX will catch your mistake. There is one error that can slip past MLX: Because of the checksum formula used, MLX won't notice if you accidentally type FF in place of 00, and vice versa. And there's a very slim chance that you could garble a line and still end up with a combination of characters that adds up to the proper checksum. However, these mistakes should not occur if you take reasonable care while entering data.

Editing Features

To correct typing mistakes before finishing a line, use the INST/DEL key to delete the character to the left of the cursor. (The cursor-left key also deletes.) If you mess up a line really badly, press CLR/HOME to start the line over. The RETURN key is also active, but only before any data is typed on a line. Pressing RETURN at this point returns you to the command menu. After you type a character of data, MLX disables RETURN until the cursor returns to the start of a line. Remember, you can press CLR/HOME to quickly get to a line number prompt.

More editing features are available when correcting lines in which MLX has detected an error. To make corrections in a line that MLX has redisplayed for editing, compare the line on the screen with the one printed in the listing, then move the cursor to the mistake and type the correct key. The cursor left and right keys provide the normal cursor controls. (The INST/DEL key now works as an alternative cursor-left key.) You cannot move left beyond the first character in the line. If you try to move beyond the rightmost character, you'll reenter the line. During editing, RETURN is active; pressing it tells MLX to recheck the line. You can press the CLR/HOME key to clear the entire line if you want to start from scratch, or if you want to get to a line number prompt to use RETURN to get back to the menu.

Display Data

The second menu choice, DISPLAY DATA, examines memory and shows the contents in the same format as the program listing (including the checksum). When you press D, MLX asks you for a starting address. Be sure that the starting address you give corresponds to a line number in the listing. Otherwise, the checksum display will be meaningless. MLX displays program lines until it reaches the end of the program, at which point the menu is redisplayed. You can pause the display by pressing the space bar. (MLX finishes printing the current line before halting.) Press space again to restart the display. To break out of the display and get back to the menu before the ending address is reached, press RETURN.

Other Menu Options

Two more menu selections let you save programs and load them back into the computer. These are SAVE FILE and LOAD FILE; their operation is quite straightforward. When you press S or L, MLX asks you for the filename. You'll then be asked to press either D or T to select disk or tape.

You'll notice the disk drive starting and stopping several times during a load or save. Don't panic; this is normal behavior. MLX opens and reads from or writes to the file instead of using the usual LOAD and SAVE commands. Disk users should also note that the drive prefix 0: is automatically added to the filename (line 750), so this should *not* be included when entering the name. This also precludes the use of @ for Save-with-Replace, so remember to give each version you save a different name.

Remember that MLX saves the entire workspace area from the starting address to the ending address, so the save or load may take longer than you might expect if you've entered only a small amount of data from a long listing. When saving a partially completed listing, make sure to note the address where you stopped typing so you'll know where to resume entry when you reload.

MLX reports the standard disk or tape error messages if any problems are detected during the save or load. (Tape users should bear in mind that Commodore computers are never able to detect errors during a save to tape.) MLX also has three special load error messages: INCORRECT STARTING ADDRESS, which means the file you're trying to load does not have the starting address you specified when you ran MLX; LOAD ENDED AT *address*, which means the file you're trying to load ends before the ending address you specified when you started MLX; and TRUNCATED AT ENDING ADDRESS, which means the file you're trying to load extends beyond the ending address you specified when you started MLX. If you see one of these messages and feel certain that you've loaded the right file, exit and rerun MLX, being careful to enter the correct starting and ending addresses.

The QUIT menu option has the obvious effect—it stops MLX and enters BASIC. The RUN/STOP key is disabled, so the Q option lets you exit the program without turning off the computer. (Of course, RUN/STOP–RESTORE also gets you out.) You'll be asked for verification; press Y to exit to BASIC, or any other key to return to the menu. After quitting, you can type RUN again and reenter MLX without losing your data, as long as you don't use the clear workspace option.

The Finished Product

When you've finished typing all the data for an ML program and saved your work, you're ready to see the results. The instructions for loading and using the finished product vary from program to program. Some ML programs are designed to be loaded and run like BASIC programs, so all you need to type is LOAD *"filename"*,8 for disk or LOAD *"filename"* for tape, and then RUN. Such programs will usually have a starting address of 0801 for the 64. Other programs must be reloaded to specific addresses with a command such as LOAD *"filename"*,8,1 for disk or LOAD *"filename"*,1,1 for tape, then started with a SYS to a particular memory address. On the Commodore 64, the most common starting address for such programs is 49152, which corresponds to MLX address C000. In either case, you should always refer to the article which accompanies the ML listing for information on loading and running the program.

An Ounce Of Prevention

By the time you finish typing in the data for a long ML program, you may have several hours invested in the project. Don't take chances—use our "Automatic Proofreader" to type the new MLX, and then test your copy *thoroughly* before first using it to enter any significant amount of data. Make sure all the menu options work as they should. Enter fragments of the program starting at several different addresses, then use the Display option to verify that the data has been entered correctly. And be sure to test the Save and Load options several times to ensure that you can recall your work from disk or tape. Don't let a simple typing error in the new MLX cost you several nights of hard work.

MLX For Commodore 64

```
SS 10 REM VERSION 1.1: LINES 8
      30,950 MODIFIED, LINES 4
      85-487 ADDED
EK 100 POKE 56,50:CLR:DIM IN$,
       I,J,A,B,A$,B$,A(7),N$
DM 110 C4=48:C6=16:C7=7:Z2=2:Z
       4=254:Z5=255:Z6=256:Z7=
       127
CJ 120 FA=PEEK(45)+Z6*PEEK(46)
       :BS=PEEK(55)+Z6*PEEK(56
       ):H$="0123456789ABCDEF"
SB 130 R$=CHR$(13):L$="{LEFT}"
       :S$=" ":D$=CHR$(20):Z$=
       CHR$(0):T$="{13 RIGHT}"
CQ 140 SD=54272:FOR I=SD TO SD
       +23:POKE I,0:NEXT:POKE
       {SPACE}SD+24,15:POKE 78
       8,52
FC 150 PRINT"{CLR}"CHR$(142)CH
       R$(8):POKE 53280,15:POK
EJ 160 PRINT T$" {RED}{RVS}
       {2 SPACES}{8 @}
       {2 SPACES}"SPC(28)"
       {2 SPACES}{OFF}{BLU} ML
       X II {RED}{RVS}
       {2 SPACES}"SPC(28)"
       {12 SPACES}{BLU}"
FR 170 PRINT"{3 DOWN}
       {3 SPACES}COMPUTE!'S MA
       CHINE LANGUAGE EDITOR
       {3 DOWN}"
JB 180 PRINT"{BLK}STARTING ADD
       RESS{4}";:GOSUB300:SA=A
       D:GOSUB1040:IF F THEN18
       0
GF 190 PRINT"{BLK}{2 SPACES}EN
       DING ADDRESS{4}";:GOSUB
       300:EA=AD:GOSUB1030:IF
       {SPACE}F THEN190
KR 200 INPUT"{3 DOWN}{BLK}CLEA
       R WORKSPACE [Y/N]{4}";A
       $:IF LEFT$(A$,1)<>"Y"TH
       EN220
PG 210 PRINT"{2 DOWN}{BLU}WORK
       ING...";:FORI=BS TO BS+
       EA-SA+7:POKE I,0:NEXT:P
       RINT"DONE"
DR 220 PRINTTAB(10)"{2 DOWN}
       {BLK}{RVS} MLX COMMAND
       {SPACE}MENU {DOWN}{4}":
       PRINT T$"{RVS}E{OFF}NTE
       R DATA"
BD 230 PRINT T$"{RVS}D{OFF}ISP
       LAY DATA":PRINT T$"
       {RVS}L{OFF}OAD FILE"
JS 240 PRINT T$"{RVS}S{OFF}AVE
        FILE":PRINT T$"{RVS}Q
       {OFF}UIT{2 DOWN}{BLK}"
JH 250 GET A$:IF A$=N$ THEN250
HK 260 A=0:FOR I=1 TO 5:IF A$=
       MID$("EDLSQ",I,1)THEN A
       =I:I=5
FD 270 NEXT:ON A GOTO420,610,6
       90,700,280:GOSUB1060:GO
       TO250
EJ 280 PRINT"{RVS} QUIT ":INPU
       T"{DOWN}{4}ARE YOU SURE
        [Y/N]";A$:IF LEFT$(A$,
       1)<>"Y"THEN220
EM 290 POKE SD+24,0:END
JX 300 IN$=N$:AD=0:INPUTIN$:IF
       LEN(IN$)<>4THENRETURN
KF 310 B$=IN$:GOSUB320:AD=A:B$
       =MID$(IN$,3):GOSUB320:A
       D=AD*256+A:RETURN
PP 320 A=0:FOR J=1 TO 2:A$=MID
       $(B$,J,1):B=ASC(A$)-C4+
       (A$>"@")*C7:A=A*C6+B
JA 330 IF B<0 OR B>15 THEN AD=
       0:A=-1:J=2
GX 340 NEXT:RETURN
CH 350 B=INT(A/C6):PRINT MID$(
       H$,B+1,1);:B=A-B*C6:PRI
       NT MID$(H$,B+1,1);:RETU
       RN
RR 360 A=INT(AD/Z6):GOSUB350:A
       =AD-A*Z6:GOSUB350:PRINT
       ":";
BE 370 CK=INT(AD/Z6):CK=AD-Z4*
       CK+Z5*(CK>Z7):GOTO390
PX 380 CK=CK*Z2+Z5*(CK>Z7)+A
JC 390 CK=CK+Z5*(CK>Z5):RETURN
QS 400 PRINT"{DOWN}STARTING AT
       {4}";:GOSUB300:IF IN$<>
       N$ THEN GOSUB1030:IF F
       {SPACE}THEN400
EX 410 RETURN
HD 420 PRINT"{RVS} ENTER DATA
       {SPACE}":GOSUB400:IF IN
       $=N$ THEN220
JK 430 OPEN3,3:PRINT
SK 440 POKE198,0:GOSUB360:IF F
       E 53281,15
```

```
         THEN PRINT IN$:PRINT"
         {UP}{5 RIGHT}";
GC 450 FOR I=0 TO 24 STEP 3:B$
         =S$:FOR J=1 TO 2:IF F T
         HEN B$=MID$(IN$,I+J,1)
HA 460 PRINT"{RVS}"B$L$;:IF I<
         24THEN PRINT"{OFF}";
HD 470 GET A$:IF A$=N$ THEN470
FK 480 IF(A$>"/"ANDA$<":")OR(A
         $>"@"ANDA$<"G")THEN540
GS 485 A=-(A$="M")-2*(A$=",")-
         3*(A$=".")-4*(A$="/")-5
         *(A$="J")-6*(A$="K")
FX 486 A=A-7*(A$="L")-8*(A$=":
         ")-9*(A$="U")-10*(A$="I
         ")-11*(A$="O")-12*(A$="
         P")
CM 487 A=A-13*(A$=S$):IF A THE
         N A$=MID$("ABCD123E456F
         0",A,1):GOTO 540
MP 490 IF A$=R$ AND((I=0)AND(J
         =1)OR F)THEN PRINT B$;:
         J=2:NEXT:I=24:GOTO550
KC 500 IF A$="{HOME}" THEN PRI
         NT B$:J=2:NEXT:I=24:NEX
         T:F=0:GOTO440
MX 510 IF(A$="{RIGHT}")ANDF TH
         ENPRINT B$L$;:GOTO540
GK 520 IF A$<>L$ AND A$<>D$ OR
         ((I=0)AND(J=1))THEN GOS
         UB1060:GOTO470
HG 530 A$=L$+S$+L$:PRINT B$L$;
         :J=2-J:IF J THEN PRINT
         {SPACE}L$;:I=I-3
QS 540 PRINT A$;:NEXT J:PRINT
         {SPACE}S$;
PM 550 NEXT I:PRINT:PRINT"{UP}
         {5 RIGHT}";:INPUT#3,IN$
         :IF IN$=N$ THEN CLOSE3:
         GOTO220
QC 560 FOR I=1 TO 25 STEP3:B$=
         MID$(IN$,I):GOSUB320:IF
          I<25 THEN GOSUB380:A(I
         /3)=A
PK 570 NEXT:IF A<>CK THEN GOSU
         B1060:PRINT"{BLK}{RVS}
         {SPACE}ERROR: REENTER L
         INE {4}":F=1:GOTO440
HJ 580 GOSUB1080:B=BS+AD-SA:FO
         R I=0 TO 7:POKE B+I,A(I
         ):NEXT
QQ 590 AD=AD+8:IF AD>EA THEN C
         LOSE3:PRINT"{DOWN}{BLU}
         ** END OF ENTRY **{BLK}
         {2 DOWN}":GOTO700
GQ 600 F=0:GOTO440
QA 610 PRINT"{CLR}{DOWN}{RVS}
         {SPACE}DISPLAY DATA ":G
         OSUB400:IF IN$=N$ THEN2
         20
RJ 620 PRINT"{DOWN}{BLU}PRESS:
          {RVS}SPACE{OFF} TO PAU
         SE, {RVS}RETURN{OFF} TO
          BREAK{4}{DOWN}"
KS 630 GOSUB360:B=BS+AD-SA:FOR
         I=BTO B+7:A=PEEK(I):GOS
         UB350:GOSUB380:PRINT S$
         ;
CC 640 NEXT:PRINT"{RVS}";:A=CK
         :GOSUB350:PRINT
KH 650 F=1:AD=AD+8:IF AD>EA TH
         ENPRINT"{DOWN}{BLU}** E
         ND OF DATA **":GOTO220
KC 660 GET A$:IF A$=R$ THEN GO
         SUB1080:GOTO220
EQ 670 IF A$=S$ THEN F=F+1:GOS
         UB1080
AD 680 ONFGOTO630,660,630
CM 690 PRINT"{DOWN}{RVS} LOAD
         {SPACE}DATA ":OP=1:GOTO
         710
PC 700 PRINT"{DOWN}{RVS} SAVE
         {SPACE}FILE ":OP=0
RX 710 IN$=N$:INPUT"{DOWN}FILE
         NAME{4}";IN$:IF IN$=N$
         {SPACE}THEN220
PR 720 F=0:PRINT"{DOWN}{BLK}
         {RVS}T{OFF}APE OR {RVS}
         D{OFF}ISK: {4}";
FP 730 GET A$:IF A$="T"THEN PR
         INT"T{DOWN}":GOTO880
HQ 740 IF A$<>"D"THEN730
HH 750 PRINT"D{DOWN}":OPEN15,8
         ,15,"I0:":B=EA-SA:IN$="
         0:"+IN$:IF OP THEN810
SQ 760 OPEN 1,8,8,IN$+",P,W":G
         OSUB860:IF A THEN220
FJ 770 AH=INT(SA/256):AL=SA-(A
         H*256):PRINT#1,CHR$(AL)
         ;CHR$(AH);
PE 780 FOR I=0 TO B:PRINT#1,CH
         R$(PEEK(BS+I));:IF ST T
         HEN800
FC 790 NEXT:CLOSE1:CLOSE15:GOT
         O940
GS 800 GOSUB1060:PRINT"{DOWN}
         {BLK}ERROR DURING SAVE:
         {4}":GOSUB860:GOTO220
MA 810 OPEN 1,8,8,IN$+",P,R":G
         OSUB860:IF A THEN220
GE 820 GET#1,A$,B$:AD=ASC(A$+Z
         $)+256*ASC(B$+Z$):IF AD
         <>SA THEN F=1:GOTO850
RX 830 FOR I=0 TO B:GET#1,A$:P
         OKE BS+I,ASC(A$+Z$):IF(
         I<>B)AND ST THEN F=2:AD
         =I:I=B
FA 840 NEXT:IF ST<>64 THEN F=3
FQ 850 CLOSE1:CLOSE15:ON ABS(F
         >0)+1 GOTO960,970
SA 860 INPUT#15,A,A$:IF A THEN
          CLOSE1:CLOSE15:GOSUB10
         60:PRINT"{RVS}ERROR: "A
         $
GQ 870 RETURN
EJ 880 POKE183,PEEK(FA+2):POKE
         187,PEEK(FA+3):POKE188,
         PEEK(FA+4):IFOP=0THEN92
         0
HJ 890 SYS 63466:IF(PEEK(783)A
         ND1)THEN GOSUB1060:PRIN
         T"{DOWN}{RVS} FILE NOT
         {SPACE}FOUND ":GOTO690
CS 900 AD=PEEK(829)+256*PEEK(8
         30):IF AD<>SA THEN F=1:
         GOTO970
SC 910 A=PEEK(831)+256*PEEK(83
         2)-1:F=F-2*(A<EA)-3*(A>
         EA):AD=A-AD:GOTO930
KM 920 A=SA:B=EA+1:GOSUB1010:P
         OKE780,3:SYS 63338
JF 930 A=BS:B=BS+(EA-SA)+1:GOS
         UB1010:ON OP GOTO950:SY
         S 63591
AE 940 GOSUB1080:PRINT"{BLU}**
          SAVE COMPLETED **":GOT
         O220
XP 950 POKE147,0:SYS 63562:IF
         {SPACE}ST>0 THEN970
FR 960 GOSUB1080:PRINT"{BLU}**
          LOAD COMPLETED **":GOT
         O220
DP 970 GOSUB1060:PRINT"{BLK}
         {RVS}ERROR DURING LOAD:
         {DOWN}{4}":ON F GOSUB98
         0,990,1000:GOTO220
PP 980 PRINT"INCORRECT STARTIN
         G ADDRESS (";:GOSUB360:
         PRINT")":RETURN
GR 990 PRINT"LOAD ENDED AT ";:
         AD=SA+AD:GOSUB360:PRINT
          D$:RETURN
FD 1000 PRINT"TRUNCATED AT END
          ING ADDRESS":RETURN
RX 1010 AH=INT(A/256):AL=A-(AH
          *256):POKE193,AL:POKE1
          94,AH
FF 1020 AH=INT(B/256):AL=B-(AH
          *256):POKE174,AL:POKE1
          75,AH:RETURN
FX 1030 IF AD<SA OR AD>EA THEN
          1050
HA 1040 IF(AD>511 AND AD<40960
          )OR(AD>49151 AND AD<53
          248)THEN GOSUB1080:F=0
          :RETURN
HC 1050 GOSUB1060:PRINT"{RVS}
          {SPACE}INVALID ADDRESS
           {DOWN}{BLK}":F=1:RETU
          RN
AR 1060 POKE SD+5,31:POKE SD+6
          ,208:POKE SD,240:POKE
          {SPACE}SD+1,4:POKE SD+
          4,33
DX 1070 FOR S=1 TO 100:NEXT:GO
          TO1090
PF 1080 POKE SD+5,8:POKE SD+6,
          240:POKE SD,0:POKE SD+
          1,90:POKE SD+4,17
AC 1090 FOR S=1 TO 100:NEXT:PO
          KE SD+4,0:POKE SD,0:PO
          KE SD+1,0:RETURN
```

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5. Same
6. Publisher, James Casella, 825 Seventh Avenue, New York, NY 10019
Editor, Robert C. Lock, 324 W. Wendover Ave., Suite 200, Greensboro, NC 27408
Managing Editor, Kathleen Martinek, 324 W. Wendover Ave., Suite 200, Greensboro, NC 27408
7. ABC Consumer Magazines, Inc. (Sole stockholder Capital Cities/American Broadcasting Companies, Inc., 1330 Ave. of the Americas, New York, NY 10019) 825 Seventh Avenue, New York, NY 10019
8. N/A
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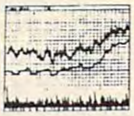

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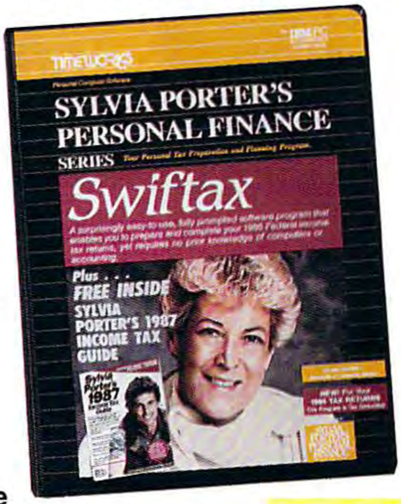

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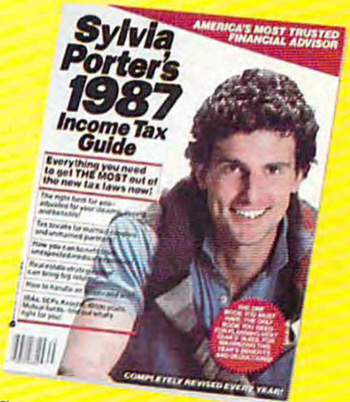

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