COMPUTE! Interviews Wendy Carlos And Frank Zappa
COMPUTE

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## Editor's Notes

This represents the first time in the history of our publications that we're printing the same set of "Editor's Notes" in both COMPUTE! and in COMPUTE!'s GAZETTE. The reason for this change of heart is a rather massive set of announcements-at least massive to me. In the space of two weeks, we've learned that two of our major competitors have chosen to close up shop. Creative Computing magazine and Popular Computing magazine are both reportedly ceasing publication with their December 1985 issues. To understand the significance of news such as this, you have to be aware of a bit of the history and folklore of our industry. COMPUTE! was first published as a fall 1979 quarterly issue. At that time, the largest, most successful publications in the industry were BYTE magazine, Creative Computing, Interface Age, Kilobaud Microcomputing, and Personal Computing. Popular didn't come along until the fall of 1980. I remember my determination to someday catch up with Creative Computing magazine in circulation. But before we could pursue 100,000 or even 50,000, we had to pursue 5,000 , and it took many months for us to achieve that goal.

I remember too the twinge of jealousy I felt when McGraw-Hill, then owner of BYTE and publisher of the new Popular Computing, announced in a flurry all of the many expenditures being made in the launch of their newest magazine. I was even approached about the position of editor-in-chief with a
promise of funds and staffing and the many things not so readily available to us at COMPUTE! without a McGraw-Hill behind us.

Creative Computing, under David Ahl's leadership, was at one time the premier magazine of consumer computing. Time and changes in the market eventually led to David's decision to sell to Ziff-Davis Publishing. Again, time and changes in the market have led to their apparent decision to close up the magazine.

Popular never seemed to establish its market niche with the clarity once demonstrated by Creative. It was always a junior introductory magazine that never seemed to bridge the gap between first time buyer and BYTE, its very successful parent. Perhaps Popular is the best example of that portion of our industry that came to rely on a massive influx of new computer buyers for growth. When, seemingly suddenly, our market dropped from 300 percent growth per year to 20 percent, the bottom fell out for many.

I applaud the immeasurable contribution to the personal computing industry made by Creative Computing and its founder David Ahl. I regret the demise of Creative and the demise of Popular as well even though it doesn't represent
the same loss of industry-impacting personality that Creative does.

This is a rather significant time, both for my own personal reflection of what we here at COMPUTE!/ ABC Publishing have accomplished, and on times past. We will assure you here and now that COMPUTE! Publications is and continues to be quite successful, quite proud of qur place in the market, and quite determined to continue to provide you, our readership, with all of the many services that have enabled us to grow and flourish, even during these particularly difficult times for the industry.


Editor In Chief/Founder


| Feature <br> 1. Multiple Weapon Systems | $\begin{aligned} & \text { "Real" } \\ & \text { F-15 } \end{aligned}$ | $\begin{aligned} & \text { F-15 } \\ & \text { STRIKE } \\ & \text { EAGLE } \end{aligned}$ | Imitation Game |
| :---: | :---: | :---: | :---: |
| - Cannon | Yes | Yes | Yes |
| - MK-82 Bombs | Yes | Yes | No |
| - Air-Air Missles | Yes | Yes | No |
| 2. Sophisticated Electronics |  |  |  |
| - Heads Up Display | Yes | Yes | No |
| - Radar | Yes | Yes | No |
| - Electronic Counter Measures | Yes | Yes | No |
| - Inertial Navigation | Yes | Yes | No |
| 3. Real Combat Missions | Yes | Yes | No |
| 4. Developed and Tested by Real Fighter Pilots | Yes | Yes | No |
| 5. Aerobatic Flying (Loops, Splits, and YọYos) | Yes | Yes | No |

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#### Abstract

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.


## Hidden 520ST Operating System

In a recent article for COMPUTE! ["Atari 520ST: A Hands-On Report," October 1985], you mentioned a way to break out of TOS (Tramiel Operating System) and get into $\mathrm{CP} / \mathrm{M}-68 \mathrm{~K}$ on the Atari 520ST. As a new dealer for this machine, we would very much like to know how to do this, since the documentation we have does not explain it.

Michael Couch
Campus Computers Brentwood, TN
Our article was ambiguous on this point, but apparently the Atari 520ST sold to the general public offers no direct way to enter $C P / M-68 K$. We did it with a program file called COMMAND.PRG, which comes on one of the disks sold by Atari to software developers. When you execute this file by double-clicking its icon or directory entry, the GEM desktop disappears and is replaced by the prompt $\{A\}$ (similar to the $A>$ prompt in PC-DOS/ MS-DOS or the D1: prompt in OS/A+ and DOS XL). To call up a directory from disk drive $A$, you simply type the command DIR. Typing B: changes the prompt to $\{B\}$ for drive $B . C P / M-68 \mathrm{~K}$ offers many other DOS commands, including Unixlike commands such as LS (a synonym for DIR). The EXIT command puts you back in the GEM desktop and returns control to the mouse.

Actually, you aren't breaking out of TOS when you enter $C P / M-68 \mathrm{~K}$ on the 520ST-you're merely peeling away the GEM desktop environment with its icons, drop-down menus, screen windows, and mouse-controlled pointer. GEM, which stands for Graphics Environment Manager, is simply a layer atop $C P / M-68 \mathrm{~K}$ and TOS which makes the computer easier to learn and use. TOS is always present, hidden beneath GEM.

The COMMAND.PRG file isn't in-
cluded on the TOS system disk supplied with the standard Atari 520ST. However, it's not a particularly long program: Someone familiar with 520ST systems programming could probably write an equivalent routine without much difficulty. If you can get a copy of COMMAND.PRG, the best way to enter CP/ $M-68 \mathrm{~K}$ is to install the program as a TOS application, rather than use it as a GEM application. This ensures that the keyboard cursor stays on the screen while you're working with $C P / M-68 K$. To install COMMAND.PRG as a TOS application from GEM, click once on the COMMAND.PRG icon or directory entry, then drop down the Options menu, select Install Application, click once on the TOS box, then click once on the OK box. You can make the installation permanent by saving the GEM desktop onto your TOS startup disk.

## Fixing A Nagging Question

Each time you save a document with Commodore 64 SpeedScript, it asks DISK OR TAPE?. By now I have told the program several thousand times that I want to save to disk, not tape. How can I change the program so I won't have to answer that question? Mark Smith
This is a simple modification. Coincidentally, someone else has contributed the answer. Our thanks to reader Eugene McMurray for sending these changes:
SpeedScript for the Commodore 64 is a great word processor, but few people use it with both tape and disk. Only three POKEs are needed to customize SpeedScript so that it always uses one device or the other. The change applies both to saving and loading. Load SpeedScript into memory, then type in the appropriate line in direct mode (without a line number) and press RETURN. Be very careful when you enter this line. Even a minor typing mistake will probably scramble that copy of SpeedScript in memory (if you mistype the line, reload SpeedScript and repeat the process).
SpeedScript 2.0 with disk:
POKE 4490,234:POKE 4491,169:POKE 4492,68
SpeedScript 2.0 with tape:

POKE 4490,234:POKE 4491,169:POKE 4492,84
SpeedScript 3.0 or 3.1 with disk:
POKE 4904,234:POKE 4095,169:POKE 4906,68
SpeedScript 3.0 or 3.1 with tape:
POKE 4904,234:POKE 4905,169:POKE 4906,84

Now resave SpeedScript with a different filename to distinguish it from the original. The program no longer prints the usual DISK OR TAPE? prompt before saving or loading a document.

Eugene McMurray

## Son Of Immortal PC Programs

I was particularly interested to read "Immortal PC Programs" in the October 1985 "Readers' Feedback" column, since I have a different sort of undeletable file. Nearly a year ago, when I first got my PCjr, I saved a BASIC program under the name "TIC TAC" and have been trying unsuccessfully to erase it ever since. Much to my surprise, I find that a program with a space in the name can be SAVEd or LOADed, but not ERASEd, KILLed or DELETEd. How can I get my computer to erase the file, and why does IBM BASIC let you create files that can never be removed?

Richard Scarbrough
Several readers have raised the same question about this glitch in the IBM $P C / P C j r$ operating system. There is a simple solution: Replace every space with a question mark wildcard symbol when specifying the stubborn filename. For example, KILL "TIC?TAC" from BASIC erases "TIC TAC" from the disk. One note of caution: Since the wildcard symbol replaces any character in the same position within that filename, this command would also delete similarly named files like TICATAC or TICOTAC. Save such files to another disk before deleting the unwanted file.

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There are only four official file types in DOS 3.3: T for text files, I for Integer BASIC, A for Applesoft BASIC, and B for binary files. However, a file's directory entry on the disk can indicate eight different file types, and some programs use one of these unofficial types. The most common example is the $R$ type, which some assembler programs use to indicate a relocatable object code file.

Track 17 of an Apple DOS 3.3 disk contains the disk directory. Each directory sector contains a file's name, its location on the disk, and a byte that indicates the file's type. The highest bit (128) of the file type byte denotes a locked file. When this bit is set to 1, an asterisk is displayed next to that file's type when you CATALOG the disk, meaning you can read the file but cannot delete or modify it. The lower seven bits contain the file type. If all seven bits contain zero, the file type is text. If only the lowest bit is set, the file contains an Integer BASIC program. Here is what the various bit values signify:

Note that although A (Applesoft) and
$B$ (binary) appear twice in this table, only the bit values 2 and 4 represent usable file types. Values of 32 and 64 represent completely different files (if there's any use for these files, we've never seen $i t$ ). The system pays attention only to the first set bit it encounters, scanning from left to right in the table shown here. For instance, the values 4 and 5 both indicate a binary file, since the first set bit occurs in the third lowest bit.

The simplest way to edit a nonstandard file is to find the program that made it and run that program. If that's not possible, you can use a disk editor like "Dr. Disk" (see compute!'s Apple Applications, Fall/Winter 1985 issue) to edit the file directly or change its type byte (making the file into something that's easier to handle). For example, if you change a file to the text type, you may be able to handle it with an ordinary text editor. File entries begin in sector 15 of track 15 and build downward. The type byte is located one byte before the filename.

| Bit Pattern | Value | Type | Meaning |
| :--- | ---: | :---: | :--- |
| L00000000 | $0 / 128$ | T | text file |
| L0000001 | $1 / 129$ | I | Integer BASIC |
| L0000010 | $2 / 130$ | A | Applesoft BASIC |
| L0000100 | $4 / 132$ | B | binary file |
| L0001000 | $8 / 136$ | S | unused type |
| L0010000 | $16 / 144$ | R | unused type |
| L0100000 | $32 / 160$ | A | not Applesoft |
| L1000000 | $64 / 192$ | B | not binary |

## Atari Program Overlays

I'm programming a trivia game on my Atari 800. I was wondering if I could use the ENTER"D:" command to merge the questions for different categories into the program. The questions are stored in additional program lines on disk. My problem is that I can't get the main program to continue running after it enters the new question lines. Is there any way to keep the program running after it does an ENTER"D:" command?

> David Rivera

Yes. In fact, there are several ways. What you're really asking is how to load over-lays-new program lines that merge into memory under program control. By loading overlays, a program can, in effect, "rewrite" itself as it runs. This powerful technique is useful for a wide variety of tasks.

The simplest way to prepare an overlay is to append an appropriate directmode command onto the file containing the new lines you want to load. This is most easily done with a word processor or text editor that handles ASCII files, since the new lines must be stored in ASCII format with the LIST command to work with ENTER, anyway. Almost all word
processors for Atari computers handle ASCII text, including AtariWriter, PaperClip, The Writer's Tool, Text Wizard, and COMPUTE!'s SpeedScript.

Follow these steps: In BASIC, type in or load the program lines that you want to merge with the main program. Store the lines on disk or tape in ASCII format with the LIST command, not SAVE or CSAVE. Load the file into your word processor or text editor. Move to the end of the file and add whatever direct-mode command you want the computer to perform after ENTER is executed. Typically, this command is either a GOTO to some other line in your program, or a RETURN if the overlayloading routine is called with a GOSUB. You must type this command as a directmode statement without a line number. Be sure the command ends with a RETURN keypress. Then save the file back to disk or tape. The overlay is now complete.

When your main program loads this overlay with ENTER, the new lines are merged into memory and become part of the main program. (Remember that the new lines will replace any existing lines that have the same line numbers.) After the computer loads the last program line of the overlay, it executes the direct-mode command you tacked on with the word
processor. If you don't have a word processor, you can add the direct-mode command by using OPEN with the append option-see your BASIC manual.

Another method of loading overlays is to use the dynamic keyboard technique. This involves printing one or more direct-mode commands on the screen, positioning the cursor over the commands, and then activating the Atari's forcedread mode by POKEing 13 into memory location 842. To see an example, LIST these lines to disk or tape as your overlay (use the filename OVERLAY.LST for disk):

```
\(1 ø \varnothing\) PRINT "NEW LINE \(1 \varnothing \varnothing\).
2øø PRINT "NEW LINE 2øø.
3øø PRINT "NEW LINE \(3 ø \varnothing\).
4øø PRINT "NEW LINE 4øø..
5øø PRINT "NEW LINE 5øø..
    .."
```

Type NEW, then enter these lines as the main program (replace the $D$ : in line 30 with C: if you're using cassette):

```
1\varnothing GRAPHICS g
2ø POSITION 2,4
3ø PRINT "ENTER";CHR$(34)
    ;"D:OVERLAY.LST"
40 POSITION 2,4
5ø PRINT "CONT"
60 POSITION 2,\emptyset
70 POKE 842,13
80 STOP
9ø POKE 842,12
99 PRINT "PRQGRAM CONTINU
ES HERE"
```

When you type RUN, you'll see the main program load the overlay and continue running. In effect, the POKE in line 70 makes the computer press its own RETURN key over the commands printed on the screen. The POKE in line 90 turns off this mode so the program can continue normally. If you want to blank the screen for cosmetic purposes while this program is working, add these lines:

## 25 POKE 559, <br> 95 GRAPHICS

By experimenting, you can add this routine to your own programs. The $d y$ namic keyboard technique can execute virtually any command under program control in this manner.

## PLUG For The Plus/4

Commodore Plus/4 owners now have a national user group, called PLUG (Plus/4 Users' Group). Membership costs $\$ 20$ annually and entitles you to receive the PLUG newsletter, printed eight times a year. The newsletter contains programming tips, Plus/4 product reviews, reader mail, and other information such as a list of bulletin boards that support the Plus/4. Softwarehungry PLUG members may obtain


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Thanks for the information. Plus/4 users should also note that the Programmer's Reference Guide for the Commodore Plus/4 will soon become available. Though we haven't seen a copy at the time of this writing, the publisher (Scott, Foresman \& Co.) has scheduled the book for release in late 1985 or early 1986, with a projected list price of $\$ 19.95$.

## TI-99/4A Subprograms

What advantage, if any, does a TI Extended BASIC subprogram (with SUB) have over an ordinary subroutine called with GOSUB?

Dan Schwarz
An Extended BASIC subprogram is quite similar to a subroutine. Both contain a series of BASIC statements set apart from the main program and are often used to perform a repetitive function. However, while a routine accessed with GOSUB may appear anywhere in the program, a subprogram must appear at the end. Subprograms are also called by name rather than by line number. For instance, the following statement calls a subprogram named MULT:

## 10 CALL MULT(A,B,C)

Inside the parentheses is the parameter list or set of variable values you want to pass from the main program to the subprogram. This is necessary because the system treats the subprogram as a separate program: The subprogram can't recognize any variables used in the main program unless you pass their values in the parameter list. Here's how the subprogram MULT would begin:

## 500 SUB MULT(D,E,F)

The SUB statement marks this as a subprogram. Since MULT expects to receive three variables from the main program, its parameter list contains three items. Parameters are passed according to their position within the parameter list: That is, the first parameter in the subprogram's list becomes equal to the first one in the calling list. In this case, $D$ equals $A$, $E$ equals $B$, and $F$ equals $C$. You can use any simple variable names, of course. All subprogram variables are local, meaning they have no effect on the main program.

In this case, you can use D, E, and F in the subprogram any way you like without affecting main program variables of the same name.

The end of a subprogram is marked with this statement:

## 580 SUBEND

One reason to use subprograms is that the computer can find them much faster than ordinary subroutines. During the prescan phase of program execution, the computer looks at the entire program text, noting (among other things) the location of any subprograms. When the subprogram is CALLed, the computer already knows its location and begins executing its statements without delay. To locate an ordinary subroutine, on the other hand, the computer must scan the entire program for the right line number, which takes significantly longer.

Because subprograms are called by name rather than line number, their placement in the main program is not dependent on line numbers. This feature, plus the use of local variables, means you can build up a library of program modules. Whenever you need one of the subprograms, you can easily merge it into the program you're working on. Since subprograms are always placed at the end of the main code, the program tends to be more structured and easier to understand. Similar features are common in more structured programming languages.

## Resetting The 1541 Drive

Please publish a reset circuit I can add to my 1541 disk drive. I understand that resetting the drive by turning the power off and on is not particularly good for it. Robert Desko
As with computers, there are two ways to reset the 1541 disk drive. A hardware reset is triggered physically (grounding the microprocessor's RESET line). A software reset is activated by a command that makes the device perform its normal powerup routines without actually switching the power off and on. Software resets save a little stress on the chips. For instance, SYS 64738 on the Commodore 64 has much the same effect as turning the power on. The equivalent command for the 1541 is UJ, as shown in this program:
10 OPEN $15,8,15$
20 GOSUB 70
30 PRINT\#15,"UJ"
40 FOR J=1 TO 1000:NEXT
50 GOSUB 70
60 CLOSE 15:END
70 INPUT\#15, ER, ER\$, TR, SE
80 PRINT ER;ER\$;TR;SE
90 RETURN
This program displays the drive status twice, before and after the drive is reset. Here's what you'll see on the screen:

0 OK 00
73 CBM DOS V2.6 154100
The first message indicates normal (no error) status. Though it's transmitted like an error message, the second message doesn't indicate an error. It's a "signature" which the drive generates every time you turn it on (like the 64's familiar powerup message *** COMMODORE 64 BASIC V2 ***). Once the command channel is open (line 10), you can reset the drive at any time by sending the characters UJ with a PRINT \# command (line 30). You may replace the J in UJ with a colon, although there's no practical advantage in doing so.

The delay loop in line 40 is needed because it takes the drive a moment or two to clear its internal memory buffers, set zero page variables, and complete other reset tasks. During that brief interval the drive can't respond to any other commands. To reset the drive from direct mode (when you're not running a program), type OPEN 15,8,15, "UJ" and press RETURN. Wait a second or two, then enter CLOSE 15 to close the command channel.

In most circumstances, a software reset is as effective as a hardware reset and has the advantage of resetting the drive without disturbing anything in the computer's memory. If you can't bring the drive back with LJ or by pressing RUN/ STOP-RESTORE, you must do a hardware reset. Since the 1541 uses a 6502 microprocessor, building a reset switch is no more difficult than building one for the 64 or VIC-20. All you need is a momen-tary-contact, normally open switch wired between the 6502's reset line (RESET) and its ground line (GND). Since these lines are available on pins 6 (RESET) and 2 (GND) of the 6-pin DIN connector at the back of the drive, it's possible to make a switch that plugs directly into the serial port connector. Your disk drive manual contains a diagram of the pins. It's a good idea to debounce the switch by wiring a small capacitor in parallel with the switch terminals. Use extreme caution when attempting this modification: If you don't understand exactly how to build the switch, get help from a friend who does or refer the work to a qualified technician.

There's one disadvantage to performing a hardware reset. Since the serial cable connects to the RESET line in the computer's microprocessor, pressing a reset switch on the drive resets the computer as well-destroying any BASIC program in memory. Grounding RESET anywhere on the serial bus resets every serial device in the system. If you have a reset switch on your computer, an expansion card, etc., you'll rarely need a separate switch for the drive.

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## TurboTape For 64 SpeedScript

People who use Commodore 64 SpeedScript [COMPUTE!, March 1985] and "TurboTape" (COMPUTE!, January 1985) might be glad to know there is a way to turbosave and turboload SpeedScript documents. This method is for use only with the latest versions of SpeedScript ( 3.0 or 3.1 ). First, create a new TurboTape program on tape for use with SpeedScript: Load and run TurboTape, choosing option two. Then enter NEW, followed by TURBOSAVE"RELOCATED TURBO" $, 52606,53248$. Once that's done, you can load and run SpeedScript and write your document. When you're ready to turbosave it, exit SpeedScript via the RESTORE key, then enter LOAD "RELOCATED TURBO" and press RETURN. Now enter the following statement as one line:
POKE768,126:POKE769,205:POKE678,139: POKE679,227:POKE2498,96
Enter this statement:
TURBOSAVE"FILENAME",2049,52606
The process is complete. When you load the turbosaved document, you don't need to load and run SpeedScript first, because the turbosaved file includes SpeedScript. Just turn on the computer, load the file, and run it. This method steals about 400 bytes from the memory available for a SpeedScript document. If you frequently write documents that use up most of memory, you may want to make an additional modification to lower SpeedScript's top-ofmemory pointer. Load SpeedScript 3.0 or 3.1, enter POKE 2481,205 and resave the program.

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At Lincoln Center, Tom
Scott on saxophone plays a duet with an Amiga computer running a sophisticated MIDI-equipped music software program.

As the house lights at New York City's Lincoln Center dim, composer and jazzrock musician Tom Scott blows a saxophone blast that wails through the auditorium. Moments later, Scott is joined by an Amiga computer running a program called Harmony, which plays a series of improvisational tracks that draws appreciative murmurs from the audience.

The Amiga was connected to an electronic keyboard and to Scott's saxophone through a link called the Musical Instrument Digital Interface (MIDI). Thanks to the Harmony software and MIDI, the Amiga was suddenly transformed into a powerful musical tool-part instrument, part performer.

The Lincoln Center concert was just one demonstration of the


# MAKING MUSIC 

WITH


Selby Bateman, Features Editor

MIDI is a simple communications standard that lets you interconnect electronic keyboards, synthesizers, drum machines, sequencers, and personal computers. Adopted only a few years ago, MIDI has quickly become a genuine breakthrough that is changing the zoay musicians compose, play, and even think about music. Over the next few years, experts predict, MIDI will be increasingly spreading from recording studios and professionals into the hands of amateur musicians.

Amiga's capabilities at the computer's gala introduction to the press last summer. But it represented another milestone in the brief yet remarkable history of MIDI.

A new era in music began in 1982 when some of the electronic music industry's most respected companies-Yamaha, Korg, Roland, E-Mu Systems, Sequential Circuits, and others-reached an
important decision during the National Association of Music Manufacturers (NAMM) convention. They agreed to establish a set of digital transmission standards for electronic music. During the following year, the idea became reality when the companies adopted a standard of technical specifications called MIDI.

Under the MIDI concept, electronic music devices which
include MIDI circuitry can work together with other devices or instruments also equipped with MIDI. MIDI consists of a hardware standard for physically connecting musical devices, plus a software communications protocol that governs data transmission over the interfaces. It's doubtful that even the companies themselves realized at the time how swiftly and thoroughly this

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standardized hardware and software combo would alter the world of electronic music.

Without MIDI, consider the viewpoint of a musician or an instrument manufacturer. Suppose you want an electronic keyboard from Yamaha, but also would like to play a particular synthesizer built by Korg-and want to add the percussive sounds of a Sequential Circuits drum machine, too. How does one musician control all these instruments to take advantage of their features? That's a lot of hardware to use all at once, no matter how ambidextrous the musician.
communicating with another breed of powerful creative tools-personal computers. Electronic musical devices and computers were a natural combination. With computers, the MIDI bandwagon really began to roll.
"More than anything else, MIDI is turning musical instruments into computer peripherals. And it's making it possible for a much larger group of people to make music," says David Kusek, president of Passport Designs, a computer music company that sells a variety of MIDI products. "MIDI is changing the nature of music learning and production."

A computer's advanced pro-


MIDI-controlled musical devices, like this \$1,395 digital sampling instrument from Ensoniq with a built-in $3^{1 / 2}$-inch disk drive, are bringing computers and electronic instruments closer together.

Could the instruments somehow be linked together and controlled from a master board? Before MIDI, the answer in most cases was no. And even if two of the instruments could be patched together, advanced features of both would be inaccessible. For professional musicians, the limitations were oppressive. For manufacturers, the incompatibilities meant lost sales.

MIDI was designed to solve those problems. Compatibility among instruments had arrived. But what quickly became obvious was that MIDI was also perfect for
cessing capabilities, when coordinated by the right MIDI software, let a musician control an orchestra of electronic instruments in ways that would have been impossible just a couple of years ago. Suddenly, the composing, editing, and playing features which previously cost tens of thousands of dollars are within the reach of amateur musicians and computer owners. A single musician can perform like an entire band. A composer can create works for a full orchestra, and then hear the results before another musician ever sees the composition.

There are already dozens of companies creating hundreds of products to take advantage of the MIDI standard. They range from MIDI-compatible interfaces and MIDI computer software to musical instruments with MIDI circuits and jacks for receiving and sending digital musical data.

It's relatively easy to understand the basics of how MIDI works. The best source for MIDI technical information is the International MIDI Association (IMA), a nonprofit organization made up of manufacturers, musicians, educators, and others interested in electronic music. IMA makes available the current MIDI 1.0 technical specifications. The 14 -page MIDI specs and a 50 -page detailed technical explanation of MIDI, written by the MIDI Manufacturers Association, are available together from IMA for \$35 (or \$30 for IMA mem-bers-see the accompanying "MIDI Buyer's Guide" for more information).

Although MIDI's effects can be quite sophisticated, the technical specifications are simple. First, MIDI is an open-ended system, based on a minimum set of standards. Manufacturers can go beyond the minimum specifications as long as they maintain MIDI compatibility.

There are three types of MIDI ports: MIDI IN for receiving data, MIDI OUT for sending data, and MIDI THRU for passing along data. The ports are common five-pin DIN female jacks, so they can be connected together with shielded audio cables ending in five-pin DIN male plugs.

For example, the rear panel of the Atari 520ST computer has MIDI IN and MIDI OUT ports that let the computer control any MIDIequipped instrument, such as a keyboard, synthesizer, or rhythm machine. With help from the right software, the computer could capture the digital music data from a synthesizer and let you edit it, reverse it, change its key, modify the tempo, and even repeat the sound with the voice of a new instrument. The modified signals



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The Eidolon

Strategy Games for the Action-Game Player ${ }^{\text { }}$
would be sent back to the synthesizer via the MIDI OUT port. The possibilities are limited only by the sophistication of the software and the memory available in the computer.

MIDI THRU ports, found on many electronic instruments, allow digital data to pass unchanged through the instrument to a third device. For instance, you could connect the Atari ST's MIDI OUT to a synthesizer's MIDI IN, and then link the synthesizer's MIDI THRU to a drum machine's MIDI IN. The synthesizer would pass the information sent from the ST to the drum machine without changing it. By selecting one data channel for the synthesizer and another for the drum machine, the ST could transmit separate instructions to both devices. This is possible because MIDI specs require 16 independent channels for receiving or transmitting data. The interfaces send data in asynchronous serial fashion at 31.25 kilobaud (roughly 31,250 bits per second) in a ten-bit code consisting of one start bit, eight data bits, and a stop bit.

For most purposes, though, you don't need much technical background to use MIDI. Setting up a MIDI interface between a computer and musical instruments is relatively easy. Connect the MIDI IN, OUT, and THRU ports, set the channels you'll be using, and your hardware system is just about complete. However, taking advantage of the power of this system and the computer programs which control it are entirely different matters. A musician who has trouble handling one instrument faces a greater challenge when given the opportunity to conduct the near-equivalent of an orchestra.

The range of MIDI-equipped musical instruments is wide, from high-end synthesizers, keyboards, and digital sampling devices costing thousands of dollars to some low-end keyboards below several hundred dollars and interfaces and programs under a hundred. MIDI is still in its infancy, but the amount of computer software


A command screen from RolandCorp's MUSE (MIDI Users Sequencer/ Editor) for the Commodore 64 and Apple II-series computers.
hitting the MIDI market is growing phenomenally, says Lachlan Westfall, director of the IMA.
"There are scads of products coming out. About a year ago, we published an article on one of the first MIDI programs to become commercially available. Now I'd say the number is close to hundreds."

Since connecting a MIDI network is about as easy as hooking up a home stereo system, manufacturers are starting to produce MIDI products that sell for lower prices, says Westfall. "For example, more and more synthesizers are not including internal sequencers. Why put a limited sequencer in a synthesizer when you can concentrate on a more sophisticated one that's a stand-alone sequencer? It just drives the price of the synthesizer up too much."

Increasingly, personal computers are being put to work as smart controllers for MIDI devices. Software and hardware interfaces have been developed for popular eightbit computers such as the Commodore 64, Apple II series, and the Atari. (See the accompanying "MIDI Buyer's Guide.")

One recent example is RolandCorp's new MUSE (MIDI Users Sequencer/Editor), a \$150 MIDI controller program for the Commodore 64 and Apple II series. MUSE has eight independent tracks for recording and overdubbing musical sequences, editing by measure, track-merging capabilities, auto-
locating, track muting, a chain mode for building longer tracks, looping, transposing, and MIDI channel reassignment. The system also features an autocorrect function that lets you correct rhythm errors in recorded sequences without affecting articulation or phrasing. MUSE can be synchronized with drum machines, other sequencers, and multitrack tape decks, and is compatible with all MIDI-equipped instruments. There's enough memory to enter about 6,000 notes.

Despite the power and sophistication of relatively inexpensive packages like MUSE, 64 K computers do run out of memory if your composing and playing requirements are extensive.
"The big note number is about 6,000 on those [ 64 K ] machines," says Westfall. "You're hard-pressed to get a really complex song in there at once. If you use MIDI performance controls like a modulation wheel on a synthesizer or pressure sensitivity, that eats up significantly more memory than just playing notes. So, if you record a song and use some pressure sensitivity on your keyboard, and put some pitch bend in for expression, it eats up two or three times as much memory, and you can't even get a song [to fit in 64 K ]," he explains.

Westfall says he uses a similar program for the Macintosh which permits approximately 24,000 notes. "You can really do some stuff; I never run out of notes.'

There's a growing amount of MIDI software under development for larger computers such as the Macintosh, Westfall notes. "A lot of people see that as a very good computer for a musician. And the new computers, the Atari 520ST and the Amiga from Commodore-I'm increasingly talking to more and more developers who are aiming in that direction."

The Amiga, especially, promises to bring personal computing into the world of digital music. The advanced computer has four lownoise digital voices, each with

# 22 FASLPACED, EXCIINGEVENIS. GOFORTHECOLD 

## A Buyer's Guide To MIDI

MIDI-related products number in the hundreds now, and more arrive every day. The following list of vendors and products, although not meant to be comprehensive, should help you get started.

## CZ Rider

Cherry Lane Technologies
110 Midland Avenue
P.O. Box 431

Port Chester, NY 10573
\$150
Customizes Casio CZ synthesizer sounds with an Apple II-series computer and a MIDI instrument.
Dr. T's MIDI Sequencer Program
Dr. T's Music Software
24 Lexington Street
Watertown, MA 02172
\$125
Software which controls MIDI instruments through the Commodore 64.
International MIDI Association
11857 Hartsook Street
North Hollywood, CA 91607
One-year membership (includes MIDI specs): $\$ 40$.
MIDI/4
Passport Designs, Inc.
625 Miramontes Street
Half Moon Bay, CA 94019

## $\$ 99$

Four-channel MIDI software for Commodore 64 or Apple II-series ( 48 K minimum) computers. Unlimited overdubs, realtime editing, transposition, external sync, tempo control.

## MIDI/8 PLUS

Passport Designs, Inc.
\$150
Eight-channel MIDI software for Commodore 64 or Apple II-series ( 48 K minimum) computers.
MIDI Interface for Apple II and Commodore 64
Passport Designs, Inc.
\$195
Allows use of MIDI instruments.
MIDI Processing Unit (MPU-401) and
MIF-IPC Interface
RolandCorp
7200 Dominion Circle
Los Angeles, CA 90040
MPU, \$200; MIF-IPC, \$110
MIDI adapter and intelligent interface.
MIDI Interface for Commodore 64
Sequential Circuits
3051 N. First Street
San Jose, CA 95134
$\$ 99$
Allows use of MIDI instruments.

## MIDI Interface for 64

MIDI Sequencer for 64
MusicData, Inc.
8444 Wilshire Blvd.
Beverly Hills, CA 90211
Interface, $\$ 100$; Sequencer, $\$ 150$.
Interface and sequencer software.

## MIDIMATE

Hybrid Arts
11920 W. Olympic Blvd.
Los Angeles, CA 90064
\$200
MIDI interface for Atari $400 / 800$, XL, XE.

## MIDITRACK II

## Hybrid Arts

\$150
MIDI software for Atari $400 / 800$, XL, XE with 16 -track recording capability from keyboard. Editing commands, track commands, channel commands, sync commands. Requires 48 K .

## MIDITRACK III

## Hybrid Arts

\$374
MIDITRACK II with sequencing.

## MUSE (MIDI Users

Sequencer/Editor)
RolandCorp
\$150
Software for Commodore 64 and Apple II-series computers, with eight independent tracks for recording and overdubbing, plus editing functions.

## Music Processing System

RolandCorp
\$495
MIDI software for IBM PC; built-in sequencer; generates scores; screen editing.

## PC to MIDI Card

Noteworthy Systems
2835 Seventh Street
Boulder, CO 80302
MIDI board for IBM PC with programmable timer chips and tape sync signals.
\$250
Performance/7
Mimetics Corp.
P.O. Box 60238

Station A
Palo Alto, CA 94306
\$125
MIDI software for Commodore 64, IBM PC, Apple II-series computers; stores MIDI compositions in a library.

## MIDITRACK C

Hybrid Arts
\$349
Interface and sequencer for Commodore 64.

## Personal Composer

Mr. Jim Miller
14080 Edgewater Lane, NE
Seattle, WA 98125
\$495; \$49 per DX voice library.
Integrated software package for IBM PC for music scoring, 32-track MIDI recording, sequencing, and editing. Composing and editing possible via synthesizer or computer.

## Sequencer Plus

Octave-Plateau Electronic, Inc.
51 Main Street
Yonkers, NY 10701

## \$500

Composing software for IBM PC; prints hi-res sheet music.

## Polywriter

Passport Designs, Inc. \$299
Software for Apple II-series computers; translates performances to sheet music; full-screen editing.
Pro Pac
Passport Designs, Inc.
Interface, sequencer, and transcription program for Commodore 64 and Apple II series.
Commodore $64 / 128$ version: MIDI interface with tape and drum sync, MIDI 8/PLUS, Music Shop, Music Shop Utilities. $\$ 499.80$.
Apple IIe version: MIDI interface with tape \& drum sync, Polywriter, Polywriter utilities; $\$ 729.80$.
Apple IIc: MIDI interface with tape and drum sync, MIDI 8/PLUS, Polywriter, Polywriter utilities \$779.80.
Soundware Music Software Library Passport Designs, Inc.
\$29-\$79
Software which includes educational, performance, recording, music printing, and storage programs.
Super Music Synthesizer
Applied Engineering
P.O. Box 470301

Dallas, TX 75247
\$159
Portable synthesizer that fits in slot of Apple II-series computers.
Total Music for Mac
Southworth Music Systems
P.O. Box 275, R.D. 1

Harvard, MA 01451
\$489
Sequencer and music notation package for the Macintosh; 99 tracks, dual MIDI inputs, editing features.



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[^2]independently programmable volume, level, and sound-sampling rates, plus stereo output. With an optional sound-sampling device, you can capture and store in memory any external sound. At press time, several MIDI software packages for the Amiga and 520ST were scheduled for release before the holidays. Manufacturers also are developing keyboards for the Amiga, ST, and Macintosh that will transform the computers into sophisticated musical synthesizers and sequencers.

One of the most interesting software packages is Harmony (recently renamed Concert Craft), one of several music programs being prepared for the Amiga by Cherry Lane Technologies of Port Chester, New York. The program, to be marketed by Commodore, can create musical accompaniment with either the Amiga's extensive built-in sound capabilities or stored sounds from MIDI instruments. The program follows the musician's tempo rather than forcing the musician to follow the machine's tempo. As several hundred people witnessed during the Tom Scott performance at Lincoln Center, the effects can be remarkable.
"There's a good and growing base of computer music programs," says David Sesnek, president of Sequential Circuits, one of the founders of the MIDI standard. "And MIDI has solidified to the point where we can pick up an instrument, walk over to a developer's instrument, plug it in, and it works. That's what standards are supposed to do."

MIDI already is having an extensive impact on professional musicians, and now it is emerging in the educational and home environments as well. During the next year, a growing wave of MIDI computer software and lower-priced keyboards, synthesizers, and other musical devices will become available. Because of this, Sesnek believes the biggest impact is yet to come.
"The real power is with the consumer," he says. "MIDI will allow the marginal musician perfect performances, if he's willing to use it.'

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Kathy Yakal Assistant Features Editor.

Sophisticated synthesizers, sequencers, digital sound samplers, and other computerized instruments of the electronic age are becoming more widely adopted by professional musicians than ever before. Thanks to personal computers, many of these devices are coming within reach of amateurs as well. To learn more about how these developments are affecting today's music and musicians, COMPUTE! talked to two innovative composers performers who have spent years. exploring the potential of electronic instruments.
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COMPUTE! pioneer in etectronic music, Wendy Carlos served as an adviser to Robert Moog in perfecting the Moog synthesizer. Using that tool, she developed electronic simulations of orchestral sounds and set an early standard for such realizations with her 1968 album, Switched-On Bach, which became the largest-selling classical record of all time. Carlos' original music has been heard on such movie soundtracks as A Clockwork Orange, The Shining, and Tron. Her latest album was Digital Moonscapes, and she is now completing.

Interviews
Catalyst, to be released in the spring of 1986.
C !: Computers have simplified many tasks that used to be very time-consuming and difficult. Some people have drawn the same analogy with synthesizers and music performance and composition. How do you respond to that?
CARLOS: The more I get into the music field, the more difficult I realize it is, and the more amazed I am that the Beethovens and Bartoks accomplished so much in their
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Wendy Carlos And Frank Zappa
lives, because it is so hard to write music and try to approach masterpiece status. The closer you get, the more you're in awe of how onerous. that task is.

Please don't believe that because an artist makes something look easy that it's really easy. The practice doesn't go away because you have a fancy machine with a lot of bells and whistles on it.

Composition is that same kind of process. Sure, you can set up a song with eight bars followed by eight bars of the same followed by eight bars of something different
and finally eight bars of repeating the first thing again. That kind of thing is done all the time. A lot of people who have wonderful words strum a guitar and play things they call songs. But there's a big difference between doing that and putting together Beethoven's Fifth Symphony or one of the Mozart operas. It's all the difference between writing an advertising slogan in English and Shakespearean plays in English-you use the same tools, but can't you see that there's a vast difference? Don't put your hopes on going out and becoming
star of the day with some technical hardware.

But there certainly is a breakthrough. The period of time we're going through now is a time in which the first generation of computer-assisted music-making machines is taking place, and that's exciting.
C!: But it's been almost 20 years since the first synthesized music was created. Why do you still call it the first generation?
CARLOS: Ninety-five percent of the synthesizers on the market
today do exactly what we realized in 1968 was not quite good enough, but it was at least enough to get started in putting sounds together. That precedent was set by those of us who were working in the field, and it's lingered now for a good long while. Now you're at a time in the history of music when the stage of those instruments is starting to get phased out very gradually, very slowly, by the new computer generation of instruments which are only prototyped. Each company has its own approach on what to do, and there really is no standard as there was with the analog synthesizers.

I'm fed up and have been for a number of years with the analog synthesizers. I got very bored with them by the end of the first album, and I'm amazed that pop music is still using the same vocabulary, since there are so few sounds that are available in that kind of instrument. I don't know why people haven't said "Hey, I'm bored with this instrument." There's much more sound available in the guitar than there is in the average synthesizer.

All of the manufacturers like Bob Moog, when we all get together, we kind of frustratedly roll our eyes around. We'd like to see the market encourage that there be something different, but the market is extremely conservative about any change with this funny little machine that they think is something that must have come down with Moses. I'm hoping that they just finally get bored so we can start getting into what only a few instruments have now.

## C!: What kind of music equipment do you use?

CARLOS: I'm fortunate to be able to work with a machine that's based on an instrument that Bell Labs developed. It's a digital synthesizer which is so open-ended that it allows you to make an awful lot of things that are foolish and silly, because it's such a good tool that it overlaps everything. They did not want to become trapped like so many companies in the past by saying "Oh, this is inaudible. Don't put it in. You're not going to need
that ever, we'll cut that out too." They didn't do that. They left everything in. It's an elaborate, messy affair, but it allows you to come very close to what everyone else says they can do, and that is to make any sound you can conceive.

The truth is that even this instrument cannot make any sound imaginable, but it's a lot closer. The reason is it takes apart every sound into individual parts of sound, sine waves, harmonics, which you then have the option of moving around from millisecond to millisecond, amplitude and frequency, all of them, and there can be hundreds of them. It's like having an artist who

is painting on a canvas with a very tiny paintbrush.
C!: How would you compare your work with your synthesizer to what a conductor can do with a traditional orchestra?

CARLOS: One of Carlos' laws is anything you can control, you must control. If you make a machine that gives the pilot of a plane the ability to move every molecule on the surface of the plane, the pilot will probably crash the plane because there's too much there to controlit's overwhelming. Whereas if you
have an automatic pilot with a lot of automatic features, the pilot has very little to do, and there's very little difference from one flight to another because it's almost automatic.

Somewhere in-between is where we stand with synthesizers. It's a machine that allows you to do just about everything, but it carries the burden that you have to do just about everything. You have to control all kinds of nuances that most musicians take for granted when they pick up a good violin or good trumpet or good french horn. They know the instrument will do certain things for them already. But if you had to build the instrument from scratch, starting from pouring some molten brass into a mold and figuring out what length you wanted to make it, then you'd have the possibility of making an entirely different kind of french horn, plus you'd have to spend a lot of time doing it.

So that's the other edge of the sword. If you have a good, powerful tool, it's extremely exciting and useful, but it's also going to require you to spend an awful lot of perspiration and time learning to use that tool. I think it always works that way in any field. Electronic instruments have now reached the stage of sophistication where they're like all of the other good tools in the world.

## C : Then what does that imply for the near future?

CARLOS: I'm within a couple of minutes of finishing an album that has been overwhelmingly time-consuming and exciting. It's the most exciting thing I've ever done in my life, and I don't usually indulge in that kind of hyperbole. Because of this technology, I can do music that is totally unlike anything that has existed, yet which is totally based on the shoulders of giants.

This machine has the ability to play any kind of timbre, even if it's orchestral or electronic sounding or anything in-between-and that's actually where you stay, is in-between-and any tuning, so you don't have to use the equaltempered scale that all of the other synthesizers are locked into using.


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Which means you can use perfectly pure intervals that sound absolutely like clean air when you're used to breathing musty air, or like drinking pure, good water. It's not a huge thing. It's not going to knock you over like my infamous first record, which was so much filled with the novelty of new sounds that everyone with tin ears could even tell the difference. This stuff is a little subtler, but also remarkably more sophisticated. The music is available to use any way the intervals sound best to the ears, no matter what it looks like on paper. In the past, the equal-tempered scale made good numbers, but it didn't make good sound.

I'm talking about things that are not scientific and mathematical so much as they are plain, oldfashioned, sounding good. It's like cooking by taste rather than with a recipe. Instead of following the rules that someone else sets down, you taste along the way and say, "I think it needs a pinch more garlic," or whatever. You shape it as you go along to make it the most sensorily exciting thing it can be.

I feel-and I didn't think this would happen in my lifetime-it's probably the best way to get out of the abysmal mess that most modern music is in. We're in a situation in history where now we have tools to make anything imaginable, and yet we have all kinds of rules, with people telling us, "Pop music can only be in this kind of key. It has to be diatonic with a tempo of $4 / 4$ or 6/8." Classical music is terribly abysmal because you have to write it very, very ugly-not a single triad, no harmony, no melody. And it goes on and on.

It's contradictory to me. We now have the ability to stand on 95 percent of a floor that we could never before stand on more than 50 percent of, and we have nothing but dogma around telling us we're not allowed to do that.

I suspect there are going to be an awful lot of uptight people who, when they hear my new work, are not going to understand it, or they're not going to want to understand it because it represents leaving the confines of what they do and facing the great unknown. Which is what art should always be about.

C!: It sounds like this album will have a very unusual sound. Will any of the instrument sounds be familiar to listeners?

CARLOS: The sounds are extrapolated from traditional sounds, like what would happen if we took the sound of a nice, rich Stradavaria and instead of playing it with a bow, make it sound like it was being played with a piano keyboard. Or if we made a marimba out of brass. Or if the timpani weren't percussive but a woodwind, and you played by blowing on it. They're going to sound like nonelectronic acoustic instruments that somebody must have built, because they just never existed before.

The trick-the thing that was the hardest-was to control this entire mass of what could be a very chaotic enterprise and pound it into a shape which I hope is going to be comprehensible by the people listening to it. It's taken every ounce of musicality that I have. I would love to have the musical geniuses of the past right here in the room with me to help shape it.

I'd like the album to tempt other people to try different things, to leave the safe American way of doing things, like trying to cook Japanese after eating sushi at a restaurant for the first time. Like shoes that you wear every day until they wear out because they're so comfortable, I think we've certainly worn out the musical system that we've been using since 1600 s.

## C!: Why do you think the norms haven't changed faster?

CARLOS: There's a perfectly simple reason. Habit. And the technology didn't permit you to do much different. Now the technology, without a whole lot of money, is there around the corner for any manufacturer who wants to bring it to the public. Or the public can yell about it so the manufacturers are forced to bring it to them, to make these possibilities available. Manufacturers, all the way up to the half-million-dollar Synclavier, have not done anything that is more than mini-minded.

My friends in the business are so depressed, because if you say "sampling machine," manufacturers' eyebrows shoot up. That's
something good. But if you say "synthesizer," they don't want to hear about it. That's a sad situation. That's like saying, "We've got a cook here who's going to cook you a fine meal," and you say, "Nah, I don't want it. How about a TV dinner?" It's exactly at that level, but people don't see it yet. I would like people to be aware that they're going to have to ask for something a bit more ambitious than frozen concentrated food in their sound machines.

C!: How does your excitement about this new musical equipment compare to your feelings about the Moog synthesizer in 1968?

I am genuinely excited about this stuff. I can hardly go to sleep at night. It's like I have to get all of these things done before death happens. I feel a little silly in a way. Emotionally you're at the level of a child again. Something that's such a rich horizon of colors that you're giddy with delight, and you can't contain yourself because you want to get at them so much.

If I had had these tools back in 1968, I wouldn't have done Switched-On Bach because there would have been no need to do anyone else's music. There would have been no need to try and find ways of making these ugly sounds be a little bit musical. These sounds are musical. And they're already there to play. In 1968 I would have given my eyeteeth for this, and at the same time I would never have been able to predict anything like this was going to happen, except in science fiction.

C!: How do you think your musical training would be different if you were just starting out in the field today?
CARLOS: Using synthesizers, teachers can teach students things that I never was able to learn, which is how the sounds work, what makes them tick. They can take apart sounds to some extent, so if you have a drumstick tapping on a snare drum, you can see in which part of the sound the wood hits the metal, and then where the drumhead starts to let go, and then you can watch where it decays. There was no way to get at these

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things in the past, so you just read books. And the books were usually wrong because they didn't know, either. Whereas now you can really learn what makes sound tick while you're young, and go way past anything I'm able to do now.

So it's the best of times that I can see for music during the last 100 years, since the orchestra sort of got locked in, and since the instruments pretty much stopped changing. There's been a lot of sensationalism, but nothing of real substance. There's a marked change in what can be done right now that is as exciting as from Bach through Mozart into Beethoven, when the big orchestra started to get put together. And by the time of Wagner and Strauss and, of course, Papa Brahms, we finally were able to put together the most sublime of the acoustic instruments doing the most sublime things that people had trained themselves to perform.

That has never been equalled by electronic devices in any fashion. It used to be painful to work in the electronic form because you were aware that you were giving up the richness of a traditional orchestra in order to work with a lot of simple-minded, ugly sounds, and it was a bad tradeoff. It's no longer a tradeoff.

## C!: Is there still need for and value in learning traditional methods and instruments?

CARLOS: In producing this latest record, each time I tried to find a cheap, quick, and dirty way of doing something I knew how to do the hard way, I wasted so many months. It's larceny that always gets us in the end, anyway. If you don't look for the shortcut and you just do the job simply, it gets done.

You've got to know what chords are doing and how to shape a phrase, or your music is going to suffer. I think all of the knowledge you can get now that didn't exist a hundred years ago should be added to, not replaced-the kinds of musical savvy and things we've had up to now, like knowing how to play and harmonize and write and how to orchestrate. With the new sounds, you've got to know how to put sounds together. So orchestration is probably as important now as it's ever been-maybe more.

But added to that is this new insight into what makes sounds the way they are. You have to start by learning what makes the sounds of traditional instruments-not because you're going to do that for the rest of your life, but only because you're standing on the shoulders of

those giants. If you were an apprentice chef, you would learn to do all the traditional recipes before you went on and invented your own. That's the way I think it should be, and I don't think this is a preposterous, pompous, old stodgy idea at all. I think it's just a wise thing to do. Not to look for your own larceny, but to go for the simple path that's proven to work for anyone who's ever done anything of value in music. Do it while you're young if possible, and just enjoy the most exciting time that's ever been in music.

C : Do you sense a certain level of panic on the part of acoustic musicians? Do they feel threatened that this new technology will make their talents obsolete?
CARLOS: Yes. A lot of people talk this way. Of course, they think they're unique, but they're not unique at all. In almost any field where there has been any kind of
technology change, like in the British industrial revolution when people started making teacups out of a mold instead of on a wheel, the people who had done it by hand might have felt uptight in exactly the same way.

To some extent, they're actually right. The field has shifted, as I said, for the first time in a hundred years. To the extent that you do not keep up with the times, slowly your particular little niche is in a sense being replaced. If you already know a musical instrument well enough that you're really a fine musician-I assume that's what these people are talking about-you would be the best person to try and latch onto the new technology, because most of the younger people playing the instruments have no musicianship at all. A lot of them are very bad musicians. They don't know how to play, and they're letting the machine do the work for them and letting it hide the fact that they really don't know how to play. I think the older musicians, if they could get into the newer technology, could do it better.

The trick is you try to keep up with the times. There are a lot of drummers who are now doing drum machine programming, and they do it better than anyone else. Of course they do. How can that surprise anyone?

My own feeling is that they needn't worry, because it's going to happen so slowly. It could be 25 years before it becomes odd to see an acoustic group of instrumentalists on a stage. I don't think that's going to happen quickly at all. They'll live together comfortably for quite a few years. But the people who pay for these things will find out soon that something like two dozen people playing a new generation of instruments as based on the work of people like myself can do the same thing the orchestra can do. If they can use two dozen people instead of a hundred people, they're going to do it because it's cheaper.

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replaced by technology. People tend to move toward where it costs less to do the same job. That's the real enemy, if there is an enemy here. If you want to blame anything, blame the larceny of people who look for less cost. Don't blame the poor synthesizer player. We're trying to open up the door for more possibilities, because that's what human beings have always done.

Though probably best known for his offbeat music in the 1960s and 1970s with the rock group The Mothers of Invention, Frank Zappa has produced a body of work that includes 39 albums, more than 200 vocal songs, 91 instrumentals, 32 compositions for orchestras and choral groups, four ballets, two feature films, and two video specials. His most recent album, The Perfect Stranger, is a compilation of computer music and performances of his chamber works. Skeptical of traditional music education, Zappa learned his art by reading in public libraries, listening to records, and performing in different settings.
C!: You used to write music that was impossible for human musicians to play. Can those pieces be played now by electronic means?
ZAPPA: Absolutely.

## C!: How do you use synthesizers in your work?

ZAPPA: I use synthesizers for three things: for generating sounds that never existed before, for performing music which human beings would have difficulty playing, and to get rid of some of the drudgery of composition. In composition, you can copy phrases, which to do manually is real drudgerous. When you're doing repeats and things, a lot of that stuff on a computer is just push-button, like using a word processor.
C !: What equipment do you use?
ZAPPA: I use a Synclavier polyphonic sampling system, which costs about a quarter of a million dollars. Other things I'd like to use but haven't been able to afford are the $4 X$, which was developed in France at Ircam, and the new Fairlight system. But what I'm waiting for is a MIDI interface that will
allow the Synclavier to talk to several other sophisticated devices. Buying all these new devices individually would be like starting all over again, like learning a new language, unless there was a MIDI interface that was reliable in letting them talk to each other.

C !: Is there much distinction musically these days between instrument sounds and synthesizers?
ZAPPA: My Synclavier uses samplings, digital recordings of real sounds, and allows you to manipulate them, so there is no difference

between the real instrument and the digital recording. As for how easily people can tell the difference, it depends on the composition. The stuff that I'm doing on an album that's not yet released, you wouldn't hear real instruments playing but would recognize the sounds of real instruments that humans would have real difficulty doing. Little things like really complex rhythmic patterns that are being played by whole ensembles of instruments in harmony.
C!: So how will this technology affect future training of musicians? Will it mean that less emphasis can be placed on theory?
ZAPPA: A lot of people have already skipped over music theory because all they're interested in doing is having a recording career, and all you need for a recording career is a good hairdo and some diagonal zippers. Music theory has nothing to do with that.

If you want to do real composition, my advice to anybody is to invent your own theory. Musical
theory is an averaged-out series of regulations derived from common practices of an earlier era. When you get your theory books, they tell you "Don't do this" and "Don't do that" because in such and such a period they didn't do this and didn't do that, and that was the norm. You also have to remember that those norms were done to appease the tastes of the people who were paying the bill. That means the king, the church, or the dictator. There's no reason to assume that they had any better musical taste than you. So my advice is go out and make it up yourself, and don't worry about getting academically certified by an institution. No matter how pedigreed your technical approach to music, if you don't like the way it sounds and if somebody else doesn't like the way it sounds then why did you bother to do it? You can be totally correct as per the book, but you could wind up writing really boring music.

## C!: But hasn't a lot of that music been successful?

ZAPPA: There is a lot of really boring music that has been successful, but it wasn't generated by the means I just described. I can't think of anybody who did it all by the book and wound up either being a good composer or even a famous musician.

The other thing is that if a person wants to be a composer in America, I think he really ought to have his head examined before he goes into it, because nobody really wants to hear what you're writing How many brand-new compositions have you ever heard? Compositions that were written in the last year or two, modern, up-to-date compositions by living composers, people who want to write music in America? There are people writing music, but it just doesn't get played.

The music business has nothing to do with being a composer. Composers are out of the music business. If you're talking about composition, it lives in academia and dies in academia. If you're talking about the music business, you're talking about the hair and the zippers.

> C!: Then you think people in music schools are doing good composition work?


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ZAPPA: I have no way of knowing who's doing good stuff because, like I said, it doesn't get played. Most of the people who are getting grants, I really don't enjoy. The reason they're getting grants is because they're fashionable. Grants attract grants. People kind of nominate each other and keep it in the family. The same people get the awards and the same kind of drivel comes out. Then when the drivel comes out, the faculty, the compos-ers-in-residence at the college, say to themselves, "Well, look, this guy got a grant and he wrote drivel, so I must teach drivel, and maybe if I teach drivel, then I will get a grant, and of course my students need to learn drivel so they can get grants.'

I've always had an argument with music schools, especially the ones which deemphasize live performance. There are some conservatories which insist that the people who attend don't play gigs, which I think is foolish. It doesn't really train the musician or composer to make a living in the real world. They'd probably do better by these people to tell them to go out and get an Herbalife franchise or something like that.

C!: What about the argument that traditional musicians, people like conductors and instrumentalists and engineers, will become obsolete because of the new electronic technology?

ZAPPA: There's a lot to be said for doing away with some of those people anyway. First of all, I don't think recording engineers are ever going to be out of work. As far as conductors go, I don't have any genuine statistics on this, but I have the sense that most conductors, especially famous conductors, really aren't doing anybody any favors, because of the economics of the industry.

Let's look at the reality. When a person comes to a concert, he's coming to see a star conductor standing in front of an anonymous blob of musicians. What do those musicians play? Not any brandnew, interesting, exciting music. No. They can't. Because it costs too much money to rehearse a brandnew piece of music. They play
everything they already know from when they went to conservatory. It's like a jukebox. A conductor basically has the function of a guy who waves his arms in front of a jukebox. Everybody in the orchestra already knows how to play Beethoven, and he knows how to conduct Beethoven. He walks in and does one rehearsal on the day he arrives. They know where it goes fast, where it goes slow, and it's a scam. The people who go to the concert are not there to hear music, they're there to see the guy waving his arms and swoon over it.

On the other hand, there are a


Frank Zappa

The other factor is most of it doesn't get recorded anyway. The audience comes to a concert of new music. They get to hear the piece played one time, and if the performance is no good, they're not doing the composer any favors, either. The audience listens to it and has no idea what the composer wrote. They just get to hear the net result of all the choreography and politics that goes into those concerts.

So if the real concern is music being played accurately and being true to the composer's wishes, the computer is the thing that's going to allow that to happen. At that point, the composer gets to take the rap. If the computer plays with one hundred percent accuracy what he has in mind-and for certain types of music that is an absolute possibility-then the audience gets more for their money. They get to hear the thing the way the composer imagined it.

With certain other types of music that require a lot of styling and nuance, it is difficult to put the same kind of element into the digital storage of the composition. If there are a lot of rubatos in it or a lot of dynamics, some of the computer music sysiems don't handle that kind of information too well. But if you're just talking about getting rhythms played correctly or the right pitches always in tune, stuff like that, it can be done.

C!: So do you think we'll see less emphasis placed on the performer in the next few years, on the people with the zippers and the hair?
handful of committed conductors who have an interest in bringing new music to life, but they're stymied by the fact that the costs of doing it are astronomical. That's one of the reasons why there is very little new orchestral music writ-ten-because you can't afford to rehearse it. Most composers working in an academic setting are working on small ensemble pieces of generally such an ugly nature that who can tell whether or not anyone played a wrong note? It's also easier to rehearse those pieces, and it costs less because there are fewer musicians.

ZAPPA: I think that the people with the zippers and the hair will be supplanted by people with zippers going in another direction and a different hairdo. That's pretty much the name of the game. No major event in American music cultureI'm talking financially-has ever occurred without the cooperation and, assistance of the clothing industry. They're married. Every major cycle in rock and roll has been accompanied by clothing styles. Every time someone sells a record, someone else is selling a $t$-shirt or a pair of pants. It makes the world go 'round.


[^4]

Ben Elizer


#### Abstract

Looking for something different to do with your computer? Like the conventional game of solitaire, this computerized version requires you to think ahead at all times. The original program runs on the Commodore 64, Plus 4,16 , and 128 , and we've added versions for Apple II-series computers, the IBM PC with color/graphics adapter and BASICA, IBM PCjr with Cartridge BASIC, TI-99/4A, and Atari $400 / 800, \mathrm{XL}$, and XE with at least 16 K RAM.


"Solitaire" is an electronic version of the familiar card game. Like the original, this game challenges you to put a deck of cards in order using the fewest possible moves. Type in and save the program listed for your computer, then read the instructions before you play the game.

## Unshuffling The Deck

As you probably know, Solitaire has a very simple object. After shuffling a deck of playing cards, you must put them back in order, following a few simple rules. Though there are several different variations of the conventional game, here are the rules for this version:

When you run the program, the computer deals out four rows of

13 cards, then removes the aces, leaving four empty spaces. Your goal is to rearrange the cards into four rows of the same suit, putting the cards in each row in ascending order from the lowest (2) to the highest (king), without leaving any empty spaces between cards. That sounds simple enough. But since you must move a card into one of the four empty spaces, your choices for any given move are limited.

Your position on the screen is shown by a blinking cursor. Press the M key to move from the current position to another empty space. When you press $P$, the computer moves a card into the current space: Which card it puts there depends on which card is immediately to the left of the space. Whenever possible, the computer uses the next card in suit. For example, if the card to the left of your current position is the 2 of hearts, pressing P puts the 3 of hearts in the current space and puts a space where the 3 of hearts was before. If you press $P$ on a space to the right of the queen of diamonds, the king of diamonds moves from its current position to that space, and so on. Each time you press $P$, one space is filled and another is emptied.

In this way you can gradually
move cards into the right order. When you press P on a space at the beginning of a row, the computer asks which suit to play (hearts, clubs, spades, or diamonds). This determines the suit for that row. While it's possible to win on only one deal, most games require two or more deals. When no moves are possible (every empty space is followed by a king or another space), the computer automatically shuffles the remaining cards and deals them out again. Of course, it does not disturb cards that are already in correct order. You'll find that it takes considerable foresight to win consistently in only two or three deals. Completely random play results in an average of nine or ten deals.

## Commodore Versions

Program 1 is Solitaire for the Commodore 64. It also works as listed for the Commodore 128. For the Commodore 16 and Plus/4, change line 20 to read as follows:
$2 \varnothing$ COLORø,2,5:COLOR4,7, $\varnothing$

## Apple Version

This version of Solitaire is in two parts. Program 4 is the main BASIC

## Fly the unfriendly skies.



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program and Program 5 is a special binary file used to create the high resolution card displays．You must type in Program 5 with＂Apple MLX，＇COMPUTE！＇s machine lan－ guage entry program for Apple， published elsewhere in this issue． Follow the MLX instructions care－ fully and be sure to save a copy of the program when you are done． Here are the addresses you need for MLX：

## Starting address： 8000 <br> Ending address： 8317

The program works on any Apple II－series computer，but the graphics look much better on a color monitor．

## TI－99／4A Version

This version（Program 6）plays ex－ actly like the others except that the rows of cards are displayed vertical－ ly rather than horizontally．

＂Solitaire＂for the Commodore 64.

## Program 1：Commodore Solitaire

For instructions on entering this listing，please refer to＂COMPUTEI＇s Guide to Typing In Programs＂published bimonthly in COMPUTEI．
$1 \varnothing$ CLR：A＝RND（－TI）：PRINT＂\｛CLR\}" ；：F5＝1：C＝52：W＝1 ：rem 21
$2 \sigma$ POKE53281，15：POKE53280，14
：rem 34
$3 \varnothing \operatorname{DIMP}(4,13), \mathrm{D}(52), \mathrm{T}(52)$
：rem 2
$4 \varnothing$ GOSUB920：REM－－DRAW BOXES－－
：rem $\emptyset$
$5 \emptyset$ PRINT＂$\{$ HOME \} \{BLU\}"; TAB (15) ; ＂SHUFFLING．．．＂：rem 224 $6 \emptyset$ GOSUB1Ø2Ø：REM－－SHUFFLE DECK ：rem 159 70 PRINT＂$\{$ HOME $\}$＂；TAB（15）；＂DEAL ING．．．$\{6$ SPACES\}" :rem 17 80 FORI＝1TO4：FORJ＝1TO13：GOSUB1 Ø8Ø：NEXTJ：NEXTI ：rem 197
90 GOSUB121Ø：REM－－FIND FIRST F OUR EMPTY BOXES ：rem 26 1øø PRINT＂\｛HOME\}";"\{BLU\}TYPE ' M＇TO MOVE TO THE NEXT EMP TY SLOT＂
：rem 94 $11 \varnothing$ PRINT＂OR＇ P ＇TO PLACE A CA RD AT THE CURSOR＂：rem 89 $12 \emptyset$ IFW＝5 THENW＝1：Fl＝Ø：GOSUB128

Ø：IFFl＝ØTHEN57 ：rem 250
$130 \mathrm{I}=\operatorname{INT}((\mathrm{E}(\mathrm{W})-1) / 13)+1: \mathrm{J}=\mathrm{E}(\mathrm{W}$ ）-13 ＊ $\operatorname{INT}((E(W)-1) / 13)$
：rem 181
140 IFJ＝1THEN17ø ：rem 163
$150 \mathrm{LL}=\mathrm{P}(\mathrm{I}, \mathrm{J}-1): I F L L / 13=I N T(\mathrm{LL}$ ／13）THENW＝W＋1：GOTO12ø
：rem 61
160 IFLL＝10RLL＝140RLL＝270RLL＝4 Ø＂HENW＝W＋1：GOTO12の ：rem 6Ø
$17 \emptyset \mathrm{~N} \$=" \mathrm{~W} ": S \$=" \quad$ ：PRINT＂\｛BLU\}" ；：GOSUB1160 ：rem 123
180 GETXS：IFXS＝＂＂THENPRINT＂
\｛YEL\}";:GOSUB1160 :rem 22
190 IFXS＜＞＂＂THEN21ø ：rem 37
$2 \emptyset \emptyset$ GETXS：IFX\＄＝＂＂THENPRINT＂
\｛BLU\}"; :GOSUB1160:GOTO18Ø
：rem 156
210 IFXS＝＂p＂THEN24Ø ：rem 52
220 IFXS＝＂M＂THEN：N\＄＝＂＂：GOSUB1 160：W＝W＋1：GOTO12ø ：rem $21 \varnothing$
$23 \varnothing$ GOTO18ø
：rem 103
240 IFJ＝1THEN37ø ：rem 166
$250 \mathrm{LL}=\mathrm{P}(\mathrm{I}, \mathrm{J}-1) \quad$ ：rem 42
260 IFLL／ 13 ＝INT（LL／ 13 ）THEN18 1
：rem 190
276 IFLL＝ 1 ORLL＝$=140$ RLL＝ 27 ORLL $=4$ ØTHEN18Ø ：rem 138
$28 \emptyset \mathrm{TE}=\mathrm{P}(\mathrm{I}, \mathrm{J}): \mathrm{TT}=\mathrm{T}(\mathrm{P}(\mathrm{I}, \mathrm{J})): \mathrm{L}=\mathrm{T}$ $(P(I, J-1)+1) \quad: r e m 118$
$29 \emptyset T(P(I, J))=T(P(I, J-1)+1)$
：rem 156
$3 \emptyset \emptyset \mathrm{~T}(\mathrm{P}(\mathrm{I}, \mathrm{J}-1)+1)=\mathrm{TT} \quad:$ rem 55
$310 \mathrm{P}(\mathrm{I}, \mathrm{J})=\mathrm{P}(\operatorname{INT}((\mathrm{L}-1) / 13+1), \mathrm{L}$ －13＊INT（（L－1）／13））：rem 245
$32 \emptyset \mathrm{P}(\operatorname{INT}((\mathrm{L}-1) / 13)+1, \mathrm{~L}-13$＊INT $((L-1) / 13))=T E$ ：rem 47
$33 \emptyset$ GOSUB1ø8ø
：rem 223
$34 \emptyset \mathrm{I}=\mathrm{INT}((\mathrm{L}-1) / 13)+1: \mathrm{J}=\mathrm{L}-13$＊ I NT（（L－1）／13）：GOSUB1ø8Ø
：rem 88
$35 \emptyset$ GOSUB121ø：W＝1：GOTO12ø
：rem 225
360 REM－－OFFER CHOICE OF＇TWOS ：rem 36
$37 \emptyset$ PRINT＂$\left\{\right.$ HOME ${ }^{\prime \prime}$＂PRINT＂ \｛19 DOWN\}"
：rem 204
380 PRINT＂\｛BLU\}"; :rem 198
390 PRINT＂NOW YOU HAVE A CHOIC
E OF＂：rem 3
$4 \emptyset \emptyset$ PRINT＂WHICH＇ 2 ＇YOU WANT T
O PLACE＂：rem 151
$41 \varnothing$ PRINT＂TWO OF＇S＇，＇H＇，＇D＇， 0 R＇C＇＂；：rem 175
$42 \varnothing$ GETT\＄：IFT $\$=$＂＂THEN4 $2 \varnothing$ ：rem 117
430 IFT\＄＝＂S＂THENN2＝2：GOTO49Ø ：rem 160
$44 \varnothing$ IFT\＄＝＂H＂THENN2＝15：GOTO49ø ：rem 2 ø2
45 IFT $=$＝＂D＂THENN2＝28：GOTO49ø ：rem 203
$46 \varnothing$ IFT $=$＂C＂THENN2＝41：GOTO49
：rem 198
470 GOTO420 ：rem 106
$48 \emptyset$ REM－－NOW EXCHANGE LOCATION S－－ ：rem 23
$49 \emptyset \mathrm{TE}=\mathrm{P}(\mathrm{I}, \mathrm{J}): \mathrm{TT}=\mathrm{T}(\mathrm{P}(\mathrm{I}, \mathrm{J})): \mathrm{L}=\mathrm{T}$ （N2）
：rem 223
5 Øø $T(P(I, J))=T(N 2) \quad$ rem 252
$510 \mathrm{~T}(\mathrm{~N} 2)=\mathrm{TT}$ ：rem $16 \emptyset$
52 Ø PRINT＂$\{$ HOME $\}$＂：PRINT＂
\｛19 DOWN \}"
：rem 201
530 PRINT＂$\{25$ SPACES $\}$＂：rem 105
$54 \emptyset$ PRINT＂$\{3 \emptyset$ SPACES $\}$＂：rem $1 \varnothing 6$
$55 \emptyset$ PRINT＂$\{3 \varnothing$ SPACES $\} " ;$
：rem 166
560 GOTO310
：rem 104
$57 \emptyset$ FORI＝1TO4
：rem 17
$58 \varnothing \mathrm{~N}(\mathrm{I})=\varnothing$
：rem 242
$59 \emptyset \operatorname{IFP}(I, 1)<>2 \operatorname{ANDP}(I, 1)<>15 \mathrm{AN}$ $\operatorname{DP}(I, 1)<>28 \operatorname{ANDP}(I, 1)<>41 \mathrm{TH}$

EN650
：rem 219
6 Øø $N(I)=1$
：rem 236
610 FORJ＝2TOl2 ：rem 61
$62 \sigma \operatorname{IFP}(I, J)-1<>P(I, J-1)$ THENJ $=$ 14：GOTO64の ：rem 69
$630 \mathrm{~N}(\mathrm{I})=\mathrm{N}(\mathrm{I})+1 \quad$ ：rem 2
640 NEXTJ ：rem 35
650 NEXTI ：rem 35
$66 \emptyset \operatorname{IFN}(1)=12 \operatorname{ANDN}(2)=12 \operatorname{ANDN}(3)$ $=12 \operatorname{ANDN}(4)=12$ THEN135ø
：rem 98
$670 \mathrm{~F} 5=\mathrm{F} 5+1$ ：rem 44
$68 \emptyset$ REM－－ERASE THE WRONG ENTRI ES
：rem 212
690 PRINT＂$\{$ HOME $\}\{39$ SPACES $\} "$
：rem 131
$7 \emptyset \emptyset$ PRINT＂\｛39 SPACES $\}$＂；
：rem 163
710 NS＝＂＂：SS＝＂＂：rem 189
726 PRINT＂$\{$ HOME \} \{BLU\}";TAB (15) ；＂RESHUFFLING．．．＂：rem 171
730 FORI $=1$ TO52：D（I）＝I：NEXT
：rem 89
740 FORI＝1TO4 ：rem 16
75 б FORJ $=N(I)+1$ TO13 ：rem 85
760 GOSUB1160
：rem 229
770 NEXT：NEXT ：rem 86
78 С $3=52$ ：rem 185
790 FORI＝1TO4 ：rem 21
$8 \emptyset \emptyset \operatorname{IFN}(I)=\varnothing$ THEN820 ：rem 69
$81 \varnothing \operatorname{FORJ}=1 \mathrm{TON}(I): D(P(I, J))=\varnothing: N$ EXTJ ：rem 34
820 NEXTI ：rem 34
830 FORI＝1TO4：FORJ＝1＋N（I）TO13
：rem 3
84 Ø Rl＝INT（RND（1）＊C3＋1）
：rem 250
$850 \operatorname{IFD}(\mathrm{R} 1)=\emptyset \operatorname{THEND}(\mathrm{R} 1)=\mathrm{D}(\mathrm{C} 3): \mathrm{C}$
3＝C3－1：GOTO84ø ：rem 16
$860 \mathrm{P}(\mathrm{I}, \mathrm{J})=\mathrm{D}(\mathrm{R} 1)$ ：rem 83
$87 \varnothing \mathrm{D}(\mathrm{Rl})=\mathrm{D}(\mathrm{C} 3): \mathrm{C} 3=\mathrm{C} 3-1:$ NEXTJ
：rem 131
88 NEXTI ：rem 40
89の FORI I＝1TO52：T（II）$=\varnothing$ ：NEXT
：rem 233
$9 \emptyset \emptyset$ GOSUB1ø6ø ：rem 224
910 GOTO7ø ：rem 58
920 REM－－SET UP BOXES ：rem 235
936 PRINT＂\｛WHT\}"; :rem 173
940 FORI＝1TO4 ：rem 18
950 PRINT：PRINT ：rem 242
960 FORJ＝1TO12：PRINT＂＊＊ERヨ＂；：N EXT：PRINT＂＊＊ESヨ＂تrem 110
970 FORJ＝1TO13：PRINT＂
\｛2 SPACES \} " ; :NEXT: PRINT
：rem 169
$98 \emptyset$ FORJ＝1TO12：PRINT＂＊＊EEZ＂；：N EXT：PRINT＂＊＊EXヨ＂Frem 126
990 NEXT ：rem 225
1øøø PRINT＂\｛HOME \}"; :rem 224
$101 \emptyset$ RETURN ：rem 162
1Ø2Ø REM－－SET UP DECK ：rem 169
103ø FORI＝1TO52：D（I）＝I：NEXT
：rem 131
1040 FORI $=1$ TO4：FORJ＝1TO13：R1＝I NT（ RND（1）＊C＋1）：$P(I, J)=D(R$ 1）：$D(R 1)=D(C): C=C-1$
：rem 48
1050 NEXT：NEXT ：rem 126
1ø6Ø FORII＝1TO4：FORJJ＝1TO13：T（ $P(I I, J J))=(I I-1) * 13+J J: N E$ XT：NEXT ：rem 62
1076 RETURN ：rem 168
1 1ø8Ø REM－－SHOW CARD P（I，J）
：rem 194
$1090 \mathrm{~S}=$＝＂ASZX＂：S\＄＝MID\＄（S\＄，INT（ $(P(I, J)-1) / 13)+1,1)$
：rem 127
$11 \varnothing \emptyset$ PRINT＂$\{$ BLK $\} " ;: I F S \$=" S " O R S$ $\$=" \underline{Z} "$ THENP RINT＂$\{$ RED $\}$＂；
：rem 188
$111 \varnothing \mathrm{~N}=\mathrm{P}(\mathrm{I}, \mathrm{J})-13^{*} \operatorname{INT}((\mathrm{P}(\mathrm{I}, \mathrm{J})-1$ ）／13）

## To keep yourself from being burned to a crisp by a fire-breathing dragon, juist cast a nitfol spell. Oops. Make that a gondor spell.

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## >CAST THE NITFOL SPELL ON THE DRAGON

And the story responds:
THE DRAGON PAUSES AND ROARS OUT A BENEVOLENT GREETING, WHICH, TO YOUR CHAGRIN, FRIES YOU TO A DELICATE CRISF. YOU HAVE DIED.

Suppose, on the other hand, you decide to invoke a spell that quenches open flames:

## >CAST THE GONDAR SPELL ON THE

 DRAGONIn that case the story responds:
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1120 IFN＝1THENS\＄＝＂＂：rem 54 113 の N1 $=$＝＂ $23456789 \emptyset \mathrm{JQK} ": N \$=\mathrm{MI}$ DS（N1S，N，1）：rem 93
1140 GOSUB116ø ：rem 14
1150 RETURN ：rem 167
1160 REM－－PRINT N\＄；SS AT POSIT ION I，J ：rem 128
1170 PRINT＂$\{$ HOME \}": PRINT: PRINT ：IFI＝1THEN119ø ：rem 181
118 Ø FORZ＝2TOI：PRINT：PRINT：PRI NT：PRINT：PRINT：NEXT
：rem 194
$1190 \operatorname{PRINTTAB}(3 *(J-1)) ; N \$ ; S$
$1210 \mathrm{Z}=1$
：rem 163
1220 FORI＝1TO52STEP13：E（Z）＝T（I ）： $\mathrm{Z}=\mathrm{Z}+1:$ NEXT ：rem 98
1230 FORJ＝1TO4
：rem 60
1240 FORI $=1 \mathrm{TO} 3: \mathrm{IFE}(\mathrm{I})>\mathrm{E}(\mathrm{I}+1) \mathrm{TH}$ ENAA $=E(I): E(I)=E(I+1): E(I$ $+1)=A A \quad:$ rem 238
1250 NEXT
：rem 7
1260 NEXT
：rem 8
127 RETURN ：rem $17 \emptyset$
1280 REM－－CHECK TO SEE IF ALL \｛SPACE\}FOUR SPACES FOLLOW S A KING OR BLANK：rem 227
1290 FORK＝1TO4
：rem 67
$1300 \mathrm{X}=\operatorname{INT}((\mathrm{E}(\mathrm{K})-1) / 13+1): Y=E($ K）-13 ＊ $\operatorname{INT}((E(K)-1) / 13)$
：rem 223
131 IFY＝1 THENFl＝1 ：rem 47
132 W2＝P（X，Y－1）：IFW2＜＞1ANDW2＜ ＞14ANDW2＜＞27ANDW2＜＞4 AANDW $2 / 13<>$ INT（W2／13）THENF $1=1$
：rem 238
1330 NEXT：RETURN
：rem 32
1340 REM－－ALL DONE．．．：rem 143
1350 PRINT＂\｛HOME \} \{ 2 D DOWN\}";"
\｛BLU\}CONGRATULATIONS!!";
：rem 153
1360 PRINT＂YOU WONII＂：PRINT＂I T TOOK YOU＂；F5＂TRIES＂
：rem 49
1370 PRINT＂TYPE＇Y＇TO PLAY AG AIN＂；：rem 249
1380 GETXS：IFX\＄＝＂＂THEN1380 ：rem 233
1390 IFXS＝＂N＂THENEND ：rem 173
1400 IFXS＝＂Y＂THEN1ø ：rem 58
1410 GOTO138Ø
：rem 203

## Program 2：Atari Solitaire

Version by Kevin Mykytyn，Editorial Programmer
For instructions on entering this listing，please refer to＂COMPUTE！＇s Guide to Typing In
Programs＂published bimonthly in COMPUTEI．

DH $1 \varnothing$ REM INITIALIZE
OH $2 \varnothing$ GRAPHICS Ø：OPEN \＃1，4，$\varnothing$ ，＂K：＂：POKE 82， $0:$ POKE 7 52，1
JF $3 \varnothing$ CLR $: D I M \quad X \$(1 \varnothing), N \$(15)$ ，N1\＄（15），A\＄（1の），S\＄（1ø） ， $\mathrm{E}(52), P(4,13), D(52), T$ （52），T\＄（1ø），N（1ø）
HD 4 ø PRINT＂\｛CLEAR\}": POSITI ON 15，9：PRINT＂SOLITAI RE＂：POSITION 1ø，11：PRI NT＂HIT ANY KEY TO STA RT＂
6P5の A＝RND（PEEK（5377ø））：GET \＃1，A
CA 6（ PRINT CHR\＄（125）：F5＝1：C $=52$ ：$W=1$
IB 70 GUSUB B1ø：POSITION 12， Ø：PRINT＂SHUFFLING．．．＂


Atari version of＂Solitaire．＂
：GOSUB 860
CF 8 Ø POSITIUN 12，$\varnothing$ ：PRINT＂ DEALING．．．\｛3 SPACES\}"
PC 9ø FOR I＝1 TO 4：FOR J＝1 T 0 13：GOSUB 91ø：NEXT J： NEXT I：GOSUB $98 \varnothing$
JK $1 \varnothing \varnothing$ POSITION $\varnothing, \varnothing:$ PRINT＂
TYPE M TO MOVE TO THE NEXT EMPTY SLOT＂
AL $11 \varnothing$ PRINT＂OR $P$ TO PLAC E A CARD AT THE CURSO $R^{\prime \prime}$
PA $12 \varnothing$ IF $W=5$ THEN $W=1: F 1=\varnothing$ ： GOSUB 1ø1ø：IF F1＝ø TH EN 56』
LF $130 \mathrm{I}=\mathrm{INT}((E(W)-1) / 13)+1:$ $\mathrm{J}=\mathrm{E}(\mathrm{W})-13$（INT（ E （W）－ 1 ）／13）
KD $14 \varnothing$ IF $J=1$ THEN $17 \varnothing$
DN $150 \mathrm{LL}=\mathrm{P}(\mathrm{I}, \mathrm{J}-1): \mathrm{IF} \mathrm{LL} / 13=$ INT（LL／13）THEN $W=W+1$ ：GOTO 120
OH 16 IF LL＝1 OR LL＝14 OR L $L=27$ QR LL＝4ø THEN $W=$ W＋1：GOTO 12ø
 ＂：GOSUB $97 \boldsymbol{1}$
DB 18ø POKE 764，255
CP $19 \varnothing A=\operatorname{PEEK}(764): Q=((Q=\varnothing) *$ 12）： $\mathrm{N} \$=$ CHR $\$(Q+2 \boldsymbol{\theta}):$ IF $A=255$ THEN GOSUB $97 \emptyset$
DL 2 Øø IF $A<>255$ THEN $22 \varnothing$
IA 21 1 $A=P E E K(764): N \$=$ CHR $\$(Q$ ＋2の）：IF $A=255$ THEN GO SUB 97』：GOTO 19ø
MF 22 GET $1, X: X \$=\operatorname{CHR} \$(X): I$ $F X \$=" P "$ THEN 25ø
HB 230 IF $X \$=" M "$ THEN N $\$=" \quad "$ ：GOSUB 970：W＝W＋1：GOTO $12 \emptyset$
6J 240 GOTO $19 \varnothing$
Kl 259 IF $J=1$ THEN 3日の
CL 26 L L $=P(I, J-1)$
MA 27 IF LL／13＝INT（LL／13）T HEN $19 \varnothing$
If 280 IF $L L \equiv 1$ OR $L L=14$ OR $L$ $L=27$ OR LL＝4の THEN 19 ■
HH $290 \quad T E=P(I, J): T T=T(P(I, J)$ ）：$L=T(P(I, J-1)+1)$
JE $3 \varnothing \varnothing T(P(I, J))=T(P(I, J-1)+$ 1）
DI $310 \mathrm{~T}(\mathrm{P}(\mathrm{I}, \mathrm{J}-1)+1)=T \mathrm{~T}$
P6 $320 \mathrm{P}(\mathrm{I}, \mathrm{J})=P(\operatorname{INT}((L-1) / 13$ ＋1），L－13＊INT（（L－1）／13 ））
DA $330 \mathrm{P}(\operatorname{INT}((L-1) / 13)+1, L-1$ 3＊INT（（L－1）／13））＝TE
LB $34 \varnothing$ GOSUB $91 \varnothing$
CK $350 \quad \mathrm{I}=\mathrm{INT}((\mathrm{L}-1) / 13)+1: \mathrm{J}=\mathrm{L}$ －13＊INT（（L－1）／13）：GOS UB 910
LP 36ø GOSUB 9Bø：W＝1：GOTD 12 D

HM 376 REM OFFER CHOICE OF T

M6 $38 \varnothing$ N $=$＝CHR $\$(2 \emptyset):$ GOSUB $97 \emptyset$ ：POSITIDN ø， 21
AD $39 \varnothing$ PRINT＂NOW YOU HAVE $A$ CHOICE OF＂
JH 4 øø PRINT＂WHICH＇ 2 ，YOU WANT TO PLACE＂
KP 41 1 PRINT＂TWO OF＇$S^{\prime}$ ，＇H＇ ，＇D＇，QR＇C＇＂；
NP $42 \emptyset$ GET $1, T: T \$=C H R \$(T)$
KA 430 IF T $\$=$＂S＂THEN N2＝2：G DTO 49ø
MK 440 IF T\＄＝＂H＂THEN N2＝15： GOTO 49
ML 45 IF T\＄m＂D＂THEN N2＝2日： GOTO $49 \varnothing$
M6 460 IF T\＆＝＂C＂THEN N2＝41： GOTO 49の
6K 470 GOTO $42 \theta$
$6048 \emptyset$ REM NOW EXCHANGE LOCA TIONS
NP $496 \mathrm{TE}=P(I, J): T T=T(P(I, J)$ ）：$L=T(N 2)$
$P M 5 \emptyset \varnothing \quad T(P(I, J))=T(N 2)$
$K A 51 \varnothing \quad T(N 2)=T T$
ML 520 POSITION 0,21
AE 530 FOR $A=1$ TO 3：PRINT＂ \｛37 SPACES\}"; : NEXT A
6H 540 GOTO 32ø
IL 550 REM PLAYER CANNOT MOV E SO RESHUFFLE
JP 56ø FOR $I=1$ TD 4：N（I）$=\varnothing$
NG 57 © IF $P(I, 1)<>2$ AND $P(I$, 1）$<>15$ AND $P(I, 1)<>28$ AND $P(I, 1)<>41$ THEN 620
PD 580 $N(I)=1$
CI 59 （ FQR $J=2$ TO 12：IF P（I， J）$-1<>P(I, J-1)$ THEN $J$ ＝14：GOTD $61 \emptyset$
PP $6 \emptyset \emptyset N(I)=N(I)+1$
CA 610 NEXT J
CA 620 NEXT I
FO 630 IF $N(1)=12$ AND $N(2)=1$ 2 AND $N(3)=12$ AND $N(4$ ）$=12$ THEN $1 \varnothing 7 \varnothing$
CJ 64 F $5=F 5+1$
HH 650 REM ERASE THE WRONG E NTRIES
FB 660 FOR $A=\varnothing$ TO 1：PDSITION ø，A：PRINT＂
\｛3B SPACES\}"; : NEXT A
NF $67 \emptyset \mathrm{~N} \$="$＂：S\＄＝＂＂：POSITIO N 13， $9:$ PRINT＂RESHUFF LING．．
K6 680 FOR $I=1$ T0 52：D（I）$=1$ ： NEXT I
0669 FOR $I=1$ TO 4：FOR $J=N($ I）+1 TO 13：GOSUB 970： NEXT J：NEXT I
6A 7øの C3＝52：FOR I＝1 TO 4
EF71ø IF $N(I)=\varnothing$ THEN $73 \emptyset$
CC 72 FOR $J=1$ TO N（I）：$D(P$（I ，J））＝ø：NEXT J
CC 730 NEXT I
AD 74 Ø FOR $I=1$ TO 4：FOR $J=1+$ N（I）TO 13
PK 750 R $1=\mathrm{INT}$（RND（1） $\mathrm{ZC} 3+1$ ）
BA 76 IF D（R1）$=\varnothing$ THEN D（R1） ＝D（C3）：C3＝C3－1：GOTO 7 50
$D D 77 \emptyset P(I, J)=D(R 1): D(R 1)=D($ C3）：C3＝C3－1：NEXT J：NE XT I
HJ 78ø FOR II＝1 TO 52：T（II）＝ Ø：NEXT II
JK 790 GOSUB 89ø：GOTO 80
10 日øø REM SET UP BOXES
JHB1ø FOR I＝1 TO 4：PRINT：P RINT
CAB2ø A $\$=$ CHR $\$$（18）：FOR $J=1 \quad T$ －12：PRINT A\＄；A\＄；CHR\＄ （23）；：NEXT J：PRINT A\＄ ；A $\$$ ；CHR $\$$（5）
DF 日3 FOR J＝1 TO 13：PRINT＂



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＂；CHR\＄（124）；：NEXT J ：PRINT
KB B4ø FOR $J=1$ TO 12：PRINT $A$ \＄；A\＄；CHR\＄（24）；：NEXT J ：PRINT A\＄；A\＄；CHR\＄（3）： NEXT I：POSITION $\varnothing, \emptyset: R$ ETURN
CJ 85ø REM SET UP DECK
KG B6 FOR I＝1 TO 52：D（I）＝I ： NEXT I
AK $87 \emptyset$ FOR $I=1$ TO 4：FQR $J=1$ T0 13：R1＝INT（RND（1）\＆C ＋1）：$P(I, J)=D(R 1): D(R 1$ ）$=D(C): C=C-1$
0 88の NEXT J：NEXT I
FI 89の FOR II＝1 TO 4：FOR JJ＝ 1 T0 13：T（P（II，JJ））$=($ II－1）$\ddagger 13+J J: N E X T$ JJ：N EXT II：RETURN
NI 9 Øø REM SHOW CARD
 $((P(I, J)-1) / 13)+1: S \$=$ S\＄（Q，Q）
BP920 $N=P(I, J)-13$ \＃ INT （（ P （I） J）-1 ）（13）
AO 930 IF $N=1$ THEN 5 \＄$="$＂
CI 94の N1\＄＝＂ 23456789 のJQK＂：N \＄＝N1\＄（N，N）
NI 950 GOSUB $97 \varnothing$ ：RETURN
HK 96ø REM LOCATE CARD POSIT ION
FD 97 Ø POSITION J＊3－3，I＊5－1： PRINT N\＄；S\＄：RETURN
IJ $989 \quad Z=1: F Q R \quad I=1$ TO 52 STE P 13：E（Z）＝T（I）：Z＝Z＋1： NEXT I
HJ 99ø FOR $J=1$ TO 4：FOR $I=1$ TO 3：IF E（I）$>E(I+1) \quad T$ HEN $A A=E(I): E(I)=E(I+$ 1）：$E(I+1)=A A$
C6 1 Øøg NEXT I：NEXT J：RETURN
DJ $1 \emptyset 1 \emptyset$ FOR $K=1$ TO 4
NO 1 ø2 $2 \mathrm{X}=\mathrm{INT}((\mathrm{E}(\mathrm{K})-1) / 13+1)$ $: Y=E(K)-13$ \＆INT（ $(E(K)$ －1）／13）
CO $1.93 \emptyset$ IF $Y=1$ THEN $F 1=1$
ON $1 \varnothing 4$ Ø $\mathrm{W} 2=\mathrm{P}(X, Y-1)$ ：IF $\mathrm{W} 2<>1$ AND W $2\langle>14$ AND W $2 \ll$ 27 AND W2く＞4の AND W2 ／13＜＞INT（W2／13）THEN F1＝1
6K 1 Ø5 5 NEXT K：RETURN
JH 196 R REM YOU WON
HI $197 \emptyset$ POSITION 12，2ø：PRINT

LB 1 ø日ø POSITION 16， $21:$ PRINT ＂YOU WON！！＂：POSITIO N 11，22：PRINT＂IT TO OK YOU＂；F5；＂TRIES＂
JJ 1 פ9ø POSITION $1 \varnothing, 23:$ PRINT ＂TYPE，Y，TO PLAY A GAIN＂；
AB 11 Øø GET \＃ $1, X: X \$=\operatorname{CHR} \$(X):$ IF $X \$ \equiv " Y$＂THEN GOTO 3ø
KD $111 \varnothing$ IF $X \$=" N "$ THEN END LP $112 \emptyset$ GOTO $11 \varnothing \varnothing$

## Program 3：IBM PC／PCjr Solitaire

Version by Kevin Mykytyn，Editorial Programmer
For instructions on entering this listing，please refer to＂COMPUTE！＇s Guide to Typing In Programs＂published bimonthly in COMPUTEI．

CJ 19 REM INITIALIZE
KA $2 \emptyset$ KEY OFF：DEF SEG＝ø：POKE $1 \emptyset 4$ 7，PEEK（1947）OR 64：WIDTH 4ø
PJ $3 \emptyset$ CLEAR：COLOR 1，3，12：CLS：LOC

ATE 1 $\varnothing, 16, \varnothing:$ PRINT＂SOLITAI RE＂：PRINT：PRINT SPC（1ø）＂H IT ANY KEY TO START＂
ON 4 Ø $A=R N D(1): A \$=I N K E Y \$: I F \quad A \$="$ ＂THEN 4』 ELSE CLS：F5＝1：C＝ 52：$W=1$
HN $5 \emptyset$ DIM $P(4,13), D(52), T(52): G O$ SUB 77ø：LOCATE 1，13：PRINT ＂SHUFFLING．．．＂：GUSUB B2ø
LC 6ø LOCATE 1，13：PRINT＂DEALIN G．．
JP 70 FOR $I=1$ TO 4：FOR $J=1$ TQ 13 ：GOSUB 87ø：NEXT J：NEXT I：G OSUB $95 \emptyset$
ML $8 \emptyset$ COLOR $\emptyset, 3,12$ ：LOCATE 1，1：PR INT＂TYPE M TO MOVE TO TH E NEXT EMPTY SLOT＂


IBM PC／PCjr＂Solitaire．＂

EO $9 \emptyset$ PRINT＂OR P TO PLACE A C ARD AT THE CURSOR＂
PK 1 I $\emptyset$ IF $W=5$ THEN $W=1: F 1=\emptyset:$ GOSU B 98ø：IF F $1=\varnothing$ THEN 520
10 $110 \mathrm{I}=\mathrm{INT}((\mathrm{E}(\mathrm{W})-1) / 13)+1: \mathrm{J}=\mathrm{E}($ W）-13 ＊INT（ $(E(W)-1) / 13)$
NA $12 \emptyset$ IF $J=1$ THEN $15 \emptyset$
IH $130 \mathrm{LL}=\mathrm{P}(\mathrm{I}, \mathrm{J}-1): \mathrm{IF} \mathrm{LL} / 13=\mathrm{INT}($ LL／13）THEN $W=W+1$ ：GOTO $1 \varnothing$ Ø

CI 14ø IF LL＝1 OR LL＝14 OR LL＝27 OR LL＝4Ø THEN $W=W+1$ ：GOTO 1のロ
$\mathrm{KI} 15 \emptyset \mathrm{~N} \$=\operatorname{CHR} \$(8): S \$=" \quad$ ：COLOR 1 ，3，12：GOSUB 94Ø：DEF SEG $=\varnothing$ ：POKE 1ø5ø，PEEK（1ø52）
FP $16 \emptyset X \$=I N K E Y \$$ ：IF $X \$=" n$ THEN C OLOR 14，3，12：GOSUB 94ø
D6 $17 \emptyset$ IF $X \$<>" n$ THEN $19 \emptyset$
of $189 \times \$=I N K E Y \$$ ：IF $X \$=" n$ THEN C OLOR 1，3，12：GOSUB 94ø：GOT $016 \emptyset$
KE 190 IF $X \$=" P$ THEN $21 \varnothing$
FL $20 \emptyset$ IF $X \$=" M "$ THEN N $\$="$＂：GOS UB 94ø：$W=W+1$ ：GOTO 1 øø：ELS E 169
OP 21ø IF $J=1$ THEN $34 \emptyset$
BB 220 LL＝P（I，J－1）
IE 236 IF LL／13＝INT（LL／13）THEN $16 \square$
NE 249 IF LL＝1 OR LL＝ 14 OR LL＝ 27 OR LL $=4 \varnothing$ THEN $16 \emptyset$
JH $250 \mathrm{TE}=\mathrm{P}(\mathrm{I}, \mathrm{J}): \mathrm{TT}=\mathrm{T}(\mathrm{P}(\mathrm{I}, \mathrm{J})): \mathrm{L}=$ $T(P(I, J-1)+1)$
J6 $26 \emptyset T(P(I, J))=T(P(I, J-1)+1)$
$6627 \emptyset T(P(I, J-1)+1)=T \mathrm{~T}$
NJ $28 \emptyset \mathrm{P}(\mathrm{I}, \mathrm{J})=\mathrm{P}(\mathrm{INT}((\mathrm{L}-1) / 13+1)$ ， L－13＊INT（ $(L-1) / 13)$ ）
HB 290 P （INT $((L-1) / 13)+1$ ，L－13＊IN $T((L-1) / 13))=T E$
ML 3øø GOSUB 879
DF $319 \mathrm{I}=\mathrm{INT}((\mathrm{L}-1) / 13)+1: \mathrm{J}=\mathrm{L}-13$＊ INT（（L－1）／13）：GOSUB 87ø
FD 329 GOSUB 95ø：W＝1：GOTO 1øø
Qs 330 REM OFFER CHOICE OF TWOS
JI 34ø LOCATE 21，1：COLOR 1，3， 12
AE 350 PRINT＂NOW YOU HAVE A CHO

HO $36 \emptyset$ PRINT＂WHICH＇2＂YOU WANT TO PLACE＂
CM $37 \varnothing$ PRINT＂TWO OF＇S＇，＇H＇，＇D＇ ，OR＇C＇＂
HB 380 T\＄＝INKEY\＄：IF T\＄＝＂＂THEN 3 8ø
JD 39ø IF T\＄＝＂S＂THEN N2＝2：GOTO 45D
BL 4øø IF T $\$=$＂H＂THEN N2＝15：GOTO 45ø
EM 410 IF $T \$=$＂D＂THEN N2＝28：GOTO $45 \varnothing$
H1 420 IF T $\$=$＂C＂THEN N2＝41：GOTO $45 \emptyset$
HB $43 \varnothing$ GOTO $38 \varnothing$
JF 449 REM NOW EXCHANGE LOCATION S
KL $45 \emptyset T E=P(I, J): T T=T(P(I, J)): L=$ T（N2）
LL 46ø $T(P(I, J))=T(N 2)$
FH $470 \mathrm{~T}(\mathrm{~N} 2)=\mathrm{T} T$
BJ 48ø LOCATE 21， 1
CA 496 FOR $A=1$ TO 3：PRINT ．
＂：NEXT
6C 5øø GOTO 28ø
EA $51 \emptyset$ REM PLAYER CANNOT MOVE SO RESHUFFLE
FA 52ø FOR $I=1$ TO 4：N（I）$=\varnothing$
FL 530 IF $P(I, 1)<>2$ AND $P(I, 1)\rangle$ 15 AND $P(I, 1)<>28$ AND $P(I$ ，1）$<>41$ THEN 58ø
is $54 \emptyset N(I)=1$
LI 550 FOR J＝2 TO 12：IF P（I，J）－1 ＜$>P(I, J-1)$ THEN $J=14: G O T O$ 57』
BB $56 \emptyset N(I)=N(I)+1$
OD 570 NEXT J
OL 580 NEXT I
KP 590 IF $N(1)=12$ AND $N(2)=12$ AN D $N(3)=12$ AND $N(4)=12$ THE N 1040
MD 6 Gø F5＝F5 +1
CP 610 REM ERASE THE WRONG ENTRI ES
BO 62ø LOCATE 1，1：FOR $A=1$ TO 2：$P$ RINT＂
＂；：NE
XT
OA $630 \mathrm{~N} \$=" \mathrm{n}: \mathrm{S} \$="$＂：LOCATE 1， $1:$ COLOR 1，3，12：PRINT TAB（13 ）；＂RESHUFFLING．．．．＂
OB 640 FOR $\mathrm{I}=1$ TO 52： $\mathrm{D}(\mathrm{I})=\mathrm{I}:$ NEXT
EI 650 FOR $I=1$ TO 4：FOR $J=N(I)+1$ TO 13：GOSUB 94ø：NEXT J，I
EE 66ஏ C3＝52：FOR I＝1 TO 4
BI $67 \emptyset$ IF $N(I)=\emptyset$ THEN $69 \varnothing$
NE $68 \emptyset$ FOR $J=1$ TO $N(I): D(P(I, J))$ ＝ø：NEXT J
00690 NEXT I
OK $7 \emptyset \emptyset$ FOR $I=1$ TO 4：FOR $J=1+N(I)$ TO 13
B6 $71 \emptyset$ R1＝INT（RND（1）＊C3 +1 ）
PL $72 \emptyset$ IF $D(R 1)=\emptyset$ THEN $D(R 1)=D(C$ 3）：$C 3=C 3-1: G O T O$ 71ø
PK $73 \emptyset \mathrm{P}(\mathrm{I}, \mathrm{J})=\mathrm{D}(\mathrm{R} 1): \mathrm{D}(\mathrm{R} 1)=\mathrm{D}(\mathrm{C} 3):$ CJ＝C3－1：NEXT J，I
Q1 740 FOR II＝1 TO 52：T（II）＝ø：NE XT
LA $75 \emptyset$ GOSUB 850：GOTO 6ø
IK $76 \emptyset$ REM SET UP BOXES
HO 770 COLOR 1，3，12：FOR $\mathrm{I}=1$ TO 4 ：PRINT：PRINT
PG 78ø A $\$=\operatorname{CHR} \$(196): F O R \quad J=1$ TO 1 2：PRINT A\＄；A\＄；CHR（ 194 ）； NEXT：PRINT A\＄；A事；CHR ${ }^{(191}$ ，
PE 79 FOR $\mathrm{J}=1$ TQ 13：PRINT＂＂； CHR $\$(179)$ ；$:$ NEXT：PRINT
KH 8øø FOR $J=1$ TO 12：PRINT A $\$$ ；$A$ ；CHR\＄（193）；：NEXT：PRINT A\＄ ；A\＄；CHR\＄（217）：NEXT：LOCATE 1，1：RETURN
6D $81 \emptyset$ REM SET UP DECK
OP $82 \emptyset$ FOR $I=1$ TO 52：D $(I)=I:$ NEXT

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CA B3Ø FOR I＝1 TO 4：FOR J＝1 TO 1 3：R1＝INT（RND（1）\＆$C+1): P(I$ ， $\mathrm{J})=D(R 1): D(R 1)=D(C): C=C-1$
FN 840 NEXT：NEXT
HF 850 FOR II＝1 TO 4：FOR $J J=1$ TO 13：$T(P(I I, J J))=(I I-1) \& 13$ ＋JJ：NEXT：NEXT：RETURN
Q1 BGØ REM SHOW CARD
NP 87の S\＄＝CHR\＄（6）＋CHR\＄（3）＋CHR\＄（4 ）＋CHR\＄（5）：S\＄＝MID\＄（S\＄，INT（ $(P(I, J)-1) / 13)+1,1)$
$\mathrm{KB} 88 \emptyset \operatorname{COLOR} \emptyset, 3,12:$ IF $5 \$=\mathrm{CHR} \$(3$ ）OR $5 \$=$ CHR $\$(4)$ THEN COLD R $4,3,12$
K0 $890 \mathrm{~N}=\mathrm{P}(\mathrm{I}, \mathrm{J})-13$（INT（ $(\mathrm{P}(\mathrm{I}, \mathrm{J})-1$ ）／13）
DP 9øØ IF $N=1$ THEN $S \$="$＂
BF $910 \mathrm{~N} 1 \$={ }^{\text {＂}}$ 23456789øJQK＂：N\＄＝MI D $\$(N 1 \$, N, 1)$
MC 920 GOSUB 94ø：RETURN
JO 930 REM LOCATE CARD POSITION
PH 940 LOCATE I＊5－1，J＊3－2：PRINT N\＄；S\＄：RETURN
IL $950 \mathrm{Z}=1:$ FOR $\mathrm{I}=1$ TO 52 STEP 13 $: E(Z)=T(I): Z=Z+1: N E X T$
LA 96Ø FOR $J=1$ TO 4：FOR $I=1$ TO 3 ：IF $E(I)>E(I+1)$ THEN $A A=E$ （I）：$E(I)=E(I+1): E(I+1)=A A$
CF 970 NEXT I，J：RETURN
If $98 \emptyset$ FOR $K=1$ TO 4
F0 990 $X=I N T((E(K)-1) / 13+1): Y=E($ K）-13 （ INT $((E(K)-1) / 13)$
NG 1 1øø IF $Y=1$ THEN $F 1=1$
HE 1010 W $2=P(X, Y-1)$ ：IF $W 2<>1$ AND W2 $\langle>14$ AND $W 2<>27$ AND $W$ 2＜＞4ø AND W2／13＜＞INT（W2） 13）THEN F1＝1
JA $162 \emptyset$ NEXT：RETURN
KP $1 ø 3 \emptyset$ REM YOU WON
FN $1 ø 4 \emptyset$ LOCATE 21， $13:$ COLOR 14，3， 12：PRINT＂CONGRATULATION S！！＂
EI 1 ø5ø PRINT SPC（16）＂YOU WON！！＂ ：PRINT SPC（11）＂IT TOOK Y OU＂；F5；＂TRIES＂
6L 1 1ø6 PRINT SPC（1ø）＂TYPE $Y$＇T O PLAY AGAIN＂；
IN 1 1ø7 $X \$=I N K E Y \$:$ IF $X \$=" Y$＂THEN 3ø ELSE IF $X \$=" N$＂THEN END ELSE GOTO $1 ø 7 \varnothing$


Apple＂Solitaire．＂

## Program 4：Apple Solitaire

Version by Tim Victor，Editorial Programmer
For instructions on entering this listing，please refer to＂COMPUTE！＇s Guide to Typing In Programs＂published bimonthly in COMPUTEI．

Ef 10 HOME ：POKE 23ø，32：POKE 2 8，42：CALL 62454
8712 PRINT CHR\＄（4）；＂BLOAD CARD PLOT＂
2215 POKE 49239，Ø：POKE 49235，$็$
： POKE 49232， $0: F 5=1: C=$ 52：W＝ 1
A7 $2 \emptyset$ DIM $P(4,13), D(52), T(52)$
99 GOSUB 1 Gøø
3949 GOSUB 16פø：HTAB 15：PRINT ＂SHUFFLING．．．＂
6C $5 \emptyset$ GOSUB 11 Øø
BE 65 GOSUB 16øø：HTAB 15：PRINT ＂DEALING．．．＂
FC 7 FOR $I=1$ TO 4：FOR $J=1$ TO 13：GOSUB 12øø：NEXT J： NEXT I
12 8ஏ GOSUB 14øø
5B $9 \varnothing$ GOSUB 16øの：PRINT＂TYPE＇M ，TO MOVE TO THE NEXT EMPT Y SLOT＂
4F 1 Øø PRINT＂OR＇$P$＇TO PLACE $A$ CARD AT THE CURSOR＂
C） 110 IF $W=5$ THEN $W=1: F 1=$ Ø：GOSUB 15øø：IF F1 $=\varnothing$ THEN 6øØ
FE $12 \varnothing \mathrm{I}=\mathrm{INT}((E(W)-1) / 13)$ $+1: J=E(W)-13 *(I-$ 1）
4A 130 IF $J=1$ THEN $16 \emptyset$
6 A 140 LL $=P(I, J-1): I F L L /$ $13=$ INT（LL／13）THEN W $=W+1$ ：GOTO 11ø
F8 150 IF LL $=13$＊INT（LL／ 13 ）+1 THEN $W=W+1:$ GOT $011 \emptyset$
58160 HCOLOR＝3：GOSUB 17øø
$2417 \varnothing$ GET $X \$$ ：IF $X \$>$＂$Z$＂THEN $\mathrm{X} \$=$ CHR\＄（ASC $(\mathrm{X} \$)-32$

66175 HCOLOR＝1：GOSUB 17øø
$9 E 18 \emptyset$ IF $X \$=" P$＂THEN $21 \varnothing$
$4619 \varnothing$ IF $X \$=" M$＂THEN $W=W+$ 1：GOTO 11ø
$2 C 195$ IF $X \$=$ CHR $\$$（3）THEN TEX T ：END
912 Gø GOTO 160
B6 210 IF $\mathrm{J}=1$ THEN 4øø
$2122 \emptyset \mathrm{TE}=P(\mathrm{I}, \mathrm{J}): T \mathrm{~T}=\mathrm{T}(\mathrm{P}(\mathrm{I}, \mathrm{J})$ $): L=T(P(I, J-1)+1)$
$12236 T(P(I, J))=T(P(I, J-1)$ $+1)$
CB $24 \emptyset \mathrm{~T}(\mathrm{P}(\mathrm{I}, \mathrm{J}-1)+1)=\mathrm{TT}$
A！ 25 Ø $P(I, J)=P($ INT $(C L-1)$ （ $13+1), \mathrm{L}-13$＊INT（ $($ L－1）／13））
65260 P （ INT $((L-1) / 13)+1$ ，L－ 13 ＊INT（（L－1）／ 13）$)=T E$
Df 279 GOSUB $12 \emptyset \emptyset$
B9 $28 \emptyset \mathrm{I}=\mathrm{INT}((\mathrm{L}-1) / 13+1$ ）$: \mathrm{J}=\mathrm{L}-13$ \＆INT（（L－ 1）／13）：GOSUB 12øø
58290 GOSUB 14øø：$W=1$ ：GOTO 9ø
2A 4øø GOSUB 16øø：PRINT＂NOW YO U HAVE A CHOICE OF＂
D4 $41 \sigma$ PRINT＂WHICH＇ 2 ＇YOU WANT TO PLACE＂
$7642 \emptyset$ GET T\＄：IF ASC（T\＄）＞ 96 THEN T\＄$=$ CHR\＄（ ASC（T\＄） －32）
A6 $430 \mathrm{C}=$ の：FOR $K=1$ TO 4：IF $T \$=$ MID $\$(" S H D C ", K, 1) \quad T$ HEN C $=K: K=4$
OB 435 NEXT ：IF $C=\varnothing$ THEN $42 \varnothing$
$28440 \mathrm{~N} 2=C * 13-11: T E=P(I$ $, \mathrm{J}): \mathrm{TT}=\mathrm{T}(\mathrm{P}(\mathrm{I}, \mathrm{J})): \mathrm{L}=\mathrm{T}($ N2）
$81450 T(P(I, J))=T(N 2)$
2C $460 \mathrm{~T}(\mathrm{~N} 2)=\mathrm{TT}$
$2147 \emptyset$ GOTO 25ø
F9 6øØ FOR I＝ 1 TO 4
$11616 \mathrm{~N}(\mathrm{I})=\varnothing$
58620 IF $P(I, 1)<>13$＊INT（P $(I, 1) / 13)+2$ THEN 665
$1663 \emptyset N(I)=1$
88640 FOR $J=2$ TO 12：IF P（I，J ）$-1\langle \rangle P(I, J-1)$ THEN $J=14:$ GOTO $66 \emptyset$
ED $65 \emptyset N(I)=N(I)+1$

A $66 \emptyset$ NEXT
1E 665 NEXT
$8867 \emptyset$ IF $N(1)=12$ AND $N(2)=1$ 2 AND $N(3)=12$ AND $N(4)$ ＝ 12 THEN 2øøø
CF 68 F F5 $=$ F5 +1
B6 $685 \mathrm{PP}=1$
81690 GOSUB 16ø0：HTAB（15）：PR INT＂RESHUFFLING＂
A5 7øØ FOR I＝ 1 TO 52：D（I）＝I： NEXT
FC 719 FOR I $=1$ TO 4
BA $72 \emptyset$ FOR $J=N(I)+1$ TO 13
D1 730 GOSUB 1219
C8 740 NEXT ：NEXT
BD $750 \mathrm{C3}=52$
$0776 \emptyset$ FOR I $=1$ TO 4
10765 IF $N(I)=\emptyset$ THEN $78 \emptyset$
02770 FOR $\mathrm{J}=1 \mathrm{TO} \mathrm{N}(\mathrm{I}): \mathrm{D}(\mathrm{P}(\mathrm{I}, \mathrm{J}$ ））＝Б：NEXT
of 789 NEXT
24790 FOR I $=1$ TO 4：FOR $J=N$ （I）＋ 1 TO 13
59 8øø R1＝INT（ RND（1）$+\mathrm{C3}+$ 1）
15 81ø IF $D(R 1)=\varnothing$ THEN $D(R 1)=$ $D(C 3): C 3=C 3-1:$ GOTO 8øø
$87826 P(I, J)=D(R 1)$
$22830 D(R 1)=D(C 3): C 3=C 3-1$ ：NEXT ：NEXT
68 84の FOR II＝ 1 TO 52：T（II）＝ Ø：NEXT
DC $85 \emptyset$ GOSUB $113 \emptyset$
BE $86 \emptyset$ GOTO $6 \emptyset$
D1 1 Øøø RETURN
FO 11øø FOR I＝ 1 TO 52：D（I）＝I ：NEXT
57 111ø FOR I＝ 1 TO 4：FOR $\mathrm{J}=$ 1 TO 13：R1＝INT（ RND（ 1）$(C+1): P(I, J)=D(R$ 1）：$D(R 1)=D(C): C=C-$ 1
$2 \mathrm{~F} 112 \emptyset$ NEXT ：NEXT
$62113 \emptyset$ FOR II $=1$ TO 4：FOR JJ $=1$ TO 13：T（P（II，JJ））＝ （II－1） 13 ＋JJ：NEXT ：NEXT
E3 1140 RETURN
उE $12 \emptyset \emptyset P P=P(I, J)$
2B $121 \emptyset$ CALL $32768, P P, J * 2 \emptyset-9$ ，I＊36－22：RETURN
$3514 \emptyset \emptyset Z=1$
C6 141の FOR I $=1$ TO 52 STEP 13： $E(Z)=T(I): Z=Z+1: N$ EXT
© 1420 FOR $J=1$ TO $3:$ FOR $I=$ 1 TO 4－J
IC $143 \emptyset$ IF $E(I)>E(I+1)$ THEN $A A=E(I): E(I)=E(I+1$ ）：$E(I+1)=A A$
$6 E 144 \varnothing$ NEXT ：NEXT ：RETURN
A4 $15 \emptyset$ FOR K $=1$ TO 4
IF $1510 \mathrm{X}=\mathrm{INT}((E(K)-1) / 13$ $+1): Y=E(K)-13$ IN T（ $(E(K)-1) / 13)$
A7 1520 IF $Y=1$ THEN $F 1=1$
$521530 \mathrm{~W} 2=P(X, Y-1): I F W 2<$ $>13$ INT（W2／13）＋ 1 AND W2／ $13<>$ INT（W $2 / 13)$ THEN F1 $=1$
45 154ø NEXT ：RETURN
C4 16øØ VTAB 21：HTAB 1：POKE 35 ，25：FOR QQ $=1$ TO 4：PR INT SPC（ 4ø）：NEXT
39 161ø POKE 35，24：VTAB 21：HTA B 1：RETURN
E6 17øø $X=J * 2 \emptyset-8: Y=I * 3$ 6 －20：HPLOT $X, Y$ TO $X+$ $14, Y$ TO $X+14, Y+19 T$ $0 X, Y+19$ TO $X, Y$
EJ $171 \emptyset$ RETURN
86 2øøø GOSUB 16øø：PRINT＂CONGR ATULATIONS！！＂

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Butler-In-A-Box has a unique, built-in infraredsensorand intrusion detection system that guardsyourhome andalerts you to uninvited guests. When he detects intruders, he will speak, and ask them to identify themselves. Only you can verbally command him to turn off hisintrusion detection system, because he is trained to recognize only your voice. He is also capable of interfacing with your existing home security system,soit canbe activated by your voice.

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$11201 \varnothing$ PRINT＂YOU WON！！＂：PRINT ＂IT TOOK YOU＂；F5；＂TRI ES＂
7C 2ø2ø PRINT＂TYPE＇$Y$＇TO PLAY AGAIN＂；
B2 2030 GET $\mathrm{X} \$$ ：IF ASC $(\mathrm{x} \$)>96$ THEN $\mathrm{X} \$=$ CHR $\$$（ ASC $(\mathrm{X}$ \＄）－ 32 ）
$73204 \varnothing$ IF $X \$=" N "$ THEN END E6 $205 \varnothing$ IF $X \$=$＂$Y$＂THEN RUN
$76266 \emptyset$ GOTO $263 \varnothing$

## Program 5：Apple Graphics <br> File

For instructions on entering this listing，please refer to the＂Apple MLX＂article published elsewhere in this issue．

START ADDRESS：8øøø
END ADDRESS： 8313
8øøø：2ø EC $8 \emptyset \quad \mathrm{~B} \varnothing 722 \emptyset \quad \emptyset 282 \quad 62$ 8øø8： B 6D $2 \emptyset 5 \mathrm{D} 82 \mathrm{Bg} 68 \mathrm{AD} \mathrm{EB}$ 8ø1ø： 20 日3 Fg $6 F A 9$ 7F 8D 26 9D 8ø18： 83 8D 2783 A9 97 8D 28 g8 8ஏ2ø： 83 Dg ØF A9 55 BD $26 \quad 8344$ 8ø28：A9 2A 8D 27 83 A9 ø5 8D 97 8ø3ø： 2883 A9 938 BD 1483 A9 F8 8ø38：ஏ2 8D 1C $83 \quad 20$ ØB 81 A9 33 8ø4ø：18 8D $1583 \quad 20 \quad 9 A \quad 81 \quad 201 A$ 8ø48：5E 81 EE 1883 CE 1583 3D 8ø5ø：Dø F2 AD 2083 FD 29 Aø EE 8ø58：Øø AD $21 \quad 83 \quad 2 \emptyset 888 \emptyset$ Aø ES 8ø6ந： 64 AD $218320888 \emptyset \mathrm{AD} \mathrm{EF}$ 8ø68： 68 AD $2983 \quad 2088$ 日ø Aø D9 8ø7ø：$\emptyset C$ AD $29 \quad 83 \quad 2 \emptyset \quad 88 \quad 89 \quad 6 \emptyset$ AJ 8ø78： $74 \quad 82 \quad$ ØЗ $\varnothing 89482$ øA ø日 FF 8øBØ：AC 82 Ø1 $\emptyset 1 ~ A C ~ 82 ~ Ø A ~ Ø F ~ 3 B ~$ 8ø88：ØA ØA ØA 8D 2583 B9 78 4E 8ø9ø：8ø 85 FC C8 B9 $788 \emptyset 8595$ 8ø98：FD CB AD 2283 8D 1 A 83 AC BøAØ：B9 78 日g C8 18 6D $23 \quad 8379$日øA8：C9 Ø7 9ø 97 E9 07 EE 1A 36 8øBø： $83 \mathrm{~B} \mathrm{\emptyset}$ F5 8D 1B $83 \mathrm{B9} 78$ ØA日øBB： $8 \emptyset 18$ 6D $24 \quad 83$ 日D $18 \quad 83$ F5 8øCØ：A9 Ø1 8D 1483 A9 $\varnothing 7$ 8D 28日øC8：1C 83 A9 ø8 8D 1583 AC E2 8øDø： $25 \quad 83$ B1 FC BD $26 \quad 83 \quad 2077$日øD8： $9 B 81209 A 812 \emptyset \quad 5 E 8138$ BøEg：EE $18 \quad 83 \mathrm{EE} 25 \quad 83 \mathrm{CE} 15 \mathrm{AB}$日øE8： 83 Dø E4 $6 \emptyset 2 \emptyset \quad 69 \quad 82 \quad$ C9 F7日øFø： $359 \emptyset \emptyset 16 \emptyset$ A2 Øø BE 21 2A BøF8： 83 C9 ஏE 9ø 97 E9 ØD EE E1 81øØ： 2183 BØ F5 E9 Øø 8D 2074 81ø8： 83 18 6ø AD 1483 8D 1699 811ø： 83 AB A9 $9 \varnothing 992683$ AD 4E 8118：1B $83 \quad 18 \quad 6 \mathrm{D}$ 1C $83 \quad \mathrm{C} 9 \quad 67 \mathrm{EC}$ 8120：96 95 E9 97 EE 1683 BD BE 8128：1D 83 AD $2683 \quad 99$ 7F BD 7F B13ø： 1783 AC 1B 83 Fg 15 A2 93 8138：ஏø øE 2683 BD 2683 ØA 53 814ø：उE 2783 EA EC 1683 Dø C2 8148：F3 88 Dg EB AC 16 B3 B9 BE 815ø： $2683 \quad 99892 D 178399$ D6 8158： 268388 19 F2 $6 \varnothing$ AC 1D Fg 8160： 83 B9 8C 81 AC 168388 8A 8168： 31 FE 19268391 FE 8832 8170： $3 \emptyset$ gA FØ 98 B9 268391 AB 8178：FE 88 Dø FB AC 1B 83 B9 59 818ஏ： 9381 Aø $9 \varnothing 31$ FE gD 2687 8188： 8391 FE 60 7F 7E 7C 78 FE
 8198：1F 3F AD $1883 \quad 29 \quad 3 F A B \quad 1 A$ 81AD：B9 C2 $8165 \mathrm{E6} 85 \mathrm{FF} A D \mathrm{AC}$ 81A8： $18 \quad 83 \quad 29$ ø日 Fø $\varnothing 2$ A9 8g A1 81Bø： $18 \quad 2 \mathrm{C} 18 \quad 8370 \quad 6418 \quad 94 \mathrm{BD}$ 81B8： $69 \quad 28 \quad 69 \quad 28 \quad 6 \mathrm{D} \quad 1 \mathrm{~A} \quad 83 \quad 85 \quad 8 \mathrm{~A}$
日1C8：18 1C øø ø4 øB øC 1ø 14 C了 81Dø：18 1C $\quad 1 \quad 65 \quad 99$ ØD 1115 øB日1DB： 19 1D $\varnothing 1$ g5 99 ØD 1115 D3 81EØ： 19 1D 92 Ø6 ØA gE 1216 1B 81E8：1A 1E g2 g6 gA ge 1216 E3



82øø：1B 1F A9 Øø 8D 1A 83 8D FB 82ø8：1B $83 \quad 296982$ 8D 198316 821ø：Cø 11 9ø 12 FD Ø1 6ø C9 FE 8218：18 90 Ø1 6Ø A9 24 8D 1A 86 8229： 83 A9 94 日D 1B 83 A9 øø E4 8228：8D 1F 83 A9 Eg 8D 1E 83 CJ 823ø：AD 1983 CD 1E 839094 CJ 8238：ED 1E 83 38 2E 1F 83 4E F2 8240：1E 83 9ø EF 18 6D 1B 8376 8248：日D 1B 83 日D 23 83 18 AD 29 825D：1F 83 6D 1A 83 8D 1A 83 1F 8258：BD $22 \quad 8318 \quad 69 \quad 29 \quad 69 \quad 8277$ 826ஏ：8D 1883 日D 24 B3 C9 C 5 FE
 827ø：A1 A4 Aø 6ø 7F 7F 5F 6749 8278：Ø1 Ø1 פF 7F 7F 7F 775556 8280： 5557 5F 7F 7F 7F 5F 57 F9 8288： $55 \quad 57$ 5F 7F 7F 7F 4747 C1 829ø： 61 Ø1 47 7F 7F 7F 7F 7E AE 8298：78 78 7F 7F 7F 7F 7E 7A 51 82AD：7A 7E 7F 7F 7F 7F 7F 7E E1 82AB：7A 7E 7F 7F 7F 7F 7F 7F EA 82Bg：7E 7E 7F 7F 63 1C 1F 1F 65 82B8： 63 7C 7C 9063 1C 1F 63 4B 82Cø：1F 1F 1C 63 4F 474349 3E 82C8：4C פø 4F 4F øø 7C 7C 6ø 1E 82Dø：1F 1F 1C $63 \quad 4379$ 7C $6 \varnothing 40$ 82D8：1C 1C 1C 63 øø 1C 1F $4 F A A$ 82ED： $67 \quad 73 \quad 7373 \quad 63$ IC $1 \mathrm{Cl} 63 \quad 43$ 82E8：1C 1C 1C $63 \quad 63$ 1C 1C 1C 9C 82Fø： 63 1F 1C 6363 1C 1C 1C DE 82F8：1C 1C 1C 63 1F 1F 1F 1F 9F 830．：1F 1F 1C $63 \quad 63$ 1C 1C 1C F7 83ø8：1C 104413 1C 1C 1C $6 \emptyset$ C4 831ø：1C 1C 1C 1C FF FF øø $\emptyset \emptyset 71$

＂Solitaire＂for TI－99／4A computers．

## Program 6：TI－99／4A Solitaire

Version by Patrick Parrish， Programming Supervisor
For instructions on entering this listing，please refer to＂COMPUTE！＇s Guide to Typing in Programs＂published bimonthly in COMPUTEI．

1 פø DIM P（4，13），D（52），T（52）
$11 \varnothing$ CALL SCREEN（ 16 ）
$12 \emptyset$ GOTO $17 \varnothing$
$13 \varnothing$ FOR I7＝1 TO LEN（H\＄）
149 CALL HCHAR（ROW，COL＋I7，A SC（SEG\＄（H\＄，I7，1）））
150 NEXT IT
$16 \emptyset$ RETURN
$17 \emptyset$ CALL CLEAR
$18 \emptyset$ PRINT TAB（1ø）；＂SOLITAIR E＂：：：：：：：：：
190 GOSUB 2789
200 FS＝1
$210 \mathrm{C}=52$
$220 W=1$
23g RANDOMIZE
240 GOSUB 1760
25 五 $\$=$＂．．SHUFFLING＂
26 のROW＝24
27 © COL＝9
$28 \emptyset$ GOSUB 139
290 GOSUB 1920

3øø CALL $\operatorname{HCHAR}(24,1 \varnothing, 32,12)$ 31ø H\＄＝＂．．．DEALING＂
320 GOSUB 139
330 FOR I＝1 TO 4
34 （ FOR $J=1$ TO 13
350 GOSUB $211 \varnothing$
$36 \varnothing$ NEXT J
$37 \varnothing$ NEXT I
38ø CALL $\operatorname{HCHAR}(24,1 \varnothing, 32,1 \varnothing)$
39ø GOSUB 2300
$4 \varnothing \varnothing$ GOSUB $3 \varnothing 1 \varnothing$
$41 \varnothing$ IF W＜＞5 THEN 470
$42 \emptyset W=1$
$43 \varnothing$ F1＝ø
440 GOSUB 2450
$45 \varnothing$ IF $F 1<>\varnothing$ THEN $47 \varnothing$
460 GOTO $12 \varnothing 0$
47＠$I=I N T((E(W)-1) / 13)+1$
48ø $J=E(W)-13 * \operatorname{INT}((E(W)-1)$／ 13）
490 IF $\mathrm{J}=1$ THEN 540
590 LL $=P(1, J-1)$
510 IF（LL＜＞1）$\#(L L\rangle 14)$（LL $\rangle 27) *(L L\rangle 4 \varnothing) *(L L / 13<\rangle$ INT（LL／13））THEN $54 \emptyset$
$52 \varnothing W=W+1$
530 GOTO 410
$540 \mathrm{~N}=\mathrm{S}^{2} \mathrm{v"}$
550 5 $\$="$＂
560 GOSUB 2250
57ø CALL KEY（ø，KK，SS）
580 IF SS＜＞め THEN 66
$590 \mathrm{~N} \$={ }^{\text {＂}}$
6ヵの GOSUB 2250
$61 \varnothing \operatorname{CALL} \operatorname{KEY}(\varnothing, K K, S S)$
620 IF SS＜＞
$630 \mathrm{~N}=$＝＂v＂
640 GOSUB 2250
$65 \emptyset$ GOTO 57ø
66 IF KK＝89 THEN 720
67 IF KK＜＞77 THEN 570
68の N 末 $_{\text {＝＂＂}}$
690 GOSUB 2250
$700 \quad W=W+1$
710 GOTO $41 \varnothing$
720 IF $\mathrm{J}=1$ THEN $9 \varnothing \varnothing$
73 ■ LL＝P（I，J－1）
74 IF（LL／13＝INT（LL／13））+ （ $L L=1)+(L L=14)+(L L=27)+($ LL＝4ø）THEN 57ø
$75 \varnothing$ TE＝P（I，J）
$76 \emptyset \mathrm{TT}=\mathrm{T}(\mathrm{P}(\mathrm{I}, \mathrm{J}))$
$77 \varnothing \mathrm{~L}=\mathrm{T}(\mathrm{P}(\mathrm{I}, \mathrm{J}-1)+1)$
$78 \emptyset T(P(I, J))=T(P(I, J-1)+1)$
$79 \varnothing T(P(I, J-1)+1)=T T$
Bøø $P(I, J)=P(I N T((L-1) / 13+1$ ），L－13\＃INT（（L－1）／13））
B1ø P（INT（ $(\mathrm{L}-1) / 13)+1, \mathrm{~L}-13$＊ $\operatorname{INT}((L-1) / 13))=T E$
日20 GOSUB 2110
$83 \emptyset I=I N T((L-1) / 13)+1$
84』 $\mathrm{J}=\mathrm{L}-13$ \＆INT（ $(\mathrm{L}-1) / 13$ ）
85ø GOSUB 2110
860 GOSUB 2300
$870 \mathrm{~W}=1$
B8® GOTO 41ø
89® REM OFFER CHOICE OF TW o＇s
$9 \varnothing 0$ CALL $\operatorname{HCHAR}(23,1,32,64)$
$910 \mathrm{H} \$=$＂WHICH， 2 ，YOU WANT TO PLACE？＂
920 ROW＝23
$930 \mathrm{COL}=1$
940 GOSUB 130
$950 \mathrm{H} \$=$＂TWO OF＇S＇，＇H＇，＇D＇， OR＇C＇？＂
960 ROW＝24
970 GOSUB $13 \varnothing$
$98 \emptyset$ CALL $\operatorname{KEY}(\varnothing, K K, S S)$
$99 \varnothing$ IF KKく＞83 THEN $1 \varnothing 2 \varnothing$
100ø N2＝2
$1 \varnothing 1 \varnothing$ GOTO $111 \varnothing$
$102 \varnothing$ IF $K K<>72$ THEN $105 \varnothing$
$1030 \mathrm{~N} 2=15$

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1549 GOTO 1110
$1 ø 5 \emptyset$ IF $K K<>68$ THEN $1 ø 8 \emptyset$
1 106 $\quad \mathrm{N} 2=28$
$107 \emptyset$ GOTO $111 \emptyset$
1 1ø日ø IF KK＜＞67 THEN 98ø
$1095 \quad \mathrm{~N} 2=41$
$11 \emptyset \emptyset$ REM EXCHANGE LOCATION S
$111 \varnothing \mathrm{TE}=\mathrm{P}(\mathrm{I}, \mathrm{J})$
$112 \emptyset \mathrm{TT}=\mathrm{T}(\mathrm{P}(\mathrm{I}, \mathrm{J}))$
$113 \varnothing \mathrm{~L}=\mathrm{T}$（N2）
$114 \emptyset T(P(I, J))=T(N 2)$
$1150 \quad \mathrm{~T}(\mathrm{~N} 2)=\mathrm{T} T$
116 CALL $\operatorname{HCHAR}(23,1,32,64)$
117 GOSUB $3 \varnothing 1 \varnothing$
$118 \emptyset$ GOTO 8øø
$119 \varnothing$ REM PLAYER CAN NO LON GER MOVE SO ERASE THE WRONG ENTRIES，RESHUFF LE，\＆DEAL
$120 \emptyset$ FOR $I=1$ TO 4
$121 \emptyset \mathrm{~N}(\mathrm{I})=\varnothing$
$1220 \mathrm{IF}(P(I, 1)<>2) *(P(I, 1)$ $\langle>15) *(P(I, 1)<>28) *(P($ I，1）＜$>41$ ）THEN $13 \varnothing \varnothing$
$1230 \mathrm{~N}(\mathrm{I})=1$
124 FOR J＝2 TO 12
1250 IF $P(I, J)-1=P(I, J-1) T H$ EN 128ø
$126 \emptyset \mathrm{~J}=14$
1270 GOTD 1290
$128 \emptyset N(I)=N(I)+1$
1290 NEXT J
13 のg NEXT I
$131 \emptyset$ IF $(N(1)=12) *(N(2)=12)$ ＊$(N(3)=12)$（ $N(4)=12) \mathrm{TH}$ EN 2560
1329 F5＝F5＋1
1339 REM ERASE THE WRONG E NTRIES
1349 CALL HCHAR $(23,1,32,60)$
135 の $\mathrm{N}={ }^{13}$＂
$13695 \$="$
137 H\＄＝＂．．．RESHUFFLING＂
138 の ROW＝24
139 COL＝9
1490 GOSUB 130
141 FOR I＝1 TO 52
$1420 \mathrm{D}(\mathrm{I})=\mathrm{I}$
143 N NEXT I
144 FOR $I=1$ TO 4
145 FOR $J=N(I)+1$ TO 13
146 G GOSUB 2250
147 N NEXT J
148 N NEXT I
149 C3＝52
$15 \emptyset \emptyset$ FOR I＝1 TO 4
$151 \emptyset$ IF $N(I)=\varnothing$ THEN $155 \emptyset$
152 FOR $J=1$ TO N（I）
$153 \varnothing D(P(I, J))=\varnothing$
154 の NEXT J
155 NEXT I
$156 \emptyset$ FOR $I=1$ TO 4
157 FOR $J=1+N(I)$ TO 13
158
159 R $1=$ INT（RND＊ $\mathrm{C} 3+1$ ）
$16 \emptyset \emptyset$ IF $D(R 1)<>\emptyset$ THEN $164 \emptyset$
$1619 \mathrm{D}(\mathrm{R1})=\mathrm{D}(\mathrm{C} 3)$
162 C3＝C3－1
163 GOTO 1590
$1640 \mathrm{P}(\mathrm{I}, \mathrm{J})=\mathrm{D}\left(\mathrm{R}_{1}\right)$
$1650 \mathrm{D}(\mathrm{R} 1)=\mathrm{D}(\mathrm{C} 3)$
$1660 \quad \mathrm{CJ}=\mathrm{C} 3,-1$
1670 NEXT J
$168 \emptyset$ NEXT I
1690 FOR II＝1 TO 52
$17 \emptyset \varnothing \mathrm{~T}$（II）$=\varnothing$
1710 NEXT II
$172 \emptyset$ GOSUB 2ø4ø
1730 CALL $\operatorname{HCHAR}(24,1 \varnothing, 32,14$
1740 GOTO 310
$175 \emptyset$ REM DRAW BQXES
$176 \emptyset$ PRINT

1779 FOR $J=1$ TO 6
1780 FOR $I=1$ TO 2
1790 PRINT＂a e ba e ba eba eb＂
$18 \emptyset 0$ NEXT I
$181 \emptyset$ PRINT＂dd dd dd dd dd dd dd dd＂
1820 NEXT J
1830 PRINT ：：：：
1840 FOR $I=\emptyset$ TO 3
$185 \emptyset$ CALL HCHAR（19，7＋1＊7，99 ，2）
186 CALL VCHAR（20，3＋I＊7，97 ，2）
1870 CALL HCHAR（ $22,4+1 * 7,99$ ，2）
$188 \varnothing$ CALL VCHAR（ $2 \varnothing, 6+1 * 7,98$ ，2）
1890 NEXT I
1990 RETURN
$191 \emptyset$ REM SET UP DECK
1929 FOR I＝1 TO 52
$1930 \mathrm{D}(\mathrm{I})=\mathrm{I}$
1940 NEXT I
1959 FQR I＝1 TO 4
1969 FOR J＝1 TO 13
1979 RANDOMIZE
$1980 \mathrm{R} 1=\mathrm{INT}(\mathrm{RND} * \mathrm{C}+1$ ）
$1990 \mathrm{P}(\mathrm{I}, \mathrm{J})=\mathrm{D}(\mathrm{R} 1)$
$2 \emptyset \varnothing \emptyset D(R 1)=D(C)$
$2010 \mathrm{C}=\mathrm{C}-1$
2020 NEXT J
2630 NEXT I
$2 \emptyset 4$ FOR II＝1 TO 4
205 FOR JJ＝1 TO 13
$206 \emptyset T(P(I I, J J))=(I I-1) * 13+$ JJ
2070 NEXT JJ
2 g8ø NEXT II
209. RETURN
$21 \emptyset \varnothing$ REM SHOW CARD P（I，J）
2110 S\＄＝＂ytux＂
2120 H5＝INT（ $(P(I, J)-1) / 13)+$ 1
2139 S\＄＝SEG\＄（S\＄，H5，1）
214 g NB＝P（I，J）$-(\mathrm{HS}-1): 13$
215 IF NB＜＞1 THEN $217 \emptyset$
2160 S $\$=" \prime$
217 IF $(H 5=1)+(H 5=4)$ THEN 2 2øの
218 N1\＄＝＂hijklmnopqrs＂
2190 GOTO $221 \emptyset$

221 D $\mathrm{N} \$=\operatorname{SEG} \$(\mathrm{~N} 1 \$, \mathrm{NB}, 1)$
222 GOSUB 225 ø
2230 RETURN
224 REM PLACE N\＄；S\＄AT PO SITION I，J
225 Б $5=\mathrm{J}+(\mathrm{J}>7) * 7$
226 CALL HCHAR（J5＊3，（I－1）＊ 7＋4－（J＞7） 3 ，ASC（N\＄））
2270 CALL HCHAR（J5＊3－1，（I－1 ）\＆7＋5－（J＞7）\＆ 3 ，ASC（S\＄））
$228 \emptyset$ RETURN
229 REM FIND FIRST FQUR E MPTY BOXES
$2306 \mathrm{Z}=1$
2319 FOR I＝1 TO 52 STEP 13
232 E $\mathrm{E}(\mathrm{Z})=\mathrm{T}$（I）
$2336 \quad Z=Z+1$
2340 NEXT I
$235 \emptyset$ FOR $J=1$ TO 4
236 F FOR I＝1 TO 3
237 IF $\mathrm{IF}(\mathrm{I})<=E(I+1)$ THEN 24 $1 \varnothing$
$238 \emptyset$ AA＝E（I）
$2399 E(I)=E(I+1)$
$2409 E(I+1)=A A$
2410 NEXT I
242 DEXT J
2430 RETURN
2440 REM CHECK TO SEE IF $A$ LL FQUR SPACES FOLLOW A KING OR BLANK
$245 \emptyset$ FOR $K=1$ TO 4
$246 \varnothing \quad \mathrm{X}=\mathrm{INT}((\mathrm{E}(\mathrm{K})-1) / 13+1)$
247 D $Y=E(K)-13$ 苜INT（ $(E(K)-1)$ ／13）
$248 \emptyset$ IF $Y<>1$ THEN $25 \emptyset \varnothing$
$249 \emptyset$ F1＝1
$25 \varnothing \varnothing \quad W 2=P(X, Y-1)$
251ø IF $(W 2=1)+(W 2=14)+(W 2=$ $27)+(W 2=4 \emptyset)+(W 2 / 13=I N T$ （W2／13））THEN 2530
252 g $\mathrm{F}_{1=1}$
2530 NEXT K
2549 RETURN
255 REM ALL DONE
256 H $\mathrm{H}=$＝＂CONGRATULATIONS！！ YOU WON！！＂
2570 CALL $\operatorname{HCHAR}(23,1,32,64)$
258．ROW＝23
259 COL＝2
2600 GOSUB 130
$261 \emptyset \mathrm{H}==$ IT TOOK YOU＂\＆STR\＄ （F5）\＆＂TRIES．＂
2620 ROW＝24
2630 COL $=5$
2640 GOSUB 130
2650 CALL HCHAR（ $23,1,32,32$ ）
2660 H\＄＝＂PLAY AGAIN（Y／N）？＂
267 ROW＝23
268 D COL $=8$
269 GOSUB 130
$27 \emptyset \emptyset$ CALL $\operatorname{KEY}(\varnothing, K K, S S)$
$271 \emptyset$ IF SS＝ø THEN $27 \emptyset \varnothing$
272 IF KKく＞89 THEN 275ø
2739 CALL CLEAR
2740 GOTO 2øø
275 IF KKく＞78 THEN 27 Øø
276 END
277 R REM REDEFINE CHARS
278ø FOR I＝96 TO 1 ■1
279 READ A\＄
28øの CALL CHAR（I，A\＄）
$281 \emptyset$ NEXT I
282 DATA ஏøøøøøøøøøøøøøFF， Ø1ø1ø1ø1ø1ø1ø1ø1，8ø日ø日 の8ø8の日の8の8の
$283 \varnothing$ DATA FFøøøøøøøøøøøøøの，
 18181818181
284 FOR I $=194$ TO 118
2850 READ A\＄
286 CALL CHAR（I，A\＄）
287ø NEXT I
$288 \emptyset$ DATA $\emptyset ø 38440408192 \emptyset 7 C$ ， øø3844ø418ø44438，øøø日1 828487Cø8ø8
289ø DATA øø7C4ø78ø4ø4443日， Øø182פ4ø78444438，øø7Cø 4ø81פ2ø2ø2ø
29øø DATA 9.38444438444438 ， øø3844443Cø4ø日3ø，øø384 44444444438
$291 \emptyset$ DATA Øøø4ø4ø4ø4ø44438， øø38444444544834，øø444 85ø665． 4844
292 DATA Øø367FTFJE1Cø日øの， Øø183C7ETE3C18øø，FFFFF FFFFFFFFFFF
2930 CALL COLOR（19，7，1）
$294 \emptyset \operatorname{CALL} \operatorname{COLOR}(11,7,1)$
2950 FOR I＝12ø TO 121
296 READ A\＄
2970 CALL CHAR（I，A\＄）
2980 NEXT I
299 DATA Øø1C1C7777の日1Cのø， Øø183C7E7E1日3Cøø
उøøø RETURN
$3010 \mathrm{H}={ }^{6}=$＂$\langle M>Q V E$ TO NEXT EMP TY SLOT＂
$3 \boxed{2 g}$ ROW＝23
$3630 \mathrm{COL}=3$
3ø4ø GOSUB 130
365 $\mathrm{H} \$="\langle P\rangle L A C E$ A CARD AT CURSOR＂
396 ROW $=24$
$397 \emptyset$ GOSUB 139
398ø RETURN

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# SpeedCalc 

## For Commodore 64 And 128

Kevin Martin

In response to popular request, COMPUTE! presents this high-quality spreadsheet program for the Commodore 64 and 128 (in 64 mode).

Written completely in machine language, SpeedCalc has the major features you'd expect from a commercial spreadsheet. In addition, its data files can be-merged into text
files created with the SpeedScript word processor published last year in COMPUTE!. SpeedCalc requires a disk drive; a printer is recommended. Upcoming issues of COMPUTE! will feature versions of SpeedCalc for Apple II-series computers (DOS 3.3 and ProDOS) and Atari 400/800, XL, and XE computers. SpeedCalc also will be available on the premiere COMPUTE! DISK editions for Commodore, Apple, and Atari computers.

Have you ever planned a budget for your home or office? If so, you probably used some sort of worksheet divided into rows and columns. Perhaps you wrote the months of the year along the top of the sheet and listed categories for earnings and expenses along one side. After entering data for each category and month of the year, you could calculate total income figures by adding or subtracting numbers in each of the sheet's "cells."

That's a classic example of a worksheet. It lets you enter and organize data, then perform calculations that produce new information. A spreadsheet program is an electronic version of the familiar paper worksheet. Since it does all the calculations for you at lightning speed, an electronic spreadsheet is far more convenient than its paper counterpart. And spreadsheet programs also offer built-in editing features that let you enter and manipulate large amounts of data with a minimum of effort.

SpeedCalc is an all machine language spreadsheet program for the Commodore 64. Though relatively compact in size, it's fast and easy to use, and has many of the features found in commercial spreadsheet programs. Even better,
the "SpeedScript Integrator" program (also included here) lets you merge your SpeedCalc files into word processing documents created with SpeedScript, COMPUTE!'s popular word processor (see COMPUTE!, March 1985, or SpeedScript for the Commodore 64, published by COMPUTE! Books). Working together, SpeedCalc and SpeedScript make a powerful team. You can merge a chart of sales figures into a company report, create a table of scientific data for a term paper, and manipulate numeric information in many other ways. In a sense, a spreadsheet program brings to arithmetic all of the flexibility and power that a word processor brings to writing.

## Preparing The Program

Although SpeedCalc is small in comparison to similar commercial programs, it is the longest program COMPUTE! has ever published. Fortunately, the new "MLX" machine language entry utility makes it easier to type a program of this size. Be sure to carefully read the new MLX article elsewhere in this issue before you begin. Since this latest version of MLX was first introduced in last month's issue, you'll need to read the new article even if you've used the old MLX many times

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before. The SpeedCalc programs must be entered with the current version of MLX.

Here are the addresses you need to enter SpeedCalc with MLX:
Starting address: 0801
Ending address: 2680
Be sure to save the program at least once before running it for the first time. Though it's written in machine language, SpeedCalc has been designed to load and run just like a BASIC program. Simply enter LOAD" program name", 8 then type RUN.

## The SpeedCalc Screen

SpeedCalc uses the top line of the screen as the command line. This is where SpeedCalc displays messages and asks you questions.

Screen lines 2-4 are the input buffer area. This is the work area where you enter and edit data. As you'll see in a moment, the input buffer also displays the data contained in the current cell.

The lower 21 screen lines are your window into the spreadsheet. Though the spreadsheet contains many rows and columns, only a few can fit on the screen at a time. By scrolling the screen back and forth with the cursor, you can move the display window to any part of the spreadsheet.

The SpeedCalc worksheet consists of 50 vertical columns labeled with letters ( $\mathrm{AA}, \mathrm{AB}, \mathrm{AC}, \ldots \mathrm{BX}$ ) and 200 horizontal rows numbered from $1-200$. The intersection of a row and column is called a cell. Cells are where you store data. With 50 columns and 200 rows, the SpeedCalc spreadsheet has a maximum of $10,000(50 * 200)$ cells. Due to memory limitations, however, only about a third of these can actually contain data. But you may spread out the data over all 10,000 cells if necessary, depending on the format you need.

If you don't like the spreadsheet's screen colors, they're easily changed with the special function keys. Press the f1 key to cycle through the 16 border colors until you find one you like. The f3 key changes the background color and f5 changes the character color.

## Moving The Cursor

Each cell is identified with the letters of its column and the number


A typical screen from Commodore 64 SpeedCalc-a compact, powerful spreadsheet program written entirely in machine language.

SpeedCalc's input buffer always displays the contents of the data cell under the highlighted cursor.
of its row. For example, the cell at the extreme upper-left corner of the sheet is called AA1, since it's in column AA and row 1. The cell below that is AA2. Moving one cell to the right from AA2 puts you in cell AB2, and so on. (For the sake of clarity, this article uses uppercase letters for cell names. Note, however, that you must use lowercase letters such as aal when entering cell names within SpeedCalc.)

Your current position in the spreadsheet is shown by the highlighted cursor. The simplest way to move around the sheet is with the cursor keys, which work just as they do in BASIC. Another way to move the cursor is with the HOME key (press CLR/HOME without pressing SHIFT). Press HOME once to "home" the cursor on the current screen; the cursor moves to the upper-left cell. Press HOME twice in succession to move the cursor to cell AA1, the home position for the entire sheet.

SpeedCalc also has a goto command for moving over long distances. Press CTRL-G (hold down CTRL and press G). The command line turns blue and displays GOTO: followed by an underline cursor. The underline cursor generally indicates that SpeedCalc is waiting for data-in this case it expects the name of the cell where you wish to go. If you enter ba188 at this point, SpeedCalc moves the cursor to cell BA188, adjusting the screen window as needed. Take a few moments to practice moving around the spreadsheet with all three methods-you'll be using them a lot. In a later section, we'll discuss how to change the size and format of a cell.

## Keyboard Commands

SpeedCalc offers many different commands, a few of which are entered by pressing one key. However, most commands are entered by pressing CTRL along with another key. CTRL-G, as you've seen, is the goto command. CTRL-A displays the amount of free memory available, and so on. The most drastic command is CTRL-X, which exits SpeedCalc and returns you to BASIC. Since leaving the program effectively erases all data in memory, SpeedCalc asks ARE YOU SURE $\mathrm{Y} / \mathrm{N}$ ? before shutting down. To cancel the command and return to the spreadsheet, type N and press RETURN.

A few commands require you to press three keys at once. This sounds more awkward than it is in practice, since two of the three keys are SHIFT and CTRL. For instance, the command to switch between automatic and manual recalculation is performed by pressing SHIFT-CTRL-R (hold down SHIFT and CTRL, then press R). The accompanying table lists all the SpeedCalc commands, and the figure shows the keyboard layout with a description of what each key does. We'll be discussing each command in more detail below.

## Three Data Types

Before entering any data, you must know what kind of data SpeedCalc accepts. There are three different types: numbers, text, and formulas. Let's look at each type in turn:

1. Numeric data consists of num-bers-the basic stuff that spreadsheets work with. SpeedCalc has a few simple rules for numeric data:

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## SpeedCalc Keyboard Reference



A number must be a decimal value (base 10, not hexadecimal) composed of one or more digits from $0-9$, with an optional plus or minus sign. A decimal point is also optional. If you include any other characters in numeric input, SpeedCalc treats the entire input as text data (as explained below). Thus, the numbers 123, .001, and -65535 are valid numeric data. The numbers 65,535 (which includes a comma ) and 312 Main Street are treated as text labels.

For example, let's enter the number 123 in cell AA1. No special commands are required to enter data: Just move the cursor to AA1 and begin typing. While you're entering the number, it appears only in the input buffer near the top of the screen. As soon as you press RETURN, the number appears in AA1 and the letter N appears at the upper-right of the screen. The N signifies numeric, meaning that SpeedCalc has accepted the entry as valid numeric data. Move the cursor to a vacant cell, then move it back to AA1. The input buffer displays whatever data is found in the cell under the cursor. When the current cell is empty, the buffer is empty as well.

As you can see, pressing RETURN enters a data item into the current cell. You can also end the input by pressing a cursor key. The data is entered as if you had pressed RETURN, and the cursor moves in the indicated direction. This feature is handy for entering a lot of data:

## SpeedCalc Commands

| Command | Action |
| :--- | :--- |
| CTRL-A | available memory check |
| CTRL-B | blank (erase) current cell |
| CTRL-C | copy block verbatim |
| CTRL-D | set number of decimals |
| CTRL-E | edit current cell |
| CTRL-F | change cell format |
| CTRL-G | goto selected cell |
| CTRL-M | move block verbatim |
| CTRL-P | print sheet |
| CTRL-R | turn on/off auto recalculation |
| CTRL-W | change column width |
| CTRL-X | exit SpeedCalc |
| CTRL-4 | disk directory |
| CTRL-个 | send disk command |
| CLR/HOME | home cursor |
| SHIFT-CTRL-C | copy block relative |
| SHIFT-CTRL-D | change decimal mode for all cells |
| SHIFT-CTRL-M | move block relative |
| SHIFT-CTRL-P | print to screen, disk, or printer |
| SHIFT-CTRL-R | display current recalculation mode |
| SHIFT-CTRL-W | change width of all columns |
| SHIFT-CLR/HOME | erase entire sheet |
| f1 | change border color |
| f3 | change background color |
| f5 | change character color |
| f7 | load SpeedCalc file |
| f8 | save SpeedCalc file |
| r | recalculate sheet |

Simply type the entry, move the cursor to the next cell, enter more data, and so on.
2. Text data is not "data" in the strict sense, since SpeedCalc doesn't use it in calculations as it does numbers and formulas. Text data is there only to help humans understand what the other data means. Text may consist of comments, titles, column headings, subheadings, or whatever you need to interpret the numbers and formulas. As an example, move the cursor
to cell AA2 (just under AA1) and type the following line. Note that both uppercase and lowercase letters are acceptable:

This is some text data.
You can use the DEL key to erase mistakes while you're typing. When you press RETURN, SpeedCalc displays T (for text) in the upper-right corner. In this example, the cell isn't long enough to accept all the text, so only the leftmost portion appears in AA2. But even

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though you can't see all the text, it's there. Move the cursor to another cell, then move it back to AA2. As soon as you return to AA2, SpeedCalc displays all the text in the input buffer.
3. Formula data is a mathematical expression or formula. It may be as simple as $2+2$ or as complex as your imagination (and mathematical prowess) allows. The first character in a formula must always be an equal sign ( $=$ ). If you omit this symbol, SpeedCalc either signals an error or treats the data as text. The true power of a spreadsheet is that a formula in one cell can refer to another cell. This is easier to demonstrate than to explain. Move the cursor to cell AA3 and type the following line:
$=\mathrm{aa} 1^{*} 25.01+$ @sqr(4)
As soon as you press RETURN, SpeedCalc displays F (for formula) in the upper-right corner and puts the result of the formula (not the formula itself) in AA3. If AA1 contains 123 , the value 3078.23 appears in AA3. In plain English, this formula means "multiply the contents of cell AA1 by 25.01 and add the square root of 4 ." Before we examine the formula more closely, here's a quick demonstration of what makes a spreadsheet such a powerful tool. Move the cursor back to AA1 and press CTRL-R. The command line displays the message RECALCULATION IS ON, meaning SpeedCalc now automatically recalculates the entire sheet whenever you make a change. Now change the number in AA1 to 456 (simply move to the cell and start typing). The new result (11406.53) automatically appears in cell AA3. We'll explain more about automatic recalculation later.

When you enter the name of another cell in a formula, the letters must be lowercase (enter aa1, not AA1). The referenced cell must contain data that SpeedCalc can evaluate: a number or another formula. If the formula refers to an empty cell, or one that contains text, SpeedCalc signals an error.

## Mathematical Operators

These symbols can be used as operators in a formula:
Operator
Function addition subtraction

$$
\begin{array}{ll}
* & \begin{array}{l}
\text { multiplication } \\
\text { division }
\end{array} \\
\uparrow \text { (up arrow) } & \begin{array}{l}
\text { exponentiation } \\
\text { equality }
\end{array} \\
=
\end{array}
$$

One factor that affects formulas is precedence, or the order in which mathematical operations are performed. In SpeedCalc, formula operators have the same precedence as BASIC-the same as in general math.

The first operators to be evalu-ated-those with the highest prece-dence-are those enclosed in parentheses. Where one set of parentheses encloses another, the expression in the innermost set is evaluated first. The next operators to be evaluated are exponents. Multiplication and division have equal precedence; both operations are lower than exponentiation. Addition and subtraction have the lowest precedence of all. The mnemonic "My Dear Aunt Sally" (MDAS-Multiplication, Division, Addition, Subtraction) is a reminder of mathematical precedence.

To take one example, SpeedCalc evaluates the formula $=5^{*}\left(8+3^{*}-2\right) \uparrow 2-10 /+2$ as the value 15 , just as in ordinary math. Note how the result is affected by the plus and minus signs before the 2's.

## Functions

Formulas may also include any of the functions listed here:
@abs() absolute value
@atn() arctangent
@ave() average of a block of cells [form: @ave(xxn:xxn)]
$@ \cos () \quad$ cosine of argument in radians
@exp() complement of $\log$, gives $e^{\mathrm{x}}$ ( $e=2.7182318 \ldots$ )
@int() integer (rounds to next lowest whole number)
@log() natural logarithm base $e(\log$ of zero or a negative number is illegal)
@sgn() $\quad \operatorname{sign}$ ( -1 for negative numbers, 0 for 0,1 for positive)
$@ \sin () \quad$ sine of argument in radians
@sqr() square root (root of a negative number is illegal)
@sum() sum of a block of cells [form: @sum(xxn:xxn)]
@tan() tangent of argument in radians. @tan( $\left..5^{*} \mathrm{pi}\right)$ is illegal
pi value of pi ( $\mathbf{3 . 1 4 1 5 9 2 6 5 \text { ) }}$
All the functions except pi begin with the @ symbol and are followed by parentheses. Within the parentheses of a function you may use a number or formula. For example, the formula $=@ s q r(4)$ generates the square root of 4 . The
formula $=@ s q r(a a 1)$ returns the square root of whatever value cell AA1 contains. Note that the argument (value within parentheses) of the functions @tan(), @sin(), and @cos() must be expressed in radians; the result of the function @arc() is expressed in radians.

The function @int() generates an integer (whole number) by rounding to the next lowest whole number. For positive numbers, this is equivalent to dropping the fraction, but for a negative number like -4.3 , the next lowest number is actually -5 .

The function @ave() calculates the mean average of the values in a block (group) of cells. The function @sum() calculates the sum of a block. Both functions require that you define the block so that SpeedCalc knows which cells to include in the calculation. This is done by putting two cell names separated by a colon in the parentheses. The first cell name defines the upper-left corner of the block, and the second defines the bottomright corner. For instance, @ave(aa1: ad20) calculates the average of all the cells from AA1 to AD20. The function @su$\mathrm{m}(\mathrm{aa} 1: \mathrm{ad} 20)$ calculates the sum of AA1 through AD20, and so on. An error results if any cell in the block is blank or contains text data.

## Math Notes

SpeedCalc uses the same ROM routines for math as BASIC. Therefore, it follows almost the same rules and has the same limitations. Numbers are accurate internally to only nine digits-although you can enter long numbers and view them exactly as you entered them, only the first nine digits are used for calculations. If you enter a very long number (more than 36 digits), your input is ignored, and the cell reverts to its former state. You can also enter long numbers in the form $1.23 \mathrm{E}+05$ (scientific notation). Note, however, that SpeedCalc itself never uses scientific notation. It converts all numbers to their full length, so long numbers actually use more memory than shorter ones.

Beware of math errors such as division by zero, square root of a negative number, tangent of $\mathrm{pi} / 2$, logarithm of zero or a negative

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number, and overflow conditions like $2 \uparrow 300$. SpeedCalc detects these errors and displays *ERROR* in the cell of an illegal calculation.

## Editing The Sheet

Editing is a very important spreadsheet function. The simplest way to change what a cell contains is to move to it and start typing. The old data in that cell is replaced by whatever you enter. For instance, to replace the contents of cell AA1 with the number 456 , move to that cell, type 456, and press RETURN or exit with a cursor key.

Press CTRL-B (think of blank) to erase what's in the current cell. You can also clear a cell by typing a space and pressing RETURN, but this uses some memory. A truly blank cell doesn't use any memory.

To erase everything in the sheet, press SHIFT-CLR/HOME. Before carrying out this drastic operation, SpeedCalc asks you to confirm it by pressing Y or N .

In some cases, only a minor change is needed. Edit mode lets you change the data in a cell without retyping the entire entry. To activate edit mode, move to the desired cell and press CTRL-E. In this mode, the up/down cursor key is disabled, and the left/right cursor key moves within the input buffer. Erase unwanted characters with the DEL key. Typing in edit mode inserts new characters in the line: Everything to the right of the new character moves right one space (unless the buffer is already full). Since the cursor keys have a different function in edit mode, you cannot use them to end the input. Press RETURN to enter the new data and escape from edit mode.

As you may have learned already, SpeedCalc displays *ERROR* in a cell when you enter an erroneous formula. The usual cause is that you have made a typing error in that cell, or the formula refers to text or an empty cell. A line of asterisks (*********) signals that a number is too large to be printed in the cell. Though these messages appear in the cell area, no data is lost. You may move to the affected cell, view its contents in the input buffer, and make whatever correction is needed.

## Recalculation

The recalculation feature is the very core of SpeedCalc. As you know, entering or editing a piece of data causes SpeedCalc to perform a calculation and put the result in the cell under the cursor. In most cases, the new data relates to data in other cells, so you'll ultimately want to recalculate the entire spreadsheet as well. This can be done in two different ways: manually or automatically.

To recalculate the spreadsheet manually, press the back arrow key ( $\leftarrow$, at upper-left on the keyboard). SpeedCalc begins at AA1 and recalculates every cell that contains data, placing fresh results wherever needed. SpeedCalc displays the message RECALCULATING while it's busy.

If you switch to automatic recalculation mode, SpeedCalc automatically recalculates the entire spreadsheet each time you enter new data or edit what exists. When you press CTRL-R, SpeedCalc changes the recalculation status and displays it at the top of the screen. If automatic recalculation was turned off before, it is now on (and vice versa). If you aren't sure which mode you're in, press SHIFT-CTRL-R; SpeedCalc displays the recalculation mode without changing it.

Automatic recalculation can be fun to watch in a large spreadsheet: Every time you make a change, new results ripple all the way down the screen. However, the more data your spreadsheet contains, the longer it takes to update the entire sheet. For this reason, you may want to turn automatic recalculation off most of the time, recalculating with the back arrow key whenever you need to view results.

One problem with recalculation arises from the order in which cells are calculated. Because only one cell can be calculated at a time, you must sometimes recalculate the entire spreadsheet two or three times to get correct results in every cell (this is common to all spreadsheet programs). For instance, say you have a formula in AA1 which refers to a formula in AB15. When SpeedCalc calculates AA1, it must use the existing data from AB15which is probably out of date, since the formula in AB15 hasn't been
recalculated yet. To avoid this problem, you should always press the back arrow key two or three times before printing a spreadsheet or saving it to disk.

SpeedCalc offers a number of other features. Before experimenting with them, you should spend some time typing in a hypothetical spreadsheet-perhaps a fictitious yearly budget-to become thoroughly familiar with the basic commands covered so far. Most importantly, create formulas, using all the operators in different combinations. Try doing things that you know will cause errors. Then correct the errors in edit mode, and so on. It takes a thorough grasp of the fundamentals to get the most out of SpeedCalc's advanced features.

## Change Type And Format

The default (normal) format for numeric data is flush right with rounding to two decimal places. In other words, the number is displayed in the rightmost part of the cell, with two numbers after the decimal point. Text and formulas are flushed left (shown in the leftmost part of the cell). SpeedCalc offers several commands for changing cell formats.
Change Format (CTRL-F). This command changes the location of data in the cell and the number of decimal places. When you press CTRL-F, SpeedCalc displays the question FORMAT: Left, Center, or Right justify? in the command line. Press L, C, or R to move the data to the left, center, or right of the cell.
Change number of decimal places (CTRL-D). This command lets you specify the number of digits displayed after the decimal point. The default value is 2 , convenient for dollar amounts, but you may change it to anything from $0-15$. If you choose zero decimal places, any number in that cell is rounded off to the nearest integer (whole number). A setting of 15 is special: The number in that cell is not rounded off at all. Instead, SpeedCalc displays the number exactly as you entered it or as it was calculated from a formula. Watch out for one feature of CTRL-D: It also resets the cell to right justification, so you may need to change this with CTRL-F.

## Commodore 64



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Width (CTRL-W). The width command changes the width of an entire column of cells. Move the cursor to any cell in the desired column, then press CTRL-W. When SpeedCalc displays the prompt Width: you should respond with a number from 4-36. The entire screen is redrawn to accommodate the new format, and may look very different depending on what value you choose. For instance, if you increase a column's width, the rightmost column of the former display may disappear: SpeedCalc only displays as many complete columns as it can fit on the screen. If you decrease the width of a column, you may see asterisks where numbers used to be (indicating the cell is now too small to display the entire number). To get rid of the asterisks, expand the column as necessary.
Global Format (SHIFT-CTRL-F). This is the same as the ordinary format command, but operates globally, changing every cell in the sheet instead of just one. To alert you to the difference, SpeedCalc changes the color of the command line to blue.
Global Width (SHIFT-CTRL-W). This is a global version of the width command. The command line turns light green to signal the difference. Every column in the sheet changes to the designated width.
Global Decimal (SHIFT-CTRL-D). This command lets you change the number of decimals displayed for the entire sheet. The default for the sheet is two decimal places. Every cell changes to the designated setting, and the new setting becomes the default for future entries.

## Macroediting

After typing in a large spreadsheet, you may decide to make a major change. You may want to add new data somewhere in the middle, delete a section, or move a group of cells from one location to another. SpeedCalc's macroediting (largescale editing) commands simplify such operations, affecting an entire block of cells at once. A block is simply a group of cells connected in rectangular fashion: You can define it as a single cell, a row or column, or any rectangular area within the spreadsheet.

There are two ways in which macro commands can work: verbatim or relative. To take a simple example, say that cell AA2 contains the formula $=a a^{*} 5$ and you want to move its contents to cell AB2. When this is done in verbatim mode, AB2 contains an exact copy of what was in AA2 (=aa1*5). Note that the cell name used in the formula does not change: The formula still refers to AA1. If you perform the same operation in relative mode, the cell name in the formula is adjusted to fit the new location. In this case, AB 2 would contain the formula $=a b 1 * 5$.
Copy (CTRL-C). The copy command copies a block of cells into a different location without disturbing the original cells. Place the cursor on the upper-left corner of the block you want to copy, then press CTRL-C. SpeedCalc changes the command line to purple and prompts you to move the cursor to the lower-right corner of the block you want to copy. Once the cursor is in place, press RETURN. Now SpeedCalc prompts you to move the cursor to the place where you want to put the block: This is the upperleft corner of the new position. Once the cursor is there, press RETURN again. The new data replaces whatever was contained in the designated cells. Note that if you define an impossible block (for instance, moving the cursor to the upper-left of the original position, rather than below and to the right), SpeedCalc does not copy any data. You can use this trick to escape from Copy if you press CTRL-C accidentally. Another escape is to press RETURN twice while the cursor remains on the original cell.
Move (CTRL-M). This command works like a copy, but it fills the original cells with blanks. Though SpeedCalc has no insert command, you can use this command to make space for new data in the middle of a spreadsheet. Simply move everything below the insertion point down as far as you need. To cancel this command, press RETURN twice while the cursor is on the same cell.
Relative Copy (SHIFT-CTRL-C). This form of the copy command adjusts the cell names used in formulas within the copied block (see explanation above).

Relative Move (SHIFT-CTRL-M). This is the relative form of the move command. Cell names in formulas are adjusted to reflect the move.

## Memory Management

SpeedCalc leaves 10,752 bytes of memory ( 10.5 K ) available for data. As noted earlier, SpeedCalc lets you spread your data out over a much larger number of cells than you can actually fill with data. The extra space is provided to give you full control over the final format of the spreadsheet-for example, you could have a $15 \times 150$ spread-sheet-and to leave some elbow room for move and copy operations.

Because memory is limited, you should keep careful track of how much is free while using the program. Press CTRL-A to display the amount of free memory. We suggest limiting your spreadsheets to 1,296 cells (equivalent to 36 rows by 36 columns). If you have filled nearly all of free memory, you may have to break the spreadsheet into two smaller sheets.

Although SpeedCalc checks the amount of available memory, and displays an error message if you run out of memory, you should be careful not to exhaust free memory. Any move or copy operation in process will be aborted if sufficient memory is not available.

## Disk Operations

SpeedCalc has four disk commands which allow you to save a spreadsheet to disk, load it, display the disk directory, and send commands to the disk drive. The directory command is the simplest to use. Press CTRL-4 (think of the dollar sign, as in LOAD " $\$$ ", 8 to list the directory from BASIC): The screen clears and the directory is displayed. Press RETURN to return to the normal screen. You may pause the directory display with the space bar.

To save a spreadsheet to disk, press the f8 function key (SHIFTf7). SpeedCalc prints SAVE: on the command line, followed by an underline cursor. Enter a valid Commodore filename and press RETURN. (If you change your mind and decide not to save anything, press RETURN without typing a filename.) The disk drive spins for a
few moments，then SpeedCalc prints the drive status in the com－ mand line．The message $00, \mathrm{OK}, 00$ ， 00 means there were no errors．

To load a saved file from disk， press the f7 key．Again，SpeedCalc prompts you to enter the filename and displays the disk status when the operation is complete．Speed－ Calc files are saved as PRG（pro－ gram）file types，but do not load as normal program files．SpeedCalc uses special header bytes to identify a SpeedCalc file．If you try to load anything other than a valid Speed－ Calc file，you＇ll see the message NOT A SPEEDCALC FILE．

You can send Commodore disk commands to the drive with CTRL－ $\uparrow$－press CTRL and the $\uparrow$（up－ arrow）key together．SpeedCalc prompts you to enter a disk com－ mand．The CTRL－$\uparrow$ command works much like the Commodore Wedge utility．If you press RE－ TURN without typing a command， SpeedCalc displays the drive status and sends no command．You need not enclose the command in quota－ tion marks or type, 8 after it．For example，press CTRL－$\uparrow$ ，then enter I0 to initialize a disk．Consult your disk drive manual for more infor－ mation about Commodore disk commands．

## Printing

SpeedCalc lets you print data to three different devices：to the screen for previewing output，to a printer for permanent documenta－ tion，or to a disk file for integrating the data with another program．

To preview your spreadsheet on the screen，press SHIFT－CTRL－P， then press $S$（screen output）when prompted．Naturally，the display will look odd if your sheet is wider than 40 columns．Think of each pair of 40 －column lines as one 80 －column printed line．

To print a hardcopy of the spreadsheet，press CTRL－P．If your printer is configured like most，this should produce a satisfactory print－ out．This command sends output to the printer as device number four with a secondary address of seven （uppercase／lowercase on most sys－ tems）．Before using this command， you must position the cursor below and to the right of the block of cells you wish to print．The upper－left corner of the printout starts at cell

AA1．The entire width you define by this position is used．Therefore， don＇t try to print overly wide spreadsheets that won＇t fit on the paper．If you want to print a spread－ sheet wider than 80 columns，many printers have a condensed mode that lets you fit 132 characters on a line．You can set this by switching an internal DIP switch，or by send－ ing a CHR\＄code from BASIC before running SpeedCalc．Many printers respond to this command for condensed mode：OPEN 4，4： PRINT\＃4，CHR\＄（15）：CLOSE 4.

To send output to a printer with a device number other than four or a secondary address other than seven，enter SHIFT－CTRL－P， then enter the device number and secondary address when prompted． During a printout，you can pause the output by pressing SHIFT or SHIFT LOCK．The screen border turns white and printing ceases un－ til you release SHIFT．Press RUN／ STOP to abort printing．

You can also print SpeedCalc data to a disk file for use with termi－ nal programs，databases，or word processors（including SpeedScript）． Select the D option after pressing CTRL－SHIFT－P，then enter the file－ name you wish the new file to have．The data is saved as a SE－ Quential disk file of that name．The disk file is an exact Commodore ASCII image of what would go to the printer．

Note that printing to disk cre－ ates a different file than saving to disk：You should save files that you wish to reload into SpeedCalc，and print files that you wish to convert for SpeedScript or other programs． While you may pause this opera－ tion with SHIFT as with printer out－ put，do not use RUN／STOP to abort printing to disk．This may create a ＂poison＂（unclosed）file which can be safely removed only by validat－ ing the disk．

## SpeedScript Integrator

SpeedCalc sends data to the printer in simple，plain－vanilla form．That may be fine for personal use，but if you＇re creating a document for oth－ ers to view，you may want special features such as boldface，underlin－ ing，etc．Since SpeedScript－com－ PUTE！＇s popular word processor－ already offers a way to access these features（and many more），no at－
tempt has been made to include them in SpeedCalc．All that＇s needed is a simple program to con－ vert SpeedCalc files into a form that SpeedScript can load．Then you can edit the file with SpeedScript as you would any other document－in－ serting printer control codes，refor－ matting the text，merging it with other text，and so on．

Type in and save Program 2， using MLX as you did with Speed－ Calc．Enter 0801 as the MLX start－ ing address and 0948 as the ending address．Like SpeedCalc，the Speed－ Script Integrator loads and runs ex－ actly like a BASIC program，even though it＇s written in machine lan－ guage．Here are the steps to convert a SpeedCalc file for SpeedScript：
1．After creating a spreadsheet with SpeedCalc，print it to disk as de－ scribed above．
2．Exit SpeedCalc，then load and run the Integrator．The program prompts you to enter the name of the SpeedCalc file you printed to disk．Then it asks you to enter the name of the SpeedScript file you want to create（of course，this name should be different from the first）． The Integrator then constructs a SpeedScript－loadable disk file from the SpeedCalc file．
3．After the Integrator is finished， load and run SpeedScript，then load the new SpeedScript file as you would any SpeedScript document． The data appears on the screen， ready to be edited in any way you wish．

If you already have the Speed－ Script File Converter published with the March 1985 SpeedScript 3.0 article，you can use its Commodore ASCII to SpeedScript option to con－ vert SpeedCalc files．This option works like the Integrator．

## Program 1：SpeedCalc For Commodore 64

Please refer to the new＂MLX＂article in this issue before entering the following listing．
Ø801：ØB Ø8 øø Øø 9E 32 3Ø 36 EC Ø8ø9：31 ØØ ØØ ØØ A9 24 AØ 5 F 3Ø Ø811：A2 ØØ 2049 Ø9 2Ø 7 F ØB DD Ø819：20 E8 ØA A9 $26 \quad 18 \quad 69 \quad \emptyset 1 \quad \mathrm{~B} 4$ $\begin{array}{lllllllll}\text { Ø } 21: 8 \mathrm{D} & 82 & 26 & 18 & 69 & 4 \mathrm{~F} & 85 & 30 & \mathrm{~A} 2\end{array}$ Ø829：A9 Ø0 8D $81 \quad 26$ 8D $83 \quad 26$ 6C
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Ø861：DØ F8 C9 20 9Ø E6 C9 DB E2 ø869：BØ E2 C9 5B 9ø 94 C9 C1 63 0871：90 DA 4C 96 øC CA 8A ØA 1E Ø879：AA A9 0848 A9 4C 48 BD 9B ø881：B3 ø8 48 BD B2 ø8 $48 \quad 60$ F8 ø889：1A $931317 \quad 06 \quad 0710 \quad 03 \mathrm{CE}$ ø891：8C 88181191 1D 9D Ø2 5C ø899： $05 \begin{array}{llllllll}5 \mathrm{~F} & 85 & 86 & 87 & 01 & 12 & 1 \mathrm{E} & 9 \mathrm{~F}\end{array}$ Ø8Al：9F ØD ø4 ØD $31 \quad 3233 \quad 34 \quad$ Ø3 ø8A9： $35 \quad 36 \quad 37 \quad 38 \quad 39 \quad 30 \quad 2 \mathrm{~B} \quad 2 \mathrm{D} 5 \mathrm{~A}$ Ø8Bl：2E 1D $\emptyset_{B} 3312 \quad 6910 \quad 0712$ ø8B9：øD A4 11 8A 1473164524 ø8Cl：1A 65 1B C2 1 F 33114 C E3 ø8C9：11 63118 D 118 BA 1 D C8 EB ø8D1：1D F9 1C $30 \quad$ ø9 21 б9 FB 50 ø8D9： 08 Fø 1E 9D 1D ED 1B 5E FC ø8E1：1C $54 \quad 16$ 4B øD A5 C6 FØ ØA Ø8E9：FC 8A 48984820 E4 FF 3A ø8Fl：8D BB 2668 A8 68 AA AD EC Ø8F9：BB 2660 EE 8323 AD 83 F 3 Ø901：23 29 日F 8D 8323 A9 Øø A5 Ø909：85 F3 A9 D8 85 F4 Aø 28 ø7 0911：AD 8323 91 F3 C8 D6 F8 B5 Ø919：E6 F4 A5 F4 C9 DC DØ Fø 34 9921：60 EE 8223 AD 82232988 Ø929：øF 8D 82 23 8D 21 Dø $6 \emptyset 9 \mathrm{~B}$ Ø931：EE 8423 AD 842329 OF 2D 0939：8D 8423 8D 20 Dø 60 8A FF Ø941：30 ø3 4C $62 \quad 23$ 4C 74 A4 B3 0949：85 FC 84 FB 8E 8123208 EE $0951: 73$ Ø9 A9 1320 D2 FF Aø B2 Ø959：0ø B1 FB FØ Ø6 20 D2 FF BC Ø961：C8 D6 F6 60 A2 32 9D 8892 Ø969：26 CA D $\emptyset$ FA A9 28 8D BB CF Ø971：26 60 AØ Ø0 A9 AØ 99 øø C5 Ø979：Ø4 AD 812399 øø D8 C8 A2 Ø981：CØ 28 DØ FØ 60 AD 86 Ø2 EF Ø989：C9 ØC FØ 09 A9 24 Aø 54 A5 Ø991：A2 Ø0 2049 Ø9 3820 B 8 AF Ø999：20 90 03 4C 89 0F 4C 99 BF Ø9Al：ØF 20 A9 ØA 8D 28 Ø4 A9 D7 Ø9A9：1F 8D 29 Ø4 A2 76 A9 $2 \emptyset 76$ Ø9B1：9D 29 Ø4 AD $83 \quad 23$ 9D 2945 Ø9B9：D8 CA DØ F2 Aø Ø1 Dø Ø2 Eø Ø9C1：AØ øø B9 2884 Ø9 8099 BC Ø9C9：28 $04 \quad 20$ E6 68 8D CD 26 9B Ø9Dl：B9 $28 \quad 04 \quad 297 \mathrm{~F} 99 \quad 28 \quad 0494$ Ø9D9：AD CD 26 AE 93 ØA DD 93 F9 Ø9E1：0A F0 3A CA DØ F8 C9 2047 Ø9E9：90 D8 C9 80 90 84 C9 A0 84 Ø9Fl：9Ø DØ 20 A9 ØA 8D CD 2667 09F9：8C CE 26 CE CE 26 A2 7783 ØAø1：BD $28 \quad \emptyset 4$ C9 1F FU BB CA 1A ØAø9：BD $28 \quad 049 \mathrm{D} 29 \quad 04 \mathrm{CA} E C$ 3C ØAll：CE 26 DØ F4 AD CD 2699 ØA ØA19：28 Ø4 C8 DØ A5 CA 8A ØA DF ØA21：AA BD 9C ØA 48 BD 9B 0 A A8 ØA29：48 6Ø AØ Øø B9 28 Ø4 C9 CD ØA31：1F F0 $06 \quad 99$ 3C 03 C8 D8 BB ØА $39:$ F3 A9 øø 99 3C 038 8C BE 11 ØA41：26 60 AD 8523 FO 20 CØ 6C ØA49：øØ Fø Ø1 88 4C C3 ø9 AD 73 ØA51：85 23 FØ 13 B9 28 ø4 C9 80 ØA59：1F FØ F1 C8 4C C3 69 AD 35 פA61：85 23 F0 03 4C C3 Ø9 AD 80 ØA69：CD 26 A6 C6 EØ ØA BØ BA 7A ØA71：9D 77 Ø2 E6 C6 4 C 2B ØA A8 ØA79：CØ Ø0 FØ Dø 8898 AA BD D2 ØA81：29 Ø4 9D 28 Ø4 E8 C9 1F D7 ØA89：DØ F5 A9 $2 \emptyset \begin{array}{llllll} & \text { 9D } & 28 & \text { Ø4 } & 4 \mathrm{C} & 9 \mathrm{C}\end{array}$ ØA91：C3 ø9 07 ØD 14 5F 9111 CD ØA99：9D 1D 2A ØA 78 ØA C2 Ø9 24 ØAAl：5F ØA 5 F ØA 42 ØA 4 F 日A 57 ØАA9：C9 63 BØ Ø3 29 3F 6029 F1
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ØCA1：26 AE A4 Ø8 DD A4 38 FØ 10 ØCA9： $07 \mathrm{CA} D 0 \mathrm{~F} 8$ A9 $01 \mathrm{D} \emptyset 19 \mathrm{AD}$ ØCB1：AD BE 26 C9 25 Bø 25 AØ 88 ØCB9：3C A9 Ø3 2Ø EØ ØC 2079 AD ØCCl：Øø DØ E9 A9 Øø FØ Ø2 A9 57 ØCC9： 02 8D BD 26 AD D1 23 8D E8 ØCDI： $\mathrm{BF} \quad 26 \quad 18 \quad 20$ B8 $\quad 20 \quad 20 \quad 18$ F6 ØCD9：21 20 F4 1 C 4C 4 D Ø8 85 ØCE1：7B 84 7A $2 \emptyset 79$ Øロ 4C F3 82 ØCE9：BC A2 32 A9 Øø 8D CA 26 DB ØCF1：BD $88 \quad 26 \quad 18$ 6D CA 26 8D Cl ØCF9：CA 26 C9 25 BØ Ø3 CA DØ 84 ØDØ1：EF E8 E8 8E CE $26 \quad 60$ AD DØ ØD09：8D Ø2 C9 Ø5 FØ Ø4 A2 Ø6 D6 ØD11：DØ Ø2 A2 ØE AØ Øø A9 25 C6 ӨD19：20 49 Ø9 20 E6 ø8 29 7F E1 ØD21：C9 4C FØ ØF C9 43 F 0 ØF 8E ØD29：C9 52 F Ø Ø3 4C E2 ØD A2 B5 ØD31：ØC DØ Ø6 A2 Ø8 DØ Ø2 A2 9A ØD39：Ø4 AD D1 23 29 Fø 8D CD 23 ØD41：26 8A $\quad$ 日D CD 26 8D CD 26 B8 ØD49：4C 8A ØD AD 8D Ø2 C9 Ø5 B5 ØD51：FØ Ø4 A2 Ø6 DØ Ø2 A2 ØE 7B ØD59：AØ $\quad 30$ A9 $\quad 25 \quad 20 \quad 49$ Ø9 20 AF ØD61：CC 1Ø FØ 7D AØ ØØ A9 Ø2 36 ØD69：20 EØ ØC $2 \emptyset$ AA Bl C9 ØØ FE ØD71：DØ 6F Cø 1Ø BØ 6B AD D1 49 ØD79：23 29 ØC 8D CD 26 98 ØA ØC ØD81：ØA ØA ØA ØD CD 26 8D CD 25 ØD89：26 AD $81 \quad 23$ C9 $06 \mathrm{~F} \mathrm{\emptyset} 41 \mathrm{gE}$ ØD91：AD CD 26 8D D1 23 AD $818 B$ ØD99：26 $85 \quad 39 \mathrm{AD} 82 \quad 26 \quad 85$ 3A 1 C ØDA1：AØ $\emptyset 1 \quad \mathrm{~B} 1 \quad 39 \mathrm{F0} 118502 \mathrm{E} \quad 1 \mathrm{~B}$ ØDA9：88 B1 3985 2D B1 2 D 29 $\begin{array}{ll}\text { A7 }\end{array}$ ØDB1：ø3 ØD D1 2391 2D C8 A5 75 ØDB9： 39 18 69 Ø2 $85 \quad 39$ A5 $3 \mathrm{~A} ~ 5 \mathrm{~A}$
 ØDC9：DØ D8 38 2Ø $\begin{array}{lllllll} & \text { B8 } & 20 & 4 C & E 2 & 4 D\end{array}$ ØDD1：$\emptyset D \quad 38 \quad 2 \emptyset \quad \mathrm{~B} 8 \quad 2 \emptyset \quad 9 \emptyset \quad \emptyset A \quad A \emptyset \quad \emptyset 8$ ØDD9：Øø AD CD 26 ØD BD 2691 B8 ØDE1：2D 4 C 86 89 A5 45 8D C2 27 ØDE9：26 A5 46 8D C3 26 A9 03 2F ØDF1：8D $85 \quad 26$ AE $86 \quad 26$ ØDF9：AC $87 \begin{array}{lllllllll}87 & 26 & 84 & 46 & 98 & 18 & 69 & 87\end{array}$ ØEØ1：14 8D C $\quad 26$ BD $88 \quad 26$ 8D EE ØE09：CA 26 A9 Ø0 EC C2 26 DØ D8 ØE11：ø7 CC C3 26 DØ Ø2 A9 8 81 ØE19：8D C5 26 ØE21：ED $87 \quad 26$ A8 $\begin{array}{lllllll}\text { B9 } & 86 & 23 & 85 & 19\end{array}$ ØE29：D2 B9 9F $23 \quad 85$ D1 $\begin{array}{lllllll} & 38 & 20 & 47\end{array}$ ØE31：B8 20 Bø Ø5 A9 20 4C CØ 3 F ØE39：ØE AD BD 26 F 6 6E C9 Ø2 B 8 ØE41：Fの 6A AD CA 2638 ED BE 7F ØE49：26 AA E8 3032 E8 AD BF 93 ØE51：26 29 ØC C9 Ø8 FØ 28 BØ ED ØE59： 05 8A 4A FØ 22 AA 8E C6 92 ØE61：26 A9 20 ØD C5 26 AC 8575 ØE69：26 91 D1 C8 CA DØ FA 8C DF ØE71：C7 26 AD CA 26 38 ED C6 12 ØE79：26 AA AØ Ø2 4C 8B ØE AE E2 ดE81：CA 26 AD 85
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ØF41：46 A4 46 C $\varnothing 19$ DØ EØ AD FB ØF49：C2 $26 \quad 8545 \mathrm{AD}$ C3 $26 \quad 85$ A5 ØF51：46 Aø ØØ A9 $2 \varnothing 99 \quad 28$ Ø4 11 ØF59：C8 C $\emptyset \quad 78$ D 0 F8 $38 \quad 20$ B8 C9 ØF61：2の 9035 AØ Ø2 A2 ضØ AD AC ØF69：BD 26 C9 Ø2 DØ Ø9 AC BE ØC ØF71：26 Bl 2D 8D BE 26 C8 Bl 5F ØF79：2D 9D 28 Ø4 E8 C8 CC BE 9D ØF81：26 D0 F4 A9 1F 9D 28 Ø4 E3 ØF89：AE BD 26 BD CD 23 8D 27 4C ØF91：ø4 AD 86 Ø2 8D 27 D8 $60 \quad 29$ ØF99：A9 20 8D 27 Ø4 A9 1F 8D 4B
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 1ø09：Bø 3F B1 2D C9 2E FØ Ø8 4B 1ø11：C9 35 Bø ØC C8 4C 4A 1056 $\begin{array}{lllllllll}1019, C 8 & B 1 & 2 D & C 9 & 35 & 90 & 2 A & 88 & 15\end{array}$ 1021：98 C8 AA CA CA BD Øø Ø2 11 1029：C9 2E FØ ØB 9Ø ØC C9 39 ØA 1Ø31：D 14 A9 3Ø 9D ØØ Ø2 CA B2 1039：10 EB CA 9D ø்ø Ø2 E8 A9 13 1ø41：31 9D Øø Ø2 DØ Ø3 FE ØØ 12 1049：Ø2 88 8C BE 26 AD ØØ Ø2 F3 1051：C9 20 D0 09 A9 Ø1 85 2E 93 1059：A9 FF 85 2D 60 A9 $\varnothing 185$ Ø3 1061：2E A9 FE 85 2D EE BE 26 Ø4 1069：60 AD 8D Ø2 C9 Ø5 FØ Ø5 4ø 1071：A2 05 4C 78 10 A2 ØD A9 Ø4 1079：24 AØ Al $20 \quad 49 \quad 09 \quad 20$ CC 85 1ø81：10 АØ ØØ А9 Ø2 20 EØ ØC CA 1089：20 AA Bl C9 Øø DØ 35 CØ A5 1ø91： 04 9Ø 31 CØ 25 BØ 2D A5 F5 1099：45 8D 8626 AD 8123 C9 76 1ØAl：Ø5 FØ $07 \quad 98 \quad 2065$ Ø9 4 C C DF 10A9：Bl 1098 A6 45 9D 8826 FB 1øB1：2の EA ØC A5 45 CD CE 26 9D 1Ø日9：90 $\quad 07$ AC CE $26 \quad 88$ 8C 8659 1øCl：26 2013 ØC 4 C 86 Ø9 A9 58 1ØC9：Ø1 DØ Ø2 A9 Øø 8D C9 2669 1øD1：AØ Øø 84 D4 A9 A4 20 D2 13 10D9：FF A9 9D 20 D2 FF 20 E6 D7 1ØE1：ø8 C9 ØD FØ 3D C9 14 FØ 53 1ØE9：24 AA 297 F C9 20 90 EE C2 1ØF1：8A AE C9 $26 \mathrm{D} \emptyset \quad \emptyset 8$ C9 $3 \varnothing$ Ø9 1ØF9：9Ø E4 C9 3A Bø EØ A6 D3 A2 11Ø1：EØ 26 FØ DA 99 ØØ Ø2 $2 \emptyset$ D9 11ø9：D2 FF C8 DØ C7 CØ ØØ FØ EC 1111：CD A9 $20 \quad 20$ D2 FF A9 9D 12 1119：20 D2 FF $2 \emptyset$ D2 FF 88 4C F5 1121：D5 10 A9 $2 \emptyset \quad 20$ D2 FF A9 5 F 1129：ØØ 99 Øø Ø2 8С C8 26 AD 53 1131： 00 Ø2 60 A5 46 C9 C8 F0 16 1139：12 E6 46 AD $87 \quad 26 \quad 18 \quad 69$ 30 1141：13 C5 46 Bø Ø6 EE 872653 1149：20 95 ØВ 6Ø A5 46 C9 Ø1 23 1151：Fの 10 C6 46 AC $87 \quad 268885$ 1159：C4 46 9ø 06 CE $87 \quad 26 \quad 2 \emptyset$ E2 1161：95 ØB 6Ø A5 45 C9 32 Fø 1E 1169：23 E6 45 AC C4 26 C4 45 D7 1171：B 1 A EE $86 \quad 26 \mathrm{AE} \quad 86 \quad 26 \mathrm{D7}$ 1179：A9 9018 7D $88 \quad 26$ E8 C9 C3 1181：25 90 F7 CA CA E4 4590 ØB 1189：E9 2013 ØC 60 A5 45 C9 B9 1191：Ø1 FØ 1Ø C6 45 AC $86 \quad 26$ EE 1199：88 C4 $45 \quad 90 \quad$ Ø6 CE $86 \quad 26 \quad 81$ 11A1：2Ø 13 ØC $6 \emptyset$ A9 24 AØ A9 E8 11A9：A2 $06 \quad 20 \quad 49 \quad \emptyset 9 \quad 20$ C8 $1 \varnothing$ A1 11B1：A9 01 85 7B A9 FF 85 7A 24 11B9：20 73 Øø 90 4 E 38 E9 41 3A
 11C9：A9 1A 8D CD $26 \quad 20 \quad 73$ Ø0 6E 11D1：90 $39 \quad 38$ E9 $40 \quad 30 \quad 34 \mathrm{~F} 04 \mathrm{C}$

11D9：32 C9 1B Bø 2E 18 6D CD $7 \varnothing$ 11El：26 C9 33 BØ 26 8D CD $26 \quad 24$ 11E9：20 73 ØØ B $\quad 1 \mathrm{E} 20 \mathrm{~F} 3 \mathrm{BC} 1 \mathrm{~A}$ $11 \mathrm{Fl}: 20 \mathrm{AA}$ Bl C9 Øø D $\varnothing 14 \mathrm{C} \varnothing \mathrm{CD}$
 1201：B6 9ø ØB A9 B5 8D 8726 B9 1209：4C 12 12 4C 86 日9 8C 87 D7 1211：26 $84 \quad 46 \quad 20$ EA 日C AD CD E4 1219：26 CD CE 26 9Ø ØA AC CE D4 1221：26 88 8C $86 \quad 26$ 4C $2 \mathrm{C} \quad 1241$ $1229: 8 \mathrm{D} \quad 86 \quad 26 \quad 85 \quad 45 \quad 20 \quad 8 \mathrm{~F} \quad$ ØB $\quad$ A7 1231：4C $86 \quad 99$ AD $86 \quad 26$ C5 45 B6 1239：Dø 17 AD 8726 C5 46 DØ 5F 1241：10 A9 $\quad 118 \mathrm{BD} 86 \quad 26 \quad 85 \quad 45$ ED 1249：8D 8726854620 8F ØB 10 1251：60 AD $86 \quad 26 \quad 85 \quad 45 \mathrm{AD} 8768$ 1259：26 $8546 \quad 60 \quad 2073$ 日の 8D 1D 1261：E1 $26 \quad 20 \quad 73$ Ø0 8D E2 26 5D $1269: 20 \quad 73$ Øø 8D E3 $26 \quad 20 \quad 73 \mathrm{BE}$ 1271：Ø0 C9 28 Fø Ø3 4C 62 23 4D 1279：AE C2 12 AD E1 26 DD C2 E8 1281：12 Fø Ø6 CA DØ F5 4C 62 Bl 1289：23 AD E2 26 DD CE 12 FD A8 1291：Ø2 DØ FØ AD E3 26 DD DA 32 1299：12 DØ E8 8E BB 26 EØ ØB 44 12A1：B $\emptyset \quad \emptyset \mathrm{C}$ 8A 48 A9 $\varnothing \emptyset \quad 484 \mathrm{C} \quad 21$ 12A9：1A 2268 8D BB 26207373 12B1：$\emptyset \quad \mathrm{AE}$ BB 26 CA 8A ØA AA 9A 12 B9：BD E8 1248 BD E7 1248 B7 12C1：60 ØC $41 \begin{array}{lllllll}41 & 43 & 45 & 49 & 4 C & 63\end{array}$ 12C9：53 $53 \begin{array}{llllllll}53 & 54 & 53 & 41 & 42 & 54 & 94\end{array}$ 12Dl：4F 58 4E 4 F 47495141 B5 12D9：55 56 12E1：4E 4 E 52 4E 4D $45 \quad 57 \mathrm{BC} \quad \mathrm{DA}$ 12E9：øD E3 63 E2 EC BF CB BC E2 12F1：E9 B9 38 BC 6 A E2 70 BF CB 12F9：B3 E2 $\varnothing 114691420$ BC AA 1301：13 8E E4 26 8C E6 26 20 BF 1309：79 gø C9 3A Dø 3F 2073 FF 1311：øØ 20 BC 13 8E E5 26 8C EC 1319：E7 $26 \quad 2079$ ØØ C9 29 DØ A2 1321：2C 2073 Øø AE E4 26 CA F3 1329：EC E5 26 90 Ø3 4C $62 \quad 23$ 3E 1331：AC E6 $26 \quad 88$ CC E7 269097 1339：03 4C $62 \quad 23$ E8 C8 A5 45 6D 1341：8D CB 26 A5 46 8D CC 26 68 1349：86 $45 \quad 84 \quad 46$ 60 4C $62 \quad 2315$ 1351：18 20 B8 20 9の 54 AØ øø BB 1359：Bl 2D 29 Ø3 C9 Ø1 FØ 4A 77 1361：C8 B1 2D 8D CE 26 A2 øø 2B 1369：C8 B1 2D 9D Øø Ø2 E8 C8 82 1371：CC CE 26 Dø F4 A5 7A 48 FE 1379：A5 7B 48 A9 øø 9D Øø ø2 6D 1381：A9 Ø2 Aø ØØ 2Ø EØ ØC 6816 1389：85 7B 68857 A A5 45 CD 79 1391：E5 26 FØ Ø4 E6 $45 \quad 18 \quad 60 \quad 6 \mathrm{~F}$ 1399：AD E4 $26 \quad 8545$ A5 46 CD Ø8 13AI：E7 26 FØ $\begin{array}{lllllll}18 & \text { E6 } & 46 & 18 & 60 & 84\end{array}$ 13A9：38 60 AD CB 268545 AD F5 13B1：CC $26 \quad 85 \quad 46 \quad 18 \quad 20$ B8 20 AF 13B9：4C $62 \quad 23$ A2 $\varnothing \emptyset \quad 2 \emptyset \quad 79$ ØØ A 13C1：C9 41 FØ Ø6 C9 42 DØ E2 77 13C9：A2 1A 8E CD $26 \quad 20 \quad 73$ ØØ ØF 13D1：C9 41 9Ø D6 C9 5B Bø D2 9C 13D9：38 E9 4ø 18 6D CD 26 C9 D8 13E1：33 Bø C7 8D CD $26 \quad 2 \emptyset \quad 73$ 5A 13E9：$\emptyset \emptyset$ BØ BF $2 \emptyset$ F3 BC $2 \emptyset$ AA B3 13F1：Bl C9 ØØ DØ B5 Cø ØØ FØ 12 13F9：Bl CØ C9 Bø AD AE CD 2657 1401：60 A9 Ø1 8D BB 26 A9 Øø 86 1409：8D BC $26 \quad 20$ FF $1220151 \quad C 7$ 1411：13 Bø $47 \quad 201$ B BC A5 6657 1419：48 A5 6548 A5 64 48 A5 F4 1421：63 48 A5 6248 A5 6148 CB 1429：EE BB 26 Dø Ø3 EE BC 26 FC 1431：20 $51 \quad 13$ Ø8 68 8D CD 26 DB 1439：68 856968 85 6A $68 \quad 85$ D6 1441：6B $68 \quad 85 \quad 6 \mathrm{C} \quad 68 \quad 85$ 6D 68 4D 1449：85 6E 456685 6F A5 6175 1451：20 6A B8 AD CD 26 48 28 D5 1459：9 9 B9 AD CB $26 \quad 85 \quad 45 \mathrm{AD} 2 \mathrm{~A}$ 1461：CC $26 \quad 854618 \quad 20$ B8 2061


1471：95 68 CA DØ F9 AD BC 26 ØB 1479：AC BB 262091 B3 A5 6E C2 1481：45 $6685 \quad 6 \mathrm{~F}$ A5 $612 \emptyset$ E6 67 1489：22 6Ø A9 Øø 8D 2Ø Dø 8D 2C 1491：21 Dø 20 BD FF A9 ØB 8D A8 1499：86 $62 \quad 20 \quad 67$ ØВ А9 $93 \quad 2040$ 14A1：D2 FF A9 Ø4 8D E8 26 A9 AE 14A9：07 8D E9 26 AD 8D Ø2 C9 C9 14B1： 05 F 0 Ø3 4C 3B 15 A9 2665 14B9：AØ 23 A2 ØØ $2 \varnothing 49$ Ø9 $2 \emptyset$ A7 14Cl：E6 68 C9 53 FØ ØB C9 4459 14C9：FØ 11 C9 50 Fø 2E 4C 49 ØF 14D1：16 A9 Ø3 8D E8 26 8D E9 8D 14D9：26 Dø 5F A9 ø8 8D E8 26 3E 14El：A9 Ø1 8D E9 26 AØ 4E A9 69 14E9：26 $20 \quad 49$ Ø9 20 C8 10 AD D8
 14F9：FF 4C 3B 15 A9 26 Aの 0419 15ø1：A2 ØØ $2 \emptyset 49$ Ø9 $2 \emptyset$ E6 $\varnothing 8$ B3 1509：38 E9 3Ø C9 Ø4 Bø Ø3 4C Al 1511：49 16 C9 08 9ø 03 4C $49 \quad 91$ 1519：16 8D E8 26 A9 26 Aの ØE 66 1521：A2 ØØ 2049 Ø9 20 E6 08 D3 1529：38 E9 3010 Ø3 4C 49 16 E2 1531：C9 日A 90 ø3 4C 4916 8D 46 1539：E9 26 A9 25 AØ F7 A2 Ø0 93 1541：2Ø 49 Ø9 A9 Ø4 AE E8 26 5C 1549：AC E9 26 2б BA FF A9 Ø4 38 1551：20 C3 FF 20 Cø FF A2 Ø4 CD 1559：20 C9 FF A5 45 8D E5 26 B2 1561：8D C2 26 A5 46 8D E7 26 80
 1571：46 A9 ØD 20 D2 FF A6 45 F5 1579：BD 8826 8D CA 26 AA A9 30 1581：Øø 9D 3C ø3 CA A9 2ø 9D A5 1589：3C Ø3 CA 10 FA 3820 B8 9E 1591：20 90 5B AD BD 26 C9 Ø1 51 1599：DØ 23 AD CA 2638 ED BE Ø4 $15 \mathrm{Al}: 26 \mathrm{AA} \mathrm{E} 8$ 3Ø 14 E 8 AD BF 99 15A9：26 29 ØC C9 Ø8 FØ ØA BØ 18 $15 \mathrm{Bl}: 27$ 8A 4A FØ Ø4 AA 4C D9 A7 $15 \mathrm{~B} 9: 15 \mathrm{~A} 2$ Øø $\mathrm{F} \varnothing 1 \mathrm{~B} 2 \emptyset \mathrm{~A} 4$ ØF D7 15Cl：AE BE 26 CA CA CA EC CA 8A 15C9：26 9Ø CF AE CA 26 A9 2A 7C 15D1：9D 3B Ø3 CA D $\emptyset$ FA FØ 1611 15D9：AØ Ø2 B1 2D $2 \emptyset$ B3 ØA 9D 5F $15 \mathrm{El}: 3 \mathrm{C}$ Ø3 E8 C8 EC CA 26 FO 64 15E9：ø5 CC BE 26 DØ EC A2 ØØ 83 15F1：AD 8D Ø2 29 Ø1 Dø F9 A5 日E 15F9：91 1ø 2C BD 3C Ø3 $\mathrm{F} \emptyset \quad$ Ø6 28 1601：20 D2 FF E8 D 0 F5 A5 45 6F 16ø9：CD E5 26 FØ Ø5 E6 45 4C 04 1611：77 15 A5 46 CD E7 26 FØ A2 1619：øE E6 46 A9 $\varnothing 18545$ A9 BB 1621：ØD 20 D2 FF 4C 7715 A9 4A 1629：ØD 20 D2 FF A9 Ø4 20 C3 9F 1631：FF 20 CC FF AD C2 268549 1639：45 AD C3 268546 AD E8 D7 1641：26 C9 Ø3 DØ Ø3 2ø E6 Ø8 CE
 1651：øB 4C 86 ø9 AD 8D Ø2 8D AC 1659：D1 $\begin{array}{lllllllll}26 & 29 & \emptyset 4 & \mathrm{~F} \emptyset & 12 & \text { A9 } & \text { ØØ } & 8 \emptyset\end{array}$ 1661：8D D2 26 A5 45 8D D3 2656 1669：A5 46 8D D4 26 4C 8D 16 8C 1671：4C 86 ø9 AD 8D Ø2 8D D1 C2 1679：26 29 Ø4 FO F3 A9 Ø1 8D 68 1681：D2 26 A5 45 8D D3 26 A5 57 1689：46 8D D4 26 20 CA 16 AD 3F 1691：C2 26 8D D7 26 AD C3 26 6D 1699：8D D8 26 2б D6 16 AE D3 C9 16Al：26 CA EC D7 $26 \mathrm{~B} \emptyset \quad 15 \mathrm{AE}$ 7B 16A9：D4 26 CA EC D8 26 Bø ØC BE 16B1：A9 25 Aø 6F A2 Ø4 20.49 B5 16B9： 0920 E7 18 AD D5 268587 16Cl：45 AD D6 2685464 C 86 9D 16C9： 99 A9 25 AØ D1 A2 Ø4 20 D4 16D1：49 Ø9 4C DF 16 A9 25 AØ AE 16D9：A8 A2 $\quad 042 \emptyset \quad 49 \quad 69 \quad 2 \varnothing$ E5 1A 16E1：0D 20 E6 Ø8 AE 1317 DD C 7 16E9：13 17 Fø 66 CA D 0 F8 4C BB 16F1：DF 16 CA 8 A 日A AA A9 16 F 9 16F9：48 A9 DE 48 BD 1B 1748 E5 1701：BD 1 A $17 \quad 48 \quad 60 \quad 68 \quad 68$ A5 17

1709：45 8D D5 26 A5 46 8D D6 92 1711：26 60 Ø6 13 131 11 9 D 1D 85 1719：ØD 3312 4C 11 33 11 8D A6 1721：11 $6311 \quad 05 \quad 17 \mathrm{AD}$ DB $26 \quad 7 \emptyset$ 1729：C9 33 Bø 5B AD DC 26 C9 CB 1731：C9 Bø 54 AD D9 $26 \quad 8545$ 8D 1739：AD DA $\begin{array}{llllllll}26 & 85 & 46 & 38 & 20 & \mathrm{~B} & 1 \mathrm{E}\end{array}$ 1741：2Ø $9045 \mathrm{~A} \varnothing$ Ø2 AD BD 26 BE 1749：C9 Ø2 DØ Ø9 AC BE 26 B1 E5 1751：2D 8D BE 26 C8 A2 Øø B1 36 1759：2D 9D 3C Ø3 E8 C8 CC BE FF 1761：26 DØ F4 A9 ØØ 9D 3C Ø3 Ø2 1769：8E $\quad \mathrm{BE} \quad 26 \quad 20 \mathrm{AB} \quad 17 \mathrm{AD}$ D2 3 D 1771：26 DØ Ø3 $2099 \quad 17 \mathrm{AD}$ DB A9 1779：26 $85 \quad 45 \mathrm{AD}$ DC $\begin{array}{llllllllll}26 & 85 & 46 & 7 \emptyset\end{array}$ $\begin{array}{lllllllllllllll}1781: 18 & 20 & B 8 & 20 & 20 & 18 & 21 & 60 & \text { E }\end{array}$ 1789：AD DB $26 \quad 85 \quad 45$ AD DC $26 \quad 63$ 1791：85 $46 \quad 18 \quad 20$ B8 20 90 96 EF 70 1799：20 20 1F 18 2Ø B8 20 A9 13 17A1： 00 A8 $91 \quad 39$ C8 $91 \begin{array}{lllllll}39 & 4 \mathrm{C} & \text { ØB }\end{array}$ 17A9：88 17 AD D1 26 C9 $05 \mathrm{~F} \mathrm{\emptyset}$ Ø8
 17B9： 0160 AD DB 2638 ED D9 $\quad 3 \mathrm{BB}$ 17Cl：26 8D DF 26 AD DC 26 38 2 A 17C9：ED DA 26 8D EØ 26 A2 ØØ 28 17D1：8E BC 26 BD 3C Ø3 20 B3 F 8 17D9：ØA 9D 28 Ø4 E8 EC BE 2658 17E1：DØ Fl A9 ØØ 9D 28 Ø4 A9 69 17E9：28 85 7A A9 Ø4 85 7B A9 4E 17F1：3C 85 FB A9 Ø3 85 FC 20 Ø2 17F9：79 ØØ 20 DA $18 \quad 20 \quad 73$ Øø BE 18Ø1：C9 ØØ DØ Ø3 4C BA 18 C9 A7 1809：40 DØ $\emptyset 3$ 4C A5 1890 EA 4C 1811：C9 43 BØ E6 A2 Øø C9 4266 1819：Dø Ø2 A2 1A 8E BB 26 2Ø F7 1821：73 øØ C9 41 9Ø 66 C9 5B 65 1829：B $\emptyset \quad 6238$ E9 4018 6D BB E8 1831：26 C9 $\quad 33$ B $\emptyset \quad 57 \quad 18$ 6D $\quad \mathrm{DF} \quad 2 \mathrm{E}$ 1839：26 A2 41 C9 1B 9ø 95 A2 B1 1841：42 38 E9 1A $18 \quad 69$ 40 8D F3 1849：BB $\quad 26$ 8A $2 \emptyset$ DA 18 AD BB 82
 1859：33 20 F3 BC 20 AA B1 C9 4E 1861：Øの DØ 29 Cø ØØ FØ 25 CØ C5 1869：C9 Bø $21 \quad 98 \quad 18$ 6D EØ 26 B6 1871：A8 A9 ØØ $2 \emptyset 91$ B3 $2 \emptyset$ DD DB 1879：BD A2 Ø1 BD Øø Ø1 FØ Ø6 19 1881：20 DA 18 E8 DØ F5 207922 1889：ØØ 4C Ø1 18 A2 ØØ BD $28 \quad 27$
 1899：ø3 E8 DØ F2 A9 Øø 9D 3C 93 18A1：03 4C D4 18 20 DA 18 20 18 F 18A9：73 Øø $2 \emptyset$ DA 18 2Ø 73 Øø 6D $18 \mathrm{Bl}: 20$ DA $18 \quad 2 \emptyset 73 \quad \emptyset \emptyset \quad 4 \mathrm{C}$ FB DD 18B9：17 AC BC 26 8C BE 26 A9 EF 18C1：øø 91 FB A2 Øø BD 3C Ø3 72 18C9：Fの Ø9 2Ø A9 ØA 9D 3C Ø3 95 18D1：E8 DØ F2 A9 Aø 8D AØ Ø4 24 18D9：60 AC BC 26 CØ 78 FØ 05 2E 18E1：91 FB EE BC $26 \quad 60$ AD D7 69 18E9：26 38 ED D3 26 18 6D C2 65 18F1：26 8D DD 26 AD D8 2638 ØC 18F9：ED D4 2618 6D C3 26 8D Fg 1901：DE 26 AD D4 26 CD C3 2645 1909：Bø Ø3 4C AA 19 AD D3 26 D5 1911：CD C2 $26 \quad 904 \mathrm{~A}$ AD D3 26 7F 1919：8D D9 26 AD D4 26 8D DA 5D 1921：26 AD C2 26 8D DB 26 AD 62 1929：C3 26 8D DC 26 20 26 26 17 5B 1931：AD D9 26 CD D7 26 Fø Ø8 93 1939：EE D9 26 EE DB 26 DØ ED 14 1941：AD DA 26 CD D8 26 FØ 14 F7 1949：EE DA 26 EE DC 26 AD D3 ØC 1951：26 3D D9 26 AD C2 26 8D E9 1959：DB 26 Dø D1 4C 43 1A AD 8B 1961：D7 26 8D D9 26 AD DD 2622 1969 ：8D DB 26 AD D4 26 8D DA 2 E 1971：26 AD C3 26 8D DC 26 2б 49 $1979: 26 \quad 17 \mathrm{AD}$ D9 26 CD D3 $26 \quad \emptyset \mathrm{E}$ 1981：FØ Ø8 CE D9 26 CE DB 26 EF 1989：DØ ED AD DA 26 CD D8 2643 1991：FO CA EE DA 26 EE DC 2647 1999：AD D7 26 8D D9 26 AD DD D6 19A1：26 8D DB 26 DØ D1 4C 43 D1

19A9：1A AD D3 26 CD C2 26 9ø 87 19Bl：4A AD D3 26 8D D9 26 AD $1 F$ 19B9：D8 26 8D DA 26 AD C2 26 D4 19Cl：8D DB 26 AD DE 26 8D DC D8 19C9：26 $26 \quad 26$ 17 AD D9 26 CD 3C 19D1：D7 26 FØ Ø8 EE D9 26 EE 32 19D9：DB 26 DØ ED AD DA 26 CD 6F 19E1：D4 26 FD 14 CE DA 26 CE 64 19E9：DC 26 AD D3 26 8D D9 2648 19F1：AD C2 26 8D DB 26 Dø D1 34 19F9：4C 43 1A AD D7 26 8D D9 8D 1AØ1：26 AD DD 26 8D DB 26 AD A7 1Aø9：D8 26 8D DA 26 AD DE 26 5E 1A11：8D DC $26 \quad 20 \quad 2617$ AD D9 CC 1A19：26 CD D3 26 FØ Ø8 CE D9 CF 1A21：26 CE DB 26 DØ ED AD DA 6E 1A29：26 CD D4 26 FO 14 CE DA 31 1A31：26 CE DC 26 AD D7 26 8D D 1A39：D9 26 AD DD 26 8D DB 26 BC 1A41：DØ D1 4C FA 1C A9 24 AØ FB
 1A51：1Ø DØ Ø8 A9 ØØ 8D 86 Ø2 A2
 1A61：26 A2 Øø AØ Ø2 $2 \emptyset$ BD FF 67 1A69：A9 Ø1 A2 日8 Aø 01 20 BA 8B 1A71：FF $2 \emptyset$ C 0 FF 20 C2 1 B B 0 B8 1A79：7E A2 Ø1 20 C9 FF A9 FF 59 1A81：2Ø D2 FF A9 FF 20 D2 FF 3B 1A89：A5 33 2ø D2 FF A5 3420 AD 1A91：D2 FF Aø 32 B9 $88 \quad 26 \quad 2 \emptyset \quad \mathrm{C} 2$ 1A99：D2 FF 88 D 8 F7 AD 8126 F4 lAAl ： $85 \quad 39 \mathrm{AD} 82 \quad 26 \quad 85$ 3A Aø 21 1AA9：$\emptyset 1 ~ B 1 ~ 39 ~ F \emptyset ~ 16 ~ A 5 ~ 39 ~ 2 \emptyset ~ D A ~$ $1 \mathrm{AB} 1: \mathrm{D} 2 \mathrm{FF}$ A5 3A 20 D 2 FF 88 7C
 $1 \mathrm{ACl}: 20$ D2 FF A5 $3918 \quad 69 \quad$ Ø2 14 1 AC9 ： $85 \quad 39$ A5 3A 69 Øø 85 3A F7 1AD1：A5 3A C5 $3 \emptyset$ DØ D1 A9 FF 44 $1 \mathrm{AD} 9: 2 \emptyset$ D2 FF A5 2 F 8539 A5 D4 $1 \mathrm{AEl}: 30 \quad 85$ 3A AØ ØØ B1 39 2Ø 3 A 1AE9：D2 FF C8 D $\emptyset$ F8 E6 3A A5 2B 1AF1：3A C5 $349 \emptyset \mathrm{FO}$ FØ EE A9 17 1AF9：Ø1 20 C3 FF $2 \emptyset$ CC FF $2 \emptyset 83$ 1Bø1：E8 ØA 4C 19 1C A9 24 AØ B9
 1B11：1の Dø Ø8 A9 Øø 8D 86 Ø2 64 1B19：4C $86 \quad 99 \quad 2 \emptyset \quad 07 \quad \emptyset B A D C 8 \quad C 2$ 1B21：26 A2 Øø Aø Ø2 $2 \emptyset$ BD FF 29 1B29：A9 Ø1 A2 Ø8 AØ ØØ 2Ø BA 49
 1B39：66 A2 Ø1 $2 \emptyset$ C6 FF $2 \emptyset$ E4 C8 1B41：FF C9 FF Dø 68 20 E4 FF 84 1B49：C9 FF DØ 612057 ØB 20129 1B51：E4 FF $85 \quad 33 \quad 20$ E4 FF 85 F7 1B59：34 Aø $32 \quad 2 \varnothing$ E4 FF 9988 FC 1B61：26 88 DØ F7 20 E4 FF C9 C4
 1B71：85 3A $2 \emptyset$ E4 FF A $\emptyset \emptyset 915 \mathrm{~F}$ 1B79：39 20 E4 FF Aø 019193956 1B81：4C 65 1B A5 $2 \mathrm{~F} 85 \quad 39$ A5 9C 1B89： 3 Ø 85 3A Aø ØØ $2 \emptyset$ E4 FF D4 1B91：91 39 C8 D 9 F8 E6 3A A5 82 1B99：3A C5 34 9Ø FØ FØ EE A9 CØ 1BAl：$\emptyset 1 \quad 2 \emptyset \quad C 3$ FF $2 \emptyset$ CC FF $2 \emptyset$ 2D 1BA9：E8 ØA 4C 19 1C A9 Ø1 2ø 9B 1BB1：C3 FF $2 \emptyset$ CC FF $2 \emptyset$ E8 ØA F6 1 BB9：A9 26 Ag 6B A2 02 4C $49 \begin{array}{lllllll}18\end{array}$ $1 \mathrm{BCl}: \varnothing 920 \mathrm{CC} F \mathrm{FF}$ A9 $\quad$ Øø $2 \emptyset \mathrm{BD} 69$ $1 \mathrm{BC} 9: \mathrm{FF}$ A9 $\quad$ ØF A8 A2 $\emptyset 8 \quad 2 \emptyset \mathrm{BA} \emptyset 7$ 1BD1：FF $2 \emptyset$ C $\varnothing$ FF A2 $\quad$ ØF $2 \emptyset$ C6 $8 \emptyset$ lBD9：FF $2 \emptyset$ E4 FF 8D CE 26 2ø 26 1BE1：CC FF AD CE 26 C9 30 D $\quad \mathrm{AA}$ 1BE9：Ø2 $18 \quad 6 \emptyset \quad 38 \quad 60$ AØ 4 F A9 84 $1 \mathrm{BF} 1: 25 \mathrm{~A} 2 \quad$ Ø9 2049 Ø9 20 C8 FD 1BF9：1Ø A9 ØF A8 A2 Ø8 $2 \emptyset$ BA 3 F 1CØ1：FF AD C8 26 A2 $\emptyset \emptyset$ A $\emptyset \quad \emptyset 2 \quad 78$ 1Cø9：2の BD FF $2 \emptyset \mathrm{C} \emptyset \mathrm{FF}$ A9 ØF 2B 1C11：2の C3 FF A9 Øø 8D CE 26 DE $1 \mathrm{C} 19: 20$ E7 FF A9 ØF A8 A2 Ø8 5E $1 \mathrm{C} 21: 2 \emptyset \mathrm{BA} \mathrm{FF}$ A9 ØØ $2 \emptyset \mathrm{BD} \mathrm{FF} \mathrm{AE}$
 $1 \mathrm{C} 31: 2 \emptyset$ D2 FF A2 $\mathrm{gF}^{2} 2 \emptyset \mathrm{C} 6 \mathrm{FF}$ DE 1C39：AD CE 26 FØ Ø3 2Ø D2 FF ØE

1C41：2の E4 FF C9 ØD FØ 06 2の $\quad$ B7 1C49：D2 FF 4C 41 1C A9 日F 2ø 4E 1C51：C3 FF 20 CC FF 20 8F ØB E6 1C59：A9 øø 8D 86 Ø2 60 2ø Ø7 59 1C61：ØB A9 9320 D2 FF A9 Ø1 E8 1C69：A2 Ø8 AØ Øø $2 \emptyset$ BA FF A9 9E 1C71：Ø1 A2 5E AØ 2520 BD FF CD 1C79：2の CØ FF Bø 39 A2 $\quad$ 日1 $20 \quad 73$ 1C81：C6 FF 2Ø E2 1C 2ø E2 1C 92 1C89：20 E2 1C 2ø E2 1C FØ 26 9F 1C91：20 E2 1C 48 2ø E2 1C AA ØA 1C99：68 A8 8A 20 ØE 1F A9 2Ø E3 1CA1： 20 D2 FF $2 \emptyset$ E2 1C F 06 1ø 1CA9：20 D2 FF 4C A4 1C A9 ØD 61 1CB1：20 D2 FF 4C 89 1C A9 Ø1 84 1CB9：2の C3 FF $2 \emptyset$ CC FF A9 5 F ØE 1CCl：85 FB A9 2585 FC 2058 FB 1CC9：Ø9 2 2 E4 FF C9 ØD DØ F9 49 1CD1：2 2 E8 ØA $2 \emptyset 7 \mathrm{~F}$ ØB $2 \emptyset 8 \mathrm{~F}$ 8F 1CD9：日B A9 Øø 8D 86 Ø2 4C 86 1CE1： 0920 CF FF 48 A5 9029 C3 1CE9： BF FØ $\quad 66 \quad 68 \quad 68 \quad 684 \mathrm{C}$ B7 BA 1CF1：1C $686 \emptyset \mathrm{AD} \mathrm{D} \emptyset 23 \mathrm{D} \emptyset$ Ø1 EE 1CF9：60 A9 26 Aø 59 A2 ØØ 2011 1DØ1：49 Ø9 A5 45 8D C2 26 A5 94 1Dø9：46 8D C3 26 A9 91854546 1D11：85 46 AD $81 \quad 26 \quad 85 \quad 39 \mathrm{AD}$ D4 $\begin{array}{lllllllll}1 \text { D19：82 } & 26 & 85 & 3 A & \text { Aø } & \emptyset 1 & B 1 & 39 & 18\end{array}$ $\begin{array}{llllllllll}1 D 21: F 0 & 38 & 85 & 2 \mathrm{E} & 88 & \mathrm{~B} 1 & 39 & 85 & 78\end{array}$ 1D29：2D B1 2D 29 Ø3 C9 Ø2 D0 B2 1D31：29 38 2ø B8 20 A2 øØ AC D5 1D39：BE 26 Bl 2D 8D BE 26 C8 El 1D41：B1 2D 2ø A9 ØA 9D 3C Ø3 8ø 1D49：E8 C8 CC BE 26 DØ F1 A9 B1 1D51：øø 9D 3C Ø3 8E BE $26 \quad 2 \emptyset 86$ 1D59：18 21 A5 $39 \quad 18 \quad 69 \quad \emptyset 2 \quad 85 \quad 2 \varnothing$ 1D61：39 9Ø Ø2 E6 3A E6 46 A5 AA 1D69：46 C9 C9 D 0 AF A9 0185 2B 1D71：46 E6 45 A5 45 C9 33 Dø 14 1D79：A3 AD C2 $26 \quad 85 \quad 45 \mathrm{AD}$ C3 9 C 1D81：26 $85 \begin{array}{lllllll}46 & 38 & 20 & \text { B8 } & 20 & 4 C & \text { EC }\end{array}$ 1D89：86 Ø9 $2 \emptyset \quad 2 \sigma 1 F 1820$ B8 Al 1D91：2Ø A9 ØØ A8 $91 \quad 39$ C8 $91 \quad 65$ 1D99： 39 20 F4 1C 60 A9 24 Aø 6B 1DA1：DE A2 $082049 \quad 99 \mathrm{AD}$ D 091 1DA9：23 AE 8D Ø2 EØ 05 Fg Ø5 F4 1DB1：49 FF 8D DØ 23 C9 ØØ FØ 8Ø 1DB9： 06 A9 $4 \mathrm{E} 2 \emptyset \mathrm{D} 2 \mathrm{FF} 6 \emptyset$ A9 2 E 1DC1：46 2ø D2 FF $2 \emptyset$ D2 FF 6ø 2E
 1DD1：23 AD 3C Ø3 FØ 4E C9 3D 52 1DD9：FØ 27 AE A4 Ø8 DD A4 Ø8 7F 1DE1：F0 Ø8 CA DØ F8 A9 01 4C B9 1DE9： 04 1E AD BE 26 C9 25 BØ A2 1DF1：33 AØ 3C A9 Ø3 $2 \emptyset$ EØ ØC 76 1DF9： $2 \emptyset 79$ Øø Dø E8 A9 Øø FØ 8E
1EØ1： 02 A9 Ø2 8D BD 26 1EØ9：B8 $2 \emptyset \mathrm{~B} \emptyset \quad$ Ø9 AD D1 23 8D D8 1E11：BF 26 4C IF 1 E AØ $\quad$ ØØ Bl 57 1E19：2D 29 FC 8D BF 26 20 18 9D 1E21：21 $20 \mathrm{~F} 4 \mathrm{IC} 6 \emptyset \mathrm{AE}$ C8 26 CB 1E29：CA CA CA CA BD Øø Ø2 C9 3F 1E31：45 Dの 78 E 8 BD ØØ 02 8D 61 1E39：CD 26 E8 BD ØØ Ø2 38 E9 41 1E41：3Ø 8D BC 26 E8 BD øø Ø2 33 1E49：38 E9 30 AE BC 26 Fø 6673 1E51：18 69 GA CA Dの FA 8D BB 2B 1E59：26 AD CD 26 C9 2D Fø 4C 61 1E61：A2 Øø AØ Øø BD Øø Ø2 C9 BE 1E69：45 Fø 08 E8 C9 2E FØ F4 Fl 1E71：C8 DØ F1 88 8C CD 26 AD A2 1E79：BB $26 \quad 38$ ED CD 26 8D BB Eø 1E81：26 A2 Ø1 AØ Ø1 BD ØØ Ø2 A4 1E89：E8 C9 2E FG F8 C9 45 Fg EB 1E91：ø6 99 øø 02 C8 DØ EE A9 68 1E99：30 AE BB $26 \quad 99$ Øø 02 C8 ØD 1EA1：CA D 0 F9 A9 Øø 99 ØØ Ø2 19 1EA9：8C C8 26 6Ø CE BB 26 A2 7D 1EB1：ØØ AØ Øø BD Øø Ø2 E8 C9 95 1EB9：2E FØ F8 C9 45 F F Ø6 9998 1ECl：28 Ø4 C8 DØ EE A9 Øø 99 FØ 1EC9： 28 Ø4 A9 2E 8D Øø Ø2 AE 52 1ED1：BB 26 A9 $3 \varnothing$ 9D ØØ 02 CA 69

1ED9：D FA A2 Øø AC BB 26 C8 FA
 1EE9：E8 C8 D0 F4 8C C8 26 60 6A 1EF1：2ø 73 Ø9 A9 $132 \emptyset$ D2 FF 95 1EF9：AD $83 \quad 26 \quad 38$ E5 33 AB AD 31 1F01：84 26 E5 3420 ØE 1F A9 2C 1Fø9：øø 8D 86 Ø2 $602 \varnothing 91$ B3 F5 1F11：2ø DD BD A9 0185 FC A9 EA 1F19：$\varnothing 185$ FB $2 \varnothing 58$ Ø9 $6 \varnothing$ Aø ø3 1F21：Ø1 B1 39 Fø E7 A9 øø 91 F9 1F29：39 $88 \quad 91 \quad 39$ B1 2D 29 ø3 83 1F31：C9 ø2 Dø ø9 C8 Bl 2D A8 8F 1F39：Bl 2D 4C 41 1F C8 Bl 2D E5 1F41：85 FB 1865 2D 8D 63 1F 20 1F49：A5 2D 8D 66 1F A5 2E 8D 37 1F51：67 1F 69 øø 8D 64 1F A5 1A 1F59：34 38 ED 64 1F AA E8 Aø D9 1F61：øø B9 FF FF 99 FF FF C8 A3 1F69：Dø F7 EE $641 F$ EE 67 1F D4 1F71：CA D 0 EE A5 33 38 E5 FB C3 1F79：85 33 A5 34 E9 ø0 8534 CD 1F81：AD 812685 FD AD 8226 E5 1F89：85 FE Aø Ø1 Bl FD FØ 22 F7 1F91：38 88 Bl FD E5 2D 8D BB DE 1F99：26 C8 Bl FD E5 2E ØD BB Fø 1FAl：26 9ø ØF 88 Bl FD 38 E5 5D 1FA9：FB 91 FD C8 B1 FD E9 øø EF 1FBl：91 FD C8 FØ Ø3 C8 DØ D4 12 1FB9：E6 FE C8 A5 FE C5 $3 \varnothing$ D $\varnothing$ DE 1FCl：CB 60 A9 24 Aø 38 A2 Ø2 A2 1FC9：2ø 49 ø9 2ø E6 ø8 297 F B6 1FD1：C9 59 DØ ø3 4C E2 FC 4C C9 1FD9：86 Ø9 AD CB 268545 AD 8F 1FE1：CC $26 \quad 85 \quad 461820$ B8 20 F7 lFE9：AD CD 26 8D BD 26 AD CF Cl 1FF1：26 8D BF 26 AD CE 26 8D 83 1FF9：BE 26 4C 622348 A5 45 9B 2øø1：8D CB 26 A5 46 8D CC 2642 2øø9：AD BD 26 8D CD 26 AD BF 4F 2ø11：26 8D CF 26 AD BE 26 8D 66 2ø19：CE 2668 E9 41 3ø BB Fø 29 2ø21： 66 C9 ø2 Bø B5 A9 1A 85 3ø 2ø29：45 $2 \varnothing 73$ øб E9 4ø 3ø AA DD 2ø31：F6 A8 C9 1B Bø A4 1865 AC 2ø39：45 C9 33 Bø 9D $85452 \varnothing \mathrm{AD}$ 2ø41：73 øø Bø 96 2ø F3 BC $2 \varnothing 25$ 2ø49：AA Bl C9 øø Dø 8C Cø øø BE 2ø51：FØ 88 CØ C9 Bø 848446 C7 2ø59：38 2ø B8 2ø 9ø 97 AD BD 9ø 2ø61：26 C9 ø1 Dø Ø3 4C DB 1F 74 2ø69：A Ø 62 A2 $6 \varnothing$ B1 2D C9 2A CE 2ø71：FØ F3 Bl 2D 9D øø ø2 C8 E9 2ø79：E8 CC BE 26 DØ F4 A9 øø 49 2ø81：9D øø ø2 A5 7A 48 A5 7B E6 2ø89：48 AØ ØØ A9 Ø2 2Ø EØ ØС ØF 2091：68 85 7B 6885 7A AD CB 9A 2699：26 8545 AD CC 26854622 2øAl：18 $2 \varnothing$ B8 $2 \varnothing$ AD CD 26 8D 8D 20A9：BD 26 AD CF 26 8D BF 2612 2øBl：AD CE 26 8D BE $2660 \emptyset 871$ 20 B9：A6 45 CA 86 39 A9 C8 85 E7 2øCl：3A 18 A9 øø A2 ø8 6A 66 CA 2ØC9：39 9Ø Ø3 1865 3A CA 1066 2øD1：F5 85 3A A6 46 CA 8A 18 AA 2øD9：65 3985 39 A5 3A 69 øø 48 2øE1：85 3A 663926 3A A5 3A 67 20E9：6D 8226 85 3A Aø 01 Bl A6 20F1：39 DØ Ø3 281860 AA 88 Ø6 2ø F9：B1 3985 2D 862 E 2890 B2 21ø1：14 Bl 2D 29 Ø3 8D BD 26 El 2109：Bl 2D 29 FC 8D BF 26 C8 E4 2111：B1 2D 8D BE $26 \quad 38 \quad 60 \quad 20$ ø8 2119：2ø 1F AD BD 26 C9 ø2 Fø 12 2121：32 EE BE 26 EE BE 26 Aø D1 2129：øø A5 33 91 39 C8 A5 34 Cø $2131: 913988$ AD BD 26 gD BF D6 2139：26 9133 C8 AD BE 26 91 2C 2141：33 C8 A2 øб BD 3C Ø3 91 1A 2149：33 C8 E8 CC BE 26 D8 F4 66 2151：4C A7 $212 \emptyset$ E7 21 EE C8 34 2159：26 EE C8 26 38 AD C8 2616 2161：6D BE 26 8D BE 26 AC C8 58 2169：26 AD BE 269133 A2 øø ø3

2171：C8 BD 3C Ø3 9133 C8 E8 13 2179：CC BE 26 D $\varnothing$ F4 AØ øø A5 73 2181：33 9139 C8 A5 349139 CF 2189：88 AD BD 26 øD BF 2691 DA 2191：33 C8 AD C8 26 91 33 C8 88 2199：A2 ø2 BD FE Ø1 9133 C8 D2 21A1：E8 EC C8 26 D $\varnothing$ F4 A5 33 E7 21A9：18 6D BE 26 9ø ø6 A5 34 A9 21B1：C9 9F F0 øF A5 3318 6D 67 21 B9：BE $26 \quad 85 \quad 33$ A5 $34 \quad 69$ øø 99 21C1：85 34 60 A9 øø 85 C6 A8 C6 21C9：91 39 C8 $91 \quad 39$ A9 25 Aø Bø 21D1：89 A2 øø $2 \varnothing 49$ Ø9 A5 4582 21D9：8D 8626 A5 46 8D 872641 21E1：A2 FD 9A 4C 4D ø8 BA 8E 9B 21E9：DØ 26 A2 Øø AØ Øø BD 3C 2 F 21F1：ø3 2ø B3 ØA C9 28 DØ Ø1 66 21F9：C8 C9 29 D $\varnothing$ Ø1 88 9D 3 C E6 22ø1：ø3 E8 EC BE 26 DØ E7 Cø 8F 22ø9：øø Fø Ø3 4C $62 \quad 23$ A9 øø Al 2211：48 A9 3C 85 7A A9 Ø3 85 C9 2219：7B $2 \varnothing \quad 73$ øб 9ø 4C C9 2D ø8 2221：F0 48 C9 2B FØ 44 C9 2E 36 2229：Fø 4ø C9 50 Fø 25 C9 28 ØC 2231：Fø 15 C9 41 Fø ØB C9 42 ØA 2239：FØ 97 C9 40 FØ ØF 4C 62 B3 2241：23 20 FE 1F 4C 6E 22 A9 FA 2249：01 48 4C 1A 22 2ø 5D 12 A9 2251：4C $6 \mathrm{E} \quad 22 \quad 2073$ øø C9 4916 2259：FØ Ø3 4C 6223 A9 А8 АØ 38 2261：AE 20 A2 BB $2 \varnothing 73$ øの 4C $3 \varnothing$ 2269：6E $22 \quad 20$ F3 $\quad$ BC $2 \varnothing 79$ øø 10 A 2271：F0 78 A2 ø2 C9 2B FØ 35 D2 2279：E8 C9 2D Fø 3ø E8 C9 2A 3C 2281：Fの 2B E8 C9 2F Fø 26 E8 35 2289：C9 5E Fø 21 C9 29 Fø ø3 52 2291：4C $62 \quad 2368$ Fø 14 C9 91 EB 2299：FØ 0748202 E 234 C 944 E 22Al：22 E6 7A Dø ø2 E6 7B 4C FB 22A9：6E 22 4C AB 12864 B 68 9B 22B1：48 A8 B9 B8 23 DD B8 23 2C 22 B9：9ø 1ø 2ø 2E 23 A6 4B 68 E3 $22 \mathrm{Cl}: 48$ A8 B9 B8 23 DD B8 23 3C 22C9：B 0 FØ 201 B BC A5 6648 E9 22D1：A5 6548 A5 6448 A5 6398 22D9：48 A5 6248 A5 6148 A5 65 22E1：4B 484 C 1 A 22 FO 7 A 4 C 1 F 22E9：12 BB $6848 \mathrm{~F} \emptyset 662 \emptyset 2 \mathrm{E}$ C5 22F1：23 4C EB $22682 \varnothing$ DD BD B7 22F9：Aø Øø AD Øø Ø1 C9 $2 \emptyset$ FØ A4 2301：21 B9 Ø0 Ø1 99 ø0 Ø2 Fø 18 2309： 03 C8 D9 F5 8C C8 26 A2 F2 2311：ø0 BD 3C Ø3 FØ Ø9 2ø A9 14 2319：0A 9D 3C Ø3 E8 D6 F2 4C 40 2321：26 1E B9 Ø1 Ø1 99 Ø0 ø2 B9 2329：F0 E2 C8 DØ F5 6885 FB 1F 2331：68 85 FC 68854 C 6885 E6 2339：69 68 85 6A 68 85 6B 68 3E 2341：85 6C 6885 6D 68856 E 51 2349：45 66 85 6F A5 4C ØA A8 8E 2351：A5 FC 48 A5 FB 48 B9 C 042 2359：23 48 B9 BF 23 48 A5 61 5D 2361：60 AE Dø 26 9A A9 ø7 8D 17 2369：C8 26 Aø øø B9 9A 2499 CB 2371：øø Ø2 C8 Cø ø7 DØ F5 A9 6E 2379：øØ 99 øø Ø2 4C 10 23 øの 2 F 2381：øø ØВ ØС øø øø Ø4 Ø4 0428 2389：ø4 Ø4 ø4 Ø4 05 05 0505 DE
 2399：ø6 $0707070707 \quad 07 \quad 06 \quad 28 \quad 72$ 23A1：50 78 Aø C8 Fø 18 40 689 F 23A9：90 B8 Eø ø8 $3 \varnothing 588 \emptyset$ A8 8F
 23B9： 01 ø2 ø2 ø3 ø3 ø4 F4 22 A5 23Cl：F4 2269 B8 52 B8 2A BA 48 23C9：E5 22 7A BF 4E 5446 Øø 27 23D1：2C $2 \emptyset \quad 2 \emptyset 414141424123$ 23D9：43 41444145414641 AB 23E1：47 $414841 \quad 49414 \mathrm{~A} 415 \mathrm{E}$ 23E9：4B 4l 4C 4l 4D 4l 4E 4111 23Fl：4F $41 \quad 504151415241$ C3 23F9：53 $41 \begin{array}{llllllll}54 & 41 & 55 & 41 & 56 & 41 & 76\end{array}$ 2401：57 $41584159415 A \quad 42$ 2B

2409：41 42424243424442 DC 2411：45 $424642 \quad 4742 \quad 48 \quad 42 \quad 8 \mathrm{~F}$ 2419：49 42 4A 42 4B 42 4C 4242 2421：4D 42 4E 42 4F 425042 F4 2429：51 $42 \begin{array}{lllllll}52 & 42 & 53 & 42 & 54 & 42 & \text { A7 }\end{array}$ 2431：55 425642574258 9B B3 2439：C5 D8 C9 D4 3A 20 2ø Cl 75 2441：52 4520594 F 552053 Ø1 2449：55 52 45 2ø 28 D9 2F CE 51 2451：29 3 F øø 98 D3 $504545 \quad 37$ 2459：44 C3 41 4C 43 øø 93 ØE FØ 2461：ø8 98 D3 50 454544 C 3 DE 2469：41 4C 43 2ø $42592 \varnothing$ CB 53 2471：45 56 49 4E 2ø CD 4152 ØD 2479：54 49 4E øø 9B C3 CC C5 53 2481：C1 D2 3A 20 2ø Cl 5245 9A 2489：2ø $594 \mathrm{~F} 552 \emptyset 535552$ C2 2491：45 2ø 28 D9 2F CE 29 3F 6D 2499：日ø 2A 451212 ØF 12 2A 51 24Al：9ø D7 49445448 3A Øø CD 24A9：9B C7 4F 544 F 3A øø 9B DF 24Bl：C3 48414 E 47452054 DE 24B9：4F 3 A 28 28 2812 D4 92458 C 24Cl：58 $542 \mathrm{C} 2 \varnothing 12$ CE 925519 24C9：4D $455249432 \mathrm{C} 2 \emptyset 4 \mathrm{~F} 43$ 24D1：52 $2 \emptyset 12$ C6 924 F 524 D BD 24D9：55 4C 41 3F øø 9ø D2 4529 24El：43 41 24E9：49 4F 4E $2 \varnothing 49532 ø 4 \mathrm{~F} 9 \mathrm{D}$ 24F1：øø 98 D3 415645 3A øø 2B 24F9：98 CC 4 F 4144 3A øø 9B 66 25ø1：C6 CF D2 CD Cl D4 3A 2ø CF 25ø9：2ø 12 CC $924546542 C$ C2 2511：20 12 C3 92454 E 5445 E 2 2519：52 2C 2ø 4F $522 \varnothing 12$ D2 9A 2521：92 49474854204 A 5581 2529：53 54494659 3F øø 9В 23 2531：C6 CF D2 CD C1 D4 3A $2 \varnothing \mathrm{FF}$ 2539：2ø 23 2ø 4F $462 \varnothing 4445$ D5 2541：43 49 4D 41 4C 20 50 4C ØD 2549：41 $43 \quad 45 \quad 53$ 3A øø 9B C4 Bø 2551：49 53 4B 2ø 43 4F 4D 4D BF 2559：41 4E 44 3A øø 24 øD Dø 7F 2561：52 455353 2ø 12 D2 C5 7A 2569：D4 D5 D2 CE 92 Øø 9B DØ 77
 2579：47 20.44415441205448 2581：52 $414 \mathrm{E} \quad 53 \quad 4645 \quad 52$ ø0 30 2589：9E CE 4F $542 \emptyset 454 \mathrm{E} 4 \mathrm{~F}$ ø8 2591：55 $474820524 F 4 F 4 D 1 F$ 2599：2ø $544 \mathrm{~F} \quad 26454 \mathrm{E} 544546$ 25Al：52 $204441 \quad 5441$ Øø 9B FC 25A9：CD $4 \mathrm{~F} 5645 \quad 204355 \quad 52$ D8 25Bl：53 $4 \mathrm{~F} 52 \quad 2 \varnothing 544 \mathrm{~F} 2 \varnothing 54$ 3A 25 B9：4F 5020.4 C 4546542094 25Cl：4F $46204 \mathrm{E} 45572 \varnothing 5046$ $25 \mathrm{C} 9: 4 \mathrm{~F} 534954494 \mathrm{~F} 4 \mathrm{E}$ ø0 23 25D1：9B CD 4F 564520435533 25D9：52 53 4F 52 2б $544 \mathrm{~F} 2 \varnothing 42$ 25El：42 4F 54544 F 4D $2 \varnothing 5233$ 25E9：49 $4748542 \varnothing 4 \mathrm{~F} 462 \varnothing$ E3 25Fl：42 4C 4F 43 4B Øб 97 DØ E8 25F9：52 $494 \mathrm{E} 54494 \mathrm{E} 472 \mathrm{E} \quad \mathrm{gF}^{2}$ 2601：2E 2E 06 97 C4 455649 9A 2609：43 45 20 23 Øø 97 D3 45 C9 2611：43 4F 4E $44 \begin{array}{lllll}51 & 52 & 59 & 20 & 67\end{array}$ 2619：Cl 4444524553532043 2621：23 øø 97 D 0 D2 C9 CE D4 2F 2629：2ø 54 4F 3A $2 \varnothing 12$ D3 92 AB 2631：43 5245454 E 2 C 201226 2639：C4 924953 4B 2C 204 F 85 2641：52 2ø 12 Dø 9252494 ECC 2649：54 45 52 3F øø 97 C6 4984 2651：4C 45 4E 41 4D 45 3A $\emptyset \emptyset$ E6 2659：81 D2 $4543414 \mathrm{C} 43 \quad 55$ øF 2661：4C 4154494 E 47 2E 2E 5D 2669：2E ØØ 9E CE 4F $542 \varnothing 41 \mathrm{DA}$ 2671：2の D3 5ø 454544 C3 4125 2679：4C 43 2ø 4649 4C 45 øб 2B

## Program 2：SpeedScript Integrator

Please refer to the new＂MLX＂article in this issue before entering the following listing．
ø8ø1：øB ø8 øø øø 9E 323036 EC
 Ø811：FF Aø Øø B9 B9 Ø8 $\mathrm{F} \emptyset$ Ø6 BA Ø819：2Ø D2 FF C8 D 0 F5 $2 \emptyset 12$ 2B Ø821：Ø9 8A C9 ØØ DØ Ø3 4C B8 75 Ø829：Ø8 A2 3C AØ Ø3 2の BD FF 8B Ø831：A9 Ø1 A2 Ø8 AØ Øø $2 \emptyset \mathrm{BA} 2 \mathrm{~B}$ Ø839：FF $2 \emptyset$ CØ FF A2 Ø1 $2 \emptyset$ C6 89 Ø841：FF A9 $20 \quad 85$ FC A9 Øø 85 2C Ø849：FB 2Ø CF FF A6 9ø DØ 1D 8F Ø851：C9 ØD DØ Ø2 A9 1F 482947 Ø859：8Ø $4 \mathrm{~A} \quad 85 \quad \emptyset 2 \quad 68 \quad 29 \quad 3 \mathrm{~F} \quad 05 \quad 78$ Ø861：Ø2 AØ ØØ 91 FB E6 FB DØ F7 Ø869：EØ E6 FC DØ DC A9 1F AØ BC Ø871：Øø 91 FB E6 FB Dø Ø2 E6 E1 ஏ879：FC A9 $01 \quad 20$ C3 FF 20 CC BF Ø881：FF AØ ØØ B9 E8 Ø8 $\mathrm{F} \emptyset ~ Ø 6 ~ A 4 ~$ Ø889：2Ø D2 FF C8 DØ F5 2Ø 12 9B Ø891：Ø9 8A C9 ØØ FØ 21 A2 3C 8F Ø899：Aø Ø3 $2 \emptyset$ BD FF A9 Ø1 A2 E5 Ø8A1：$\emptyset 8$ AØ Ø1 2Ø BA FF A9 $2 \emptyset 49$ ø8A9：85 Ø3 A9 Øø 85 Ø2 A6 FB EF ø8B1：A4 FC A9 Ø2 $2 \emptyset$ D8 FF 6Ø 6D ø8B9：ØE C6 49 4C 45 4E 41 4D A3
 ø8C9：45 4144 D3 $484545 \quad 54$ C8 Ø8D1：2の $4649 \begin{array}{lllllll}4 \mathrm{C} & 45 & 2 \emptyset & 5 \emptyset & 52 & \text { ØF }\end{array}$ ø8D9：49 $4 \mathrm{E} \quad 54 \quad 4544 \quad 2 \emptyset \quad 544 \mathrm{~F} 9 \mathrm{~B}$ Ø8E1：2の $44 \quad 49 \quad 53$ 4B 3A ØØ C6 7B ø8E9：49 $4 \mathrm{C} \quad 45 \mathrm{4E} 41$ 4D 45 2ø 29 Ø8F1：4F $46 \quad 20$ D3 50454544 E2 ø8F9：D3 43525950542046 FD Ø9Ø1：49 $4 \mathrm{C} \quad 45 \quad 2 \emptyset \quad 54 \quad 4 \mathrm{~F} \quad 20 \quad 43$ D8 Ø $909: 52 \quad 45 \quad 41 \quad 54 \quad 45 \quad 2 \emptyset \quad 20 \quad 3 A \quad 28$ Ø911：Øø A2 ØØ $86 \quad$ Ø2 $2 \emptyset$ E4 FF 8E Ø919：FØ FB A6 Ø2 C9 ØD FØ 1F 1B

Ø921：C9 14 F Ø ØF 20 D 2 FF E Ø 59 Ø929：14 FØ EA 9D 3C Ø3 E6 Ø2 76 Ø931：4C 16 Ø9 EØ ØØ FØ DE 2 Ø BF Ø939：D2 FF C6 Ø2 4C 16 Ø9 $2 \emptyset$ 9A Ø941：D2 FF 6Ø Øø Øø Øø Øø øø C8

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# Casio CZ-101 Music Synthesizer, The Music Shop For MIDI, And MIDI 4/PIus For Commodore 64 

Philip I. Nelson, Assistant Editor

Requirements: Commodore 64 with a disk drive, plus an external amplification system (or headphones).

The Casio CZ-101 is a sophisticated MIDI-standard digital synthesizer. MIDI (Musical Instrument Digital Interface) is an international set of standards for electronic music devices: MIDIstandard instruments can communicate and work together, even if they're made by different manufacturers. We tested the Casio synthesizer on a Commodore 64 with a Passport Designs MIDI interface. We also tried two examples of Passport software: The Music Shop for MIDI, a screen-oriented music program licensed from Brøderbund, and MIDI 4/Plus, which Passport refers to as a "digital recording studio on disk."

On its own, the Casio CZ-101 is a powerful, programmable performance instrument capable of producing an enormous variety of sounds. Though programming your own tones takes some practice, the Casio has 32 built-in tones ranging from conventional sounds like trumpet and electric piano to the unusual fairy tale and fantastic sound \#2. To help you learn sound programming, Casio includes a book of "patches" or program information for over 40 additional tones, including everything from blues harmonica and human voice to calimba.

Sixteen of the synthesizer's tones are programmable, and it stores these custom sounds in memory even when turned off. You program the sounds with the aid of calculator-like keys and a small liquid crystal display on the face of the synthesizer. You can store additional custom tones in an optional plugin memory cartridge. Like other synthesizers, the Casio works either in monophonic (one-voice) or polyphonic
(multivoice) modes. Four of the internal tones are eight-voice polyphonicmeaning you can play up to eight notes simultaneously-while the rest are four-voice polyphonic.

Though MIDI lets you interface the synthesizer with other devices such as computers, you can have lots of fun playing the synthesizer as a standalone instrument. The Casio's output jacks and adapter cable (included) make it easy to plug into an external amplifier, stereo system, studio mixer board, or an ordinary set of headphones.

One accessory you'll need right away, however, is a nine-volt power supply (the one I used cost less than \$5 at an electronics surplus store). Although the Casio comes with six D batteries, they last only a few hours and are really intended for backing up internal memory.

## Better Than SID

The Casio comes with three manuals: An operations manual which relates chiefly to hardware functions, a sound synthesis handbook which explains Casio's Phase Distortion method of digital sound generation, and a sound data book of preprogrammed patches.

With a MIDI interface and some software, you can plug the Casio (or any MIDI synthesizer) into a home computer and operate it under computer control rather than manually. The Music Shop for MIDI is a MIDI version of Don Williams' excellent 64 music program. Like the original Music Shop, this program features on-screen editing with conventional notation, pull-down window menus, and a choice of joystick control or keyboard commands. Of course, the MIDI version of The Music Shop generates sound through the synthesizer rather than the 64 's built-in sound chip. If you're familiar with 64 music, the difference is immediately apparent. Bass notes are round and full-
heavy enough to move furniture around the room-and there's a delicious absence of crackle or background noise. Best of all, you can input notes from the synthesizer keyboard as well as a joystick or the computer keyboard.

When evaluating any MIDI software, you should be aware that the standard itself imposes certain constraints. MIDI specifies a minimum standard, which individual manufacturers are free to exceed, and many MIDI instruments (including the Casio) give you extra features. Since MIDI software is necessarily designed around the standard, it may not let you use your synthesizer's extra features.

For instance, The Music Shop for MIDI provides access to only 16 of the Casio's built-in tones; the extra tones (including custom tones) can't be used within the program. And while multipart music is available, every note plays in the same tone: You can't play a three-part harmony with three different tones. This is ordinarily done by connecting additional MIDI devices to the system, using MIDI synthesizer \#1 to play voice one, MIDI synthesizer \#2 for voice two, and so on.

## Multitrack Digital Recording

MIDI/4 Plus is an enhanced version of Passport's popular four-channel software sequencer for MIDI devices. This is a realtime digital recorder with some quite elaborate editing functions. While The Music Shop for MIDI rates high in visual appeal, MIDI/4 Plus is functional and totally lacking in frills. When you run the program and enter Record mode, you can play on the synthesizer and digitally record one track of music. Though the screen shows nothing but a furiously ticking clock, every aspect of your performance is recorded in system memory. When the first track is complete, you can record a second while listening to the first, then repeat the process until as many as four tracks of music are complete.

Though Passport calls this a fourchannel recording system, that term is a bit modest. MIDI calls for a minimum of four separate control channels, but MIDI/4 Plus lets you overdub (mix) any track with another. Since digital record-
ings are free from background noise even after many generations of rerecording, there's no practical limit to the number of times you can overdub a new track onto existing material. It's like having an unlimited number of recording tracks: No matter how many times you mix a new track onto existing material, each note sounds as clear as when you first played it. In practice, of course, the total number of notes you can record is limited by the computer's memory. Passport claims a 5,000-note capacity for this system.

MIDI/4 Plus offers a wide array of other editing tools as well. You may edit, loop, or link individual tracks, autocorrect any track to fine-tune slightly off-kilter rhythms, synchronize your music with an external MIDI sequencer or drum machine (MIDI or non-MIDI), implement velocitysensitive or aftertouch-sensitive keyboard information, and even synchronize your music with previously recorded tracks on multitrack tape decks (using MIDI synchronizing devices such as the KORG KMS-30).

Which is the best package for you? The answer depends on your tastes and abilities. The Music Shop for MIDI lets you write and edit music visually, using the electronic equivalent of a sheet of music paper. This makes it ideal for the casual musician or someone who's not a keyboard virtuoso. Even if you can't play like Liszt or Herbie Hancock, you can write or transcribe music at your leisure and let the system take care of the actual performance. (Don't mistake this program for a realtime recorder, however; although you can input the pitch of each note from the synthesizer keyboard, you must still go to the computer to change other aspects of the music, such as note duration.)

If your keyboard skills are adequate for realtime recording, MIDI/4 Plus may be a more attractive choice, particularly if you want to create very complex music or interface with other MIDI devices.
Casio CZ-101 Synthesizer
Casio Computer Co., Ltd.
15 Gardner Road
Fairfield, NJ 07006
$\$ 499$
MIDI Interface for Commodore $64 \$ 129.95$
The Music Shop for MIDI $\$ 99.95$
MIDI/4 Plus $\$ 99.95$
Passport Designs, Inc.
625 Miramontes Street
Suite 103
Half Moon Bay, CA 94109

# The Newsroom 

Kathy Yakal, Assistant Features Editor

## Requirements: Apple II-series computer

 with at least 64 K RAM and a disk drive; IBM PC/PCjr with at least 64 K and a disk drive; or a Commodore 64. All versions also require a printer. Joystick and KoalaPad optional.The debate over how microcomputers can best be integrated into schools continues. Some software developers stress that the computer is best suited to achieving abstract goals such as encouraging critical thinking, while others promote software that is more testable and quantifiable. But there are needs that computers can serve quite well in the schools, needs that don't directly relate to curriculum. Students can use word processing programs to write papers. Teachers can use databases to keep track of grades. Administrators can use spreadsheets and other business software for record keeping.

The Newsroom, from Springboard Software, is a highly specialized program, designed to help you write, design, and print a newsletter or newspaper. Though it's being used in many schools, it has many other applications besides school newspaper production. It can be used to create newsletters for small businesses, computer user groups, or other community organizations.

The Newsroom is icon-driven; you move from one section of the program to another and issue commands by selecting the appropriate icon on the screen. The opening screen is divided into six areas, each containing an icon representing a different stage in newspaper production. You move the cursor to the area you want to work in and press the appropriate key. Then you're given a menu of icons to guide you through that part of the process.

If you want to design a logo to run across the top of the paper, you may want to start in the Banner section. You can choose from a variety of typefaces for your title, then move to the Clip Art area and select from hundreds of predesigned illustrations, pictures of animals, people, maps, trees, sports, and many other drawings. The program also provides graphics tools that allow you to modify the clip art (or design your own) and add decorative touches like borders.

The Copy Desk is where you write stories for the paper, using the program's text-editing functions. If you have people in various locations writing articles, you can go to the Wire Service section and exchange files and
photos via modem with anyone else using a copy of The Newsroom, even if the other computer is different from yours. For example, using The Newsroom, an Apple II computer can exchange files with a Commodore 64 or IBM computer.

When you've written all the copy and chosen artwork, select the Layout icon and design the format for each page, then roll the Press. Printer compatibility shouldn't be a problem; the program lets you choose from a list of all major printers and interfaces. The Newsroom accommodates pages of either letter-size paper ( $81 / 2 \times 11$ inches) or legal-size ( $81 / 2 \times 14$ inches). Letter-size can contain six "panels" and a banner, or eight panels without a banner per page; legal size allows eight panels and a banner, or ten panels without a banner per page.

As the program's documentation takes you step by step through all the editorial and production stages, it also provides a brief journalism tutorial. A disk containing hundreds of additional pieces of clip art is available at extra cost.

The Newsroom
Springboard Software
7807 Creekridge Circle
Minneapolis, MN 55435
$\$ 59.95$

## Dr. T's Sequencer For 64 And Apple

Richard Mansfield, Senior Editor
Commodore 64 or Apple II + /IIe computer with a disk drive. An IBM version is scheduled for release in January 1986. The Commodore version was reviewed.

A sequencer is much like a highly versatile, multitrack tape recorder: You play something on a keyboard and the sequencer memorizes the notes, duration, attack, and even such things as aftertouch and pitch bend (detuning notes for special effects or added expressiveness). There are several sequencers available which transform the Commodore 64 or Apple into an effective music controller, but few approach the versatility and ease of use of Dr. T's Sequencer. It's astoundingly powerful. It gives you virtually total control over the elements of musical composition and performance.

Dr. T's includes all the features of an efficient sequencer-save/load to disk; midi control; merge, append, copy, and delete sequences; play and
overdub-but also has many additional features which are either unique or rare. For example, you can enter music three ways: realtime (you play, it memorizes); step time (you play as slowly as you want, but it memorizes the true tempo); or keyboard (you type in the notes and their parameters).

Any errors can easily be changed in edit mode. Request Edit Sequence from the main menu and you see eight parameters for each note: time from start, event number, rhythm, midi channel, on/off/bend/delete, pitch, velocity, duration. As with a word processor, you have considerable control over the final sounds, and you can even listen to any portion of your music from within Edit mode.

You can work with a generous maximum of 35 sequences and 3300 notes simultaneously. In addition to copying and appending sequences, you can merge them. You can create a melody in one sequence and harmony in another. Then, after you play them back together and correct any errors, you can merge the two together quite easily. Similarly, you can overdub in realtime and even manipulate pitch and other factors while you're listening to a playback. From any position within a sequence, you can trigger another sequence. Among other things, this allows you to create "controller sequences" which have no musical content, but act as conductors of other musical sequences.

## Music Processing

When you're editing a composition with Dr. T's sequencer on the 64 , the excellent Commodore full-screen editor is at your disposal. You can efficiently list, insert, copy, extend, move, delete, and otherwise music process the composition. All this is easy to learn because it's both familiar and logically arranged.

One of the most interesting features in Edit mode is called Transpose. You can modify an entire sequence all at once. The Transpose menu has six options: pitch, velocity, duration, autocorrect, compress/expand, and time reversal. You can instantly move an entire sequence to a different key. Autocorrect will smooth out the rhythm to whatever degree of perfection you specify. If you want your piece to sound like industrial funk, select an extreme resolve. The compress/expand option will speed up or slow down the tempo across the entire sequence.

Bach would have loved this: The time reversal option causes a sequence to fold over on itself, to play backwards while preserving the time values of all the notes. For some quick Baroque, create a copy of a sequence, time reverse it,
and play the two together. If the results are harmonic, you've discovered a shortcut to mirror counterpoint.

It's easy to make various clock options and timing modifications, but you should make sure that this program supports whatever synthesizers you own. It does support the Yamaha, Sequential Circuits, Passport, and Korg interfaces. The Apple version uses the Passport interface. Dr. T also offers an interface by Sequential for the Commodore 64 for an additional $\$ 90$. If you buy the software and the interface together, the total is $\$ 200$.

When you add this excellent software plus an interface and synthesizer to your Commodore 64 or Apple, you become a one-person orchestra. You've got a set of well-designed, powerful tools to craft any kind of music. You can enter a composition by whatever method is easist for you, correct it to whatever degree of perfection suits you, and play it back through whatever instrument or combination of instruments sounds right.

## Dr. T's Sequencer

Dr. T's Music Software
66 Louise Road
Chestnut Hill, MA 02167
Commodore Sequencer $\$ 125$
Apple Sequencer $\$ 150$

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## CAPUTE! <br> Commodore 3-D Animated Graphics

If you have attempted to type in the " 3 D Graphics Package" program from this article in the November 1985 issue (p. 92), you have probably discovered that there is a problem when entering the data with MLX. The article does not mention that you must protect the upper portion of memory where the program data is stored before beginning to type the listing. Otherwise, the BASIC string variables created by MLX will overwrite your data as you enter it. Since the strings extend downward from the top of memory, the more data you type, the more you lose. Fortunately, the solution is quite simple. Before running MLX to enter 3-D Graphics Package data, enter the following line: POKE 56,132:CLR
(That CLR is the BASIC CLeaR variables statement, not the clear screen character.) This protects the area of memory where the 3-D Graphics Package program is stored. You might consider adding this line as the first line of a special copy of MLX for the graphics package program.

Since any data you entered without protecting memory was overwritten, there is no way to recover any previous work; it will have to be retyped. It may be some small consolation that the new version of 64 MLX introduced last month and printed again this month will prevent this sort of problem from ever happening again. (But remember that the new MLX cannot be used to enter the data for the 3-D Graphics Package program.)

## Commodore 64 Print Poker

This program, from the article "A Better Way to POKE on the Commodore 64" in the November 1985 issue (p. 125), was renumbered after testing. Unfortunately, no renumbering utility can adjust line number values in variables and PRINT statements as used in this program. To correct the "Print Poker" program so that it will correctly delete itself after running, change the $\mathrm{RL}=60280$ in line 60250 to $\mathrm{RL}=60270$, the $\mathrm{RL}=60300$ in line 60270 to $\mathrm{RL}=60290$, the $\mathrm{RL}=60320$ in line 60290 to $\mathrm{RL}=$ 60310 , the $\mathrm{RL}=60340$ in line 60310 to RL $=60330$ and the PRINT" $60135^{\prime \prime}$ in that line to PRINT"60190", the RL= 60360 in line 60330 to $\mathrm{RL}=60350$, and the PRINT" $60390^{\prime \prime}$ in line 60350 to PRINT" 60150 ". The PRINT" $60105^{\prime \prime}$ in line 60350 can be eliminated, but it does no harm.

# COMPUTE's Author Guide 

Most of the following suggestions serve to improve the speed and accuracy of publication. COMPUTE! is primarily interested in new and timely articles on the Commodore 64/128, Atari, Apple, IBM PC/PCjr, Amiga, and Atari ST. We are much more concerned with the content of an article than with its style, but articles should be clear and well-explained.

The guidelines below will permit your good ideas and programs to be more easily edited and published:

1. The upper left corner of the first page should contain your name, address, telephone number, and the date of submission.
2. The following information should appear in the upper right corner of the first page. If your article is specifically directed to one make of computer, please state the brand name and, if applicable, the BASIC or ROM or DOS version(s) involved. In addition, please indicate the memory requirements of programs.
3. The underlined title of the article should start about $2 / 3$ of the way down the first page.
4. Following pages should be typed normally, except that in the upper right corner there should be an abbreviation of the title, your last name, and the page number. For example: Memory Map/Smith/2.
5. All lines within the text of the article must be double- or triple-spaced. A one-inch margin should be left at the right, left, top, and bottom of each page. No words should be divided at the ends of lines. And please do not justify. Leave the lines ragged.
6. Standard typing paper should be used (no erasable, onionskin, or other thin paper) and typing should be on one side of the paper only (upper- and lowercase).
7. Sheets should be attached together with a paper clip. Staples should not be used.
8. If you are submitting more than one article, send each one in a separate mailer with its own tape or disk.
9. Short programs (under 20 lines) can easily be included within the text. Longer programs should be separate listings. It is essential that we have a copy of the program, recorded twice, on a tape or disk. If your article was written with a word processor, we also appreciate a copy of the text file on the tape or disk. Please use high-quality 10 or 30 minute tapes with the program recorded on both sides. The tape or disk should be labeled with the author's name, the title of the article, and, if applicable, the BASIC/ROM/DOS version(s). Atari tapes should specify whether they are to be LOADed or ENTERed. We prefer to receive Apple programs on disk rather than tape. Tapes are fairly sturdy, but disks need to be enclosed within plastic or
cardboard mailers (available at photography, stationery, or computer supply stores).
10. A good general rule is to spell out the numbers zero through ten in your article and write higher numbers as numerals (1024). The exceptions to this are: Figure 5, Table 3, TAB(4), etc. Within ordinary text, however, the zero through ten should appear as words, not numbers. Also, symbols and abbreviations should not be used within text: use "and" (not \&), "reference" (not ref.), "through" (not thru).
11. For greater clarity, use all capitals when referring to keys (RETURN, TAB, ESC, SHIFT), BASIC words (LIST, RND, GOTO), and three languages (BASIC, APL, PILOT). Headlines and subheads should, however, be initial caps only, and emphasized words are not capitalized. If you wish to emphasize, underline the word and it will be italicized during typesetting.
12. Articles can be of any length-from a singleline routine to a multi-issue series. The average article is about four to eight double-spaced, typed pages.
13. If you want to include photographs, they should be either $5 \times 7$ black and white glossies or color slides.
14. We do not consider articles which are submitted simultaneously to other publishers. If you wish to send an article to another magazine for consideration, please do not submit it to us.
15. COMPUTE! pays between $\$ 70$ and $\$ 800$ for published articles. In general, the rate reflects the length and quality of the article. Payment is made upon acceptance. Following submission (Editorial Department, COMPUTE! Magazine, P.O. Box 5406, Greensboro, NC 27403) it will take from four to eight weeks for us to reply. If your work is accepted, you will be notified by a letter which will include a contract for you to sign and return. Rejected manuscripts are returned to authors who enclose a self-addressed, stamped envelope.
16. If your article is accepted and you have since made improvements to the program, please submit an entirely new tape or disk and a new copy of the article reflecting the update. We cannot easily make revisions to programs and articles. It is necessary that you send the revised version as if it were a new submission entirely, but be sure to indicate that your submission is a revised version by writing, "Revision" on the envelope and the article.
17. COMPUTE! does not accept unsolicited product reviews. If you are interested in serving on our panel of reviewers, contact the Review Coordinator for details.

# Disassembler 

Ever wished you could disassemble a machine language program directly from disk? Now you can with this disassembler, which is written entirely in BASIC.
"Disassembler 64" is a modification of a PET/CBM program which appeared in the February 1982 issue of COMPUTE!. Like other disassemblers or monitor programs, it translates machine language (ML) from raw numbers into standard $6502 / 6510$ mnemonics such as LDA and RTS. While most disassemblers only work with programs in memory, Disassembler 64 can disassemble a program or disk sector directly from the disk.

Type in Disassembler 64 and save it before running it for the first time. When you type RUN, the program asks whether you want to display the disassembly on the screen (S) or send it to a printer (P). Then the program asks whether you wish to disassemble an ML file (F) or a specific track and sector on the disk ( T ). If you choose to disassemble a file, you must then enter the filename as it appears in the disk directory. (Note that Disassembler 64 accepts only program (PRG) files.) After the file has been found, you're asked if you wish to skip the BASIC portion of a program. Some ML programs load as if they were written in BASIC and begin with a line such as 10 SYS 2061. This option lets you skip over the BASIC line and go directly to the ML.

Disassembler 64 then disassembles the entire file from disk. Press the space bar to pause the disassembly, or press $Q$ if you want

R.B. Miller
to quit. You may only disassemble forward: That is, once you have passed a certain section of the ML file, there is no way to back up and reexamine it. If you want to examine a previous section, you must quit the disassembly and start over again. Likewise, there is no way to begin disassembly midway through the file: You must start at the beginning and disassemble forward until you reach the part you want.

Occasionally you may find an ML program that does not appear on the directory. Such programs are loaded with direct access commands, which go to a specific track and sector rather than looking to the directory for the file location. If you can locate the beginning of such a program with a disk utility, Disassembler 64 permits you to disassemble it. After selecting this option, you must enter the track and sector numbers for the sector you want to disassemble. Then you are asked for the start address within that sector. Press RETURN at the prompt if you want to start at byte zero (the first byte in the sector).

As you may know, each sector of a disk file contains link information which indicates the location of the next sector for that file. Disassembler 64 keeps track of the sector links, permitting you to disassemble more than one sector if you wish. The manual for your disk drive contains more information about disk tracks and sectors.

## Disassembler 64

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

10 POKE53272,21:POKE53281,1:PO KE5328ø, 3:PRINT"\{BLU\}":GOTO 33Ø
:rem 232
$2 \emptyset$ IFST-64THENRETURN :rem 62
$3 \varnothing$ FG=1:RETURN :rem $12 \emptyset$
$4 \varnothing$ GETPA\$:IFPAS=" "THENPA=NOTP
A :rem 119
$5 \emptyset$ IFPATHEN4ø :rem 24
$6 \emptyset$ IFPA $=" Q " T H E N F G=1: D=\emptyset$
:rem 145
76 GET\#5,D\$:GOSUB20:IFDS=""THE ND=ø:DS="ØØ": RETURN: rem 126
8 Ø $D=A S C(D \$): D \$=H \$(D): R E T U R N$
: rem 115
$9 \varnothing \mathrm{~A} \%=\mathrm{AD} / \mathrm{B}: \mathrm{AD}$ S $=\mathrm{H} \$(\mathrm{~A} \%)+\mathrm{H}$ \$ ( $\mathrm{AD}-\mathrm{A} \%$ * $B)$ : RETURN :rem 2 ø3

1 Øб $\mathrm{A} \%=\mathrm{D} / \mathrm{B}: \mathrm{C} \$=\mathrm{H} \$(\mathrm{~A} \%)+\mathrm{H} \$(\mathrm{D}-\mathrm{A} \%$ * B ): RETURN :rem 47
$11 \varnothing$ IFFGTHENRETURN: :rem 189
$12 \emptyset$ GOSUB4 0 :ONB? (D) GOTO14 $4,16 \emptyset$ , 27Ø:IFFGTHENRETURN : rem 5

: rem 111
140 M S $=\mathrm{M} \$(\mathrm{D}) \quad$ :rem 73
150 PRINT\#DV," "AD\$AD" \{SHIFT-SPACE\}"D\$" \{9 SPACES $\}$ "MS:AD=AD+1:GOSU B90:GOTO11ø :rem 132
$160 \mathrm{Bl}=\mathrm{D}: \mathrm{B} 1 \$=\mathrm{D} \$: \mathrm{M} \$=\mathrm{M}(\mathrm{D})+\mathrm{C} \quad$ ": G OSUB7 0 : ONA\% (B1) GOTO17ø,18Ø ,190,2øб,21ø,22ø,23ø
:rem 218
$170 \mathrm{MS}=\mathrm{M} \$+$ " \# \$"+D\$:GOTO260
: rem 11
$180 \mathrm{M}=\mathrm{M} \$+$ " Z \$" +D : $\mathrm{GOTO} 26 \emptyset$
:rem 67
190 M = $=\mathrm{M}$ + + " ( $\$$ "+D\$+", X) ": GOTO2
$60 \quad:$ rem 46

の :rem 39
$210 \mathrm{M}=\mathrm{M} \$+$ "Z \$"+D\$+", X":GOTO26 Ø :rem 48
 Ø : rem 5 0
230 IFD < 128 THEND $=A D+D+2$ :GOTO25
:rem 74
$240 \mathrm{D}=\mathrm{AD}+\mathrm{D}-254$ :rem 211
25 б GOSUBl $\varnothing$ ø $: M \$=M \$+" \$ "+C \$$
: rem 38
260 PRIN'1\#DV," "AD\$AD" "Bl\$" " $D \$ "\{6$ SPACES $\} " M \$: A D=A D+2: G$ OSUB9Ø:GOTOl1ø :rem 194
$270 \mathrm{Bl}=\mathrm{D}: \mathrm{B} 1 \$=\mathrm{D} \$: \operatorname{GOSUB} 7 \varnothing: \mathrm{B} 2 \$=\mathrm{D} \$$ : GOSUB70:M\$=MS (B1)+" $\$$ " $+\mathrm{D} \$$ $+\mathrm{B} 2 \mathrm{~S} \quad:$ rem 194
280 ONA\% (B1) GOTO320,290,300,31 $0 \quad$ :rem 117
$290 \mathrm{MS}=\mathrm{MS}+", \mathrm{X}$＂：GOTO320：rem 181 $3 \varnothing \varnothing$ MS＝MS＋＂，Y＂：GOTO32ø：rem 174 310 M $=\operatorname{LEFT} \$(M \$, 4)+"(\$ "+D \$+B 2 \$$ ＋＂）
：rem 58
$32 \varnothing$ PRINT\＃DV，＂\｛SHIFT－SPACE \}"AD \＄AD＂＂B1\＄＂＂B2\＄＂＂D\＄＂
\｛3 SPACES $\}$＂$M \$$ ：$A D=A D+3$ ：GOSU B90：GOTOl10 ：rem 60
$33 \varnothing$ CLOSE4：OPEN4，4：CLOSE3：OPEN 3，3：GOSUB44ø ：rem 115
340 GOSUB5øø ：rem 172
$35 \emptyset$ GOSUB54ø：IFFSTHENGOSUB77ø ：rem 96
360 GOSUB570：IFFETHENFORI $=1$ TOI Øøøø：NEXT：POKE198， $0:$ GOTO35 Ø ：rem 85
$37 \varnothing$ GOSUB610：GOSUB64ø ：rem 5
380 GOSUB11 $0: I F F S<>\emptyset A N D N T<>\varnothing T H$ END＝9：GOSUB78ø：GOTO4øø
：rem 33
$39 \varnothing$ PRINT\＃DV，＂＂：PRINT\＃DV，＂DIS SASSEMBLY COMPLETE＂：PRINT\＃ DV，＂＂：GOTO43ø ：rem 52
$4 \varnothing 0$ IFFY $=\varnothing$ THEN430 ：rem 245
410 TR＝NT：SE＝NS：GOSUB570：IFFET HEN35
：rem 59
$42 \varnothing$ GOSUB64ø：FG＝ $6: G O T O 38 \varnothing$
：rem 242
430 GOSUB730：GOTO340 ：rem 187
$440 \mathrm{~B}=256$ ： $\mathrm{DIMD}(15)$ ， $\mathrm{H} \$(255)$ ， M S （255），B\％（255），A\％（255）， $\mathrm{C} \$(1$ 5）：rem 63
$45 \varnothing$ FORJ $=\varnothing$ TO15 5 ：READD $(\mathrm{J}):$ ：NEXT ：rem 18
460 FORJ $=\varnothing$ TO1 $5: \operatorname{READC}(\mathrm{J}): \operatorname{NEXT:}$ PRINTCHR $(147)$＂\｛RVS\}"C\$( 0 ） C\＄（1б）：PRINT＂\｛DOWN \}"C\$(11) ：rem 84
$47 \varnothing$ PRINT＂$\{$ DOWN \}"C\$(12)
：rem 152
$48 \varnothing$ FORJ $=\varnothing$ TO15 5 ：FORD $=\varnothing$ TO15：HS（ $J$ ＊ $16+\mathrm{D})=\mathrm{D}$（ J$)+\mathrm{D}$（ D$): \mathrm{NEXT}: \mathrm{NE}$ XT
：rem 185
$49 \varnothing$ FORJ $=\varnothing$ TO255：READMS（J），B\％（J ），A\％（J）：NEXT：RETURN

## ：rem $2 ø 2$

500 D＝1：GOSUB790：IFD $=$＝＂S＂THEND $\mathrm{V}=3$ ： $\mathrm{GOTO} 33 \varnothing$
：rem 234
51ø IFDS＜＜＂P＂THEN5ø ：rem 95
$520 \mathrm{DV}=4$
530 RETURN ：rem 120
540 PRINT＂\｛CLR\}": D=2:GOSUB790: FS $=$＝C $:$ IFFS $\$=" T$＂THENFS＝1：R ETURN
rem 138
550 IFFS $\langle$＜＞＂F＂THEN546 ：rem 178
560 FS＝ $0: D=4$ ：GOSUB790：FL\＄＝DS：P RINT\＃DV，＂＂：PRINT\＃DV，FL\＄：P RINT\＃DV，＂＂：RETURN：rem 231
57ø CLOSE5：CLOSE15：OPEN15，8，15 ：GOSUB830：IFFETHENRETURN
：rem 221
$58 \emptyset \mathrm{FS}=\mathrm{FS}+1$ ：ONFSGOSUB5 $90,600:$ F S＝FS－1：RETURN
：rem 217
590 OPEN5，8，5，FL\＄＋＂，P，R＂：GOSUB 830：RETURN ：rem 132
600 OPEN5，8，5，＂\＃＂：PRINT\＃15，＂U1 ＂5；$\varnothing$ ；TR；SE：GOSUB83 $\varnothing$ ：RETURN
：rem 94
610 IFFSTHEN630 ：rem 135
$62 \varnothing$ GOSUB7ø：AD＝D：AD $=\mathrm{D}$ ：$:$ GOSUB7 $\emptyset: A D=A D+D * B: A D=D \$+A D \$: R E T$ URN
：rem 58
$630 \mathrm{D}=3: \operatorname{GOSUB} 790: \mathrm{AD}=\operatorname{INT}(\mathrm{A} \%): \mathrm{AD}$ \＄＝D
：rem 205
64ø PRINTCHR（147）：D＝5：GOSUB79 Ø：IFFY＝øTHEN71ø ：rem 251
650 IFFY－1 THEN640
：rem 240
$66 \emptyset$ PRINTC $\$(\varnothing) \operatorname{cs}(6): J=\varnothing$
：rem 240

0670
：rem 6
68 G GET\＃5，DS：IFDSTHENJ＝J＋2：GOT 0670 ：rem 8
690 GET\＃ $5, D \$: I F D \$ T H E N J=J+3: G O T$ $0670 \quad:$ rem $1 \varnothing$
7 （ø AD＝AD＋J＋3：GOSUB9 Ø ：rem 212
710 PRINTCHRS（147）C\＄（Ø）C\＄（7）＂
\｛2 DOWN \}": PRINT" \{DOWN \}
\｛7 RIGHT\}PRESS SPACE BAR T O PAUSE
：rem 4
720 PRINTSPC（12）＂\｛DOWN\}OR <Q> \｛SPACE\}TO QUIT\{2 DOWN\}":FO RX＝1TO6Øø：NEXT：RETURN
：rem $6 \varnothing$
$73 \emptyset$ FG $=\varnothing$ ：CLOSE5：CLOSE15
：rem 143
$740 \mathrm{D}=8$ ：GOSUB79の：IFFY＝ØTHENPRI NT\＃4：CLOSE4：END ：rem 139
$75 \emptyset$ IFFY－1THEN74ø ：rem 242
76 RETURN ：rem 125
77 Ø $\mathrm{D}=14$ ： $\mathrm{GOSUB} 790: T R=\operatorname{INT}$（A\％）： D $=15: \operatorname{GOSUB790}: \mathrm{SE}=\operatorname{INT}(\mathrm{A} \%): \mathrm{RE}$ TURN
：rem 227
$78 \emptyset$ PRINT＂$\{2$ DOWI $\}$ \｛ 2 RIGHT \}NEX T TRACK IS＂NT＂NEXT SECTOR \｛SPACE\} IS"NS
：rem 78
$79 \varnothing$ FY＝2：PRINTC\＄（ $\varnothing$ ）C\＄（D）＂
\｛3 LEFT\}";:INPUTDS:IFD\$="＂THEN79の
：rem 143
$8 \emptyset \emptyset A \%=\operatorname{VAL}(D \$): C \$=\operatorname{LEFT}(D \$, 1):$ IFCS＝＂N＂THENFY＝$\quad$ ：rem 84
810 IFCS＝＂Y＂THENFY＝1 ：rem 165
$82 \emptyset$ RETURN
：rem 122
$830 \mathrm{FE}=\emptyset:$ INPUT\＃15，ENS，EMS，ETS， ES\＄：IFEN\＄＝＂øø＂THENRETURN
：rem 236
84の CLOSE4：PRINTCS（ $\varnothing$ ）＂$\{$ RVS $\}$＂C\＄ （13）：PRINTCS（ $\varnothing$ ）ENS＂，＂EMS＂ ＂ESS＂，＂ETS：FE＝1：RETURN
：rem 153
$85 \emptyset$ DATAØ， $1,2,3,4,5,6,7,8,9, A$ ， B，C，D，E，F，＂\｛3 DOWN $\}$
\｛9 RIGHT \}
：rem 115
$86 \emptyset$ DATASCREEN／PRINTER
\｛2 SPACES \}S,T/S OR FILE
$\{2$ SPACES $\}\langle T / F\rangle\{3$ SPACES $\} F$ ，＂START ADDR\｛3 SPACES \}øøøø \｛3 LEFT\}
：rem 248
870 DATAFILENAME $\{2$ SPACES $\}-$ ，SK IP BASIC PROGRAM\｛3 SPACES \} N
：rem 82
$88 \emptyset$ DATASKIPPING BASIC．．．．，DIS ASSEMBLING．．．．：rem 226
890 DATADISASSEMBLE ANOTHER FI LE\｛ 3 SPACES $\} N$ ，DO NEXT T $\$$ \｛SPACE\}S\{3 SPACES\}Y,DISK U NASSEMBLER 64 ：rem 138
$9 \emptyset \emptyset$ DATA－BASIC DISASSEMBLER FO R C64 DISK FILES－：rem 31
$91 \emptyset$ DATAOUTPUT RESEMBLES ASSEM BLER SOURCE CODE．，DISK ERR OR．．．．．．：rem 244
920 DATA＂WHICH TRACK\｛3 SPACES\} 18\｛LEFT\}",WHICH SECTOR \｛3 SPACES\} 0
：rem 134
930 DATABRK，1，，ORA，2，3，．，．，．，， ，，ORA，2，2，ASL，2，2，．，
：rem 139
$94 \emptyset$ DATAPHP，1，ORA， 2,1, ASL A， 1 ，，，，，，，，ORA，3，1，ASL，3，1，,
：rem 229
950 DATABPL， 2,7, ORA， $2,4, \ldots,$, ，，，ORA，2，5，ASL，2，5，
：rem 2 ø3
960 DATACLC， 1, ，ORA， $3,3, \ldots, \ldots$, ，，ORA，3，2，ASL，3，2，，
：rem 132
970 DATAJSR，3，1，AND， $2,3,,,,$, BIT，2，2，AND，2，2，ROL， $2,2, \ldots$
：rem 4
$98 \emptyset$ DATAPLP，1，AND ，2，1，ROL A， 1
，，，，，BIT，3，1，AND，3，1，ROL， 3
，1，,
：rem 44
$99 \emptyset$ DATABMI，2， 7, AND 2,4 ，，，AND，2，5，ROL，2，5，，
：rem 184
1 Øøø DATASEC， 1, ，AND $, 3,3, \ldots$
，，，AND，3，2，ROL，3，2，，，
rem 158
1010 DATARTI，1，，EOR，2，3，．，．，．，
，，，EOR，2， $2, L S R, 2,2, \ldots$
：rem 218
$1 \varnothing 2 \emptyset$ DATAPHA， 1, EOR， $2,1, L S R$ A， 1，，，，，JMP，3，1，EOR，3，1，LSR ，3，1，．，
：rem 113
1030 DATABVC， $2,7, E O R, 2,4, \ldots, \ldots$ ，，．，EOR，2，5，LSR，2，5，．，
：rem 7
$1 \varnothing 4 \varnothing$ DATACLI， 1, EOR， $3,3, \ldots, \ldots$, ，，，EOR，3，2，LSR，3，2，，
rem 201
1050 DATARTS，1，，ADC，2，3，
，，，ADC，2，2，ROR，2，2，，
：rem 174
$106 \emptyset$ DATAPLA，1，，ADC，2，1，ROR A， $1, \ldots,, \mathrm{JMP}, 3,4, \mathrm{ADC}, 3,1$ ，ROR ，3，1，．，
：rem 68
1070 DATABVS，2，7，ADC，2，4，．，．，．， ，，，，ADC，2，5，ROR，2，5，，
：rem 225
1080 DATASEI， 1, ，ADC $, 3,3$ ，，，ADC，3，2，ROR，3，2，．， ：rem 156
$109 \emptyset$ DATA，，，STA， $2,3, \ldots, \ldots, S T Y$, $2,2, \mathrm{STA}, 2,2, \mathrm{STX}, 2,2, .$,
：rem 56
1100 DATADEY，1，，．，．，TXA，1，，．，．，S TY，3，1，STA，3，1，STX，3，1，，
：rem $2 \emptyset$
1110 DATABCC， 2,7, STA， $2,4,,,,$, ，STY，2，5，STA，2，5，STX，2，6， ：rem 109
1120 DATATYA，1，，STA，3，3，TXS， 1 ， ，，，，，，，STA，3，2，，4，．，
rem 240
1130 DATALDY， 2,1, LDA， 2,3, LDX， 2 ，1，，．，LDY，2， 2 ，LDA， 2 ，2，LDX ，2，2，．，：rem 110
1140 DATATAY，1，，LDA，2，1，TAX，1， ，，，，LDY， 3 ， 1, LDA， 3 ， 1 ，LDX， 3 ，1，，
：rem 19
1150 DATABCS，2，7，LDA，2，4，，．，．， ，LDY ，2，5，LDA，2，5，LDX ，2，6， ，：$\quad$ rem 37
$116 \emptyset$ DATACLV，1，，LDA，3，3，TSX，1， ，，，，LDY， 3 ， 2 ，LDA， 3 ， 2 ，LDX， 3 ，3，，：rem 37
$117 \emptyset$ DATACPY， 2,1, CMP， 2,3 ， ，CPY，2，2，CMP，2，2，DEC，2，2，
，，：rem 47
$118 \emptyset$ DATAINY，1，CMP ，2，1，DEX， 1 ， ，，，，CPY， 3,1, CMP，3，1，DEC， 3 ，1，．，
：rem 18
1190 DATABNE， 2,7, CMP， 2,4 ， ，，，，CMP ，2，5，DEC，2，5，
rem 215
12 Øø DATACLD，1，，CMP，3，3， ，，，CMP，3，2，DEC，3，2，，
rem 145
1210 DATACPX，2，1，SBC，2，3，．，．，．， ，CPX ，2，2，SBC，2，2，INC，2，2，
：rem 38
$122 \emptyset$ DATAINX，1，$S B C, 2,1, N O P, 1$ ， ，，，，CPX，3，1，SBC，3，1，INC， 3 $, 1,,, \quad:$ rem 21
1230 DATABEQ， 2,7, SBC， 2,4 ， ，，，，SBC， 2,5, INC， $2,5, \ldots$
：rem 211
1240 DATASED，1，，SBC， $3,3, \ldots, \ldots$ ，，，SBC，3，2，INC，3，2，．，，END ：rem 159

67 GET\＃5，DS：IFD\＄THENJ＝J＋1：GOT

## HOTWARE: Software Best Sellers



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# Introduction To AmigaDOS Part 1 

Charles Brannon, Program Editor

Amiga's Workbench, like the Macintosh desktop, is an easy to use operating system environment. Workbench gives you almost full access to the Amiga's features without requiring that you memorize commands. But there's another option on the Amiga, too: AmigaDOS, a more conventional and very powerful command-oriented operating system. Here's a guide to getting started with AmigaDOS.

The Commodore Amiga comes with a large looseleaf binder packed with information on this advanced computer. Even if you've never used a graphics-oriented operating system before, you can plug in the mouse and be up and running on the Amiga Workbench in very little time.

But there's something missing from the standard manuals: instructions for using AmigaDOS, a powerful alternative to the Workbench. Although the Workbench is a versatile tool for both beginners and expert users, there are also advantages to a command-driven operating system. With AmigaDOS, you can gain finer control over the computer and its many functions-at the expense of having to memorize dozens of commands and their proper syntax. These tradeoffs have been a subject of hot debate ever since the Macintosh made its debut three years ago. Fortunately, the Amiga gives you both options. And thanks to its multitasking capabilities, you can even flip back and forth between both systems at will.

All this is made possible by the Amiga's multilevel operating sys-
tem. The core is Intuition, a package of efficient subroutines designed to ease the software designer's task. It's filled with routines needed by almost every program, saving programmers the trouble of reinventing the wheel. Intuition includes powerful graphics utilities so programmers needn't program the computer at the hardware level.

## Pay No Attention To The Little Man

Attached to the Intuition core is AmigaDOS, which itself has two levels. First, AmigaDOS provides all the disk operating system functions for the computer, such as managing, opening, accessing, updating, and closing files; buffering direct memory access (DMA) for the disk drives; supporting named devices; and allocating memory.

Second, AmigaDOS as a tool provides one or more Command Line Interfaces (CLIs). A CLI is a traditional command-oriented operating system interface, much like CP/M, MS-DOS, and PC-DOSbut even more powerful. At a screen prompt, you can type in commands to load and run programs, list disk directories, copy, rename, and delete files, and even write simple programs called batch files.

When you start the Workbench, AmigaDOS comes with it. In fact, you've undoubtedly seen the AmigaDOS screen briefly appear when you first boot up the Workbench disk. AmigaDOS comes up first, loads the Workbench, then shuts down its CLI, transferring control to the Workbench.

AmigaDOS is like the Wizard of Oz . It pulls the strings of the marionette that is the Workbench. Meanwhile, hidden from sight, AmigaDOS is doing much of the work. When you step behind the curtain, you see how things are really done. Once the object-oriented illusion of the Workbench is stripped away, you find yourself working with files, streams, subdirectories, and pathnames.

## Starting A CLI

To start an AmigaDOS CLI, first run the Preferences tool by opening up the Workbench dissk and doubleclicking on the Preferences icon. The Preferences screen (see photo) has an option box labeled CLI [ON] [OFF]. Click the box ON, then click on either USE or SAVE, depending on whether you'd like the CLI option available whenever you start the Workbench in the future.

With CLI enabled, open the Workbench's System folder. In addition to the usual icons for Disk Copy and Initialize, you'll see a cube-shaped icon marked with 1> and labeled CLI. Double-click on this icon to open a CLI window.

The first thing you'll notice in the window is the $1>$ prompt. Unlike DOS prompts on most other computers, this doesn't represent the current disk drive. Instead, it represents the task number assigned to the window. AmigaDOS is one of the few microcomputer operating systems that can multitask itself.

To see how this works, enter NEWCLI at the $1>$ prompt. When you press RETURN, a second CLI window pops up with the prompt $2>$. This CLI is a complete, full-
powered CLI, independent from the first CLI. In effect, you now have two command-driven operating systems running on the computer. Each window can execute a different DOS task. While one CLI is busy printing a file, you can go to another CLI window to list a directory.

Although several CLI windows can be displaying output simultaneously, only one CLI window at a time can accept input. To select which CLI is active, point to its window and click the mouse button. You can distinguish active from inactive windows by glancing at the title bars-the bar of an inactive window is dimmed.

If you type NEWCLI at the $1>$ or $2>$ prompt, a third CLI window opens with a $3>$ prompt. How many CLI windows can be opened at once? On a 512 K Amiga, we've opened as many as 20 CLIs before encountering an out-of-memory message.

When you're done with a CLI, close it by entering ENDCLI. When you close the primary CLI, control reverts to the Workbench.

## AmigaDOS Devices

For any DOS commands to work, the startup (Workbench) disk must be in the current drive. Unlike other operating systems, AmigaDOS contains no memory-resident commands. All commands are extrin-sic-they're loaded from disk only when called. AmigaDOS always looks for commands first from the current directory, then the $C$ subdirectory on the SYS: (startup) disk. We'll elaborate on this in a moment.

You can type AmigaDOS commands and filenames in either upper- or lowercase (for clarity, all our examples are shown in uppercase). If you make any typing mistakes, you can press BACKSPACE or cursor-left to retype. Type CTRL$X$ to erase the whole line. You can get a complete list of all commands by typing DIR SYS:C. This shows the contents of the $C$ subdirectory on the startup disk, the directory where all AmigaDOS commands are stored.

The DIR command displays the current directory. By default, the current directory is listed from the internal drive, which is referred


To allow access to AmigaDOS from the Workbench, click the mouse button with the pointer positioned upon the CLI [ON] box within the Preferences screen.
to as DF0:. If you have a multipledrive system, you can get a directory of the first external drive by typing DIR DF1:. Up to three external drives can be daisy-chained, numbered DF1: to DF3:. The colon following the drive name is impor-tant-it tells AmigaDOS that it is a device name rather than the name of a file.

A special device, SYS:, refers to the system (startup) disk. Although the startup disk is usually in drive DF0:, SYS: is not necessarily synonymous with DF0:. SYS: refers to the startup disk, not a drive.

## Disk Names

Instead of referring to a physical drive, you can access a disk by name. When you use Workbench to copy or format a new disk, the disk is assigned a unique name, which is displayed beneath the disk icon on the Workbench screen. When specifying a disk name in a command, you must end it with a colon, as you do with device names. If the disk is not in a drive when you refer to it in a command, AmigaDOS prompts you to insert it.

The ability to specify disk names is vital with single-drive Amigas. When you type DIR, the DIR program is loaded from the Workbench disk and displays the directory of that disk. If you insert another disk and type DIR, you have to reinsert the Workbench disk so AmigaDOS can read the DIR file. Unfortunately, AmigaDOS doesn't ask you to put the other disk back in-so you still get the directory of the Workbench disk.

The solution? Follow the DIR command with the proper disk name. For example, DIR "BASIC

Demos:" (remember the colon) calls a directory of the disk named BASIC Demos. AmigaDOS still loads the DIR command file from the Workbench disk, but now asks you to insert "BASIC Demos" before displaying the directory. Specifying the disk name (also known as a volume name) forces AmigaDOS to refer to a disk instead of a drive.

Other device names are PAR: for the parallel printer port, SER: for the serial/modem port, PRT: for whatever printer port you've specified via the Preferences tool, and RAM: for the RAM disk. Another device, NIL:, is a null handler. It accepts output instantly, but does nothing with it. The NIL: device is useful for testing a program without wasting paper or time-just redirect the output to NIL:.

The RAM disk behaves just like a superfast disk drive, except that its contents are lost when the computer is rebooted or turned off. Be sure to copy anything important from the RAM disk to a real disk before shutting down, or even more frequently if power failures and brownouts are common in your area. The RAM disk is dynamic: Unlike some RAM disks, it has no fixed size. It starts out empty, then grows or shrinks as you add or remove files. Therefore, it's always 100 percent full, using only as much memory as it needs to hold the files you've stored there.

Whenever you want to refer to the RAM disk in an AmigaDOS command, just precede a filename with the prefix RAM:. At present, the RAM disk isn't accessible from the Workbench.

Another special device name, *, refers to the current keyboard/ screen device. Input from * is from the keyboard; output to * appears in the current window. Notice that this is different from the use of * as a wildcard character in some other operating systems.

## Understanding Pathnames

A file is the basic data storage object in AmigaDOS. A file is addressed by a filename, a string of up to 30 characters. Each file must have a unique filename. Filenames can include almost any character, including characters such as space, $=,+$,
and ", special AmigaDOS delimiters that you should avoid. (If a file contains special characters, you can enclose it in quotes to make sure the special characters aren't acted upon by AmigaDOS.) However, two characters are forbidden in filenames by AmigaDOS-the colon (:) and the slash (/).

Each drive has its own directo$r y$, a list of all filenames and subdirectory names. A subdirectory is a directory within a directory. Subdirectories are like drawers on the Workbench. You can even nest subdirectories within subdirectories within subdirectories, which can get confusing.

You separate a subdirectory name from a filename with the slash (/). Notice that this slash leans in the opposite direction of the backslash ( $\backslash$ ) used in IBM PCDOS for subdirectories.

A complete filename can be as simple as PROCEDURES, equivalent to DF0:PROCEDURES, since DF0: is the default drive. Filenames can also be a lot more complicated, such as DF1:BASIC PROGRAMS/ GIDGET, which refers to the program GIDGET in the subdirectory BASIC PROGRAMS on the external drive, or RAM:LOGO/DEMOS/ SPINNER, which refers to the file SPINNER in the DEMOS subdirectory which is in the LOGO subdirectory in the RAM disk.

Fortunately, there are shortcuts. Instead of entering the current pathname, such as DF0:DEMOS/ DOTS.INFO, it's sufficient to use DOTS.INFO if the current directory is DF0:DEMOS. We'll show below how to change the current directory.

## More About Multitasking

You can do nearly everything with AmigaDOS that you can with the Workbench. There are commands to copy files, delete files, rename files, format disks, send listings to printers, set date and time, and more. You can also run any application program from AmigaDOS.

All Workbench programs have two files: one file that contains the program, and another file with an extension of INFO that contains icon information for the program. For instance, the icon for the Preferences tool is drawn from PREFERENCES.INFO. To run the


Clicking on the CLI icon from the Workbench opens up this AmigaDOS screen window.

Preferences tool from AmigaDOS, enter PREFERENCES at a CLI prompt. Similarly, enter CLOCK to start the clock tool.

Be careful not to let the program you're running override the CLI. If you'd like to keep the CLI going while running another program, preface the AmigaDOS command with another command, RUN. This starts a new, simultaneous program. RUN CLOCK starts the clock while permitting the CLI to continue running. The clock becomes a new CLI task. We've used this feature on a 512 K Amiga to run MetaComCo ABasiC simultaneously with AmigaDOS, the Workbench, and a full-screen editor.

## AmigaDOS Commands

Following is a list of AmigaDOS commands with brief descriptions and examples. There isn't enough space to include every command more will be covered in Part 2. Also, some commands shown here may not be available on your copy of AmigaDOS/Workbench, while there may be other commands available to you that have not been documented. This article was prepared with AmigaDOS version 1.0. Type DIR SYS:C at a CLI prompt to see a complete list of available commands. When experimenting with AmigaDOS commands, we strongly recommend using a scratch disk to avoid wiping out an important file or even a whole disk.
CD (Change Directory.) Follow CD with the pathname of the directory you'd like to work with. Entering CD by itself displays the current search path. When you type a command, AmigaDOS first searches for the extrinsic command file in your current directory, then in the COM-

DIR directory. AmigaDOS also looks for all filenames in the current directory, unless you override the current directory with another pathname.
Example:
CD DF1:BASIC
This switches the current directory to the first external drive and the subdirectory BASIC.
COPY This copies a file or group of files to any legal destination. The keyword TO specifies the destination path. You can use the optional keyword FROM to specify a directory other than the current directory. If you are copying entire subdirectories, append the keyword ALL so that COPY creates a subdirectory in the destination directory. COPY normally displays the name of each file as it's copied. Append the keyword QUIET if you'd like to suppress this.
Examples:
COPY MATRIX.SORT TO DF1:

## MATRIX.BKP

This copies the file MATRIX.SORT in the current directory, creating a file called MATRIX.BKP in the main directory of the first external drive. COPY FROM DF1:GOBBLE TO DF0:
This copies the file GOBBLE from the external drive to the internal drive.
COPY DFO: TO DF1: ALL
This backs up the entire contents of the internal drive onto the external drive, including the contents of all subdirectories. COPY doesn't format the destination disk, so DISKCOPY is a more convenient way of backing up an entire disk.
COPY SYS:C TO RAM: QUIET
This copies the command directory to the RAM disk without listing all the filenames.
COPY * TO PRT:
This accepts lines from the keyboard and prints them on the printer until CTRL- 1 is pressed.
DATE This command sets the current date and time. When you create or update a file, AmigaDOS stamps the date and time on the directory. Since there's no batterybackup for the clock, however, the Amiga doesn't know this information until you tell it. By default, AmigaDOS assumes the date
stamped on the most recent file. Entering DATE by itself displays the current date.

To set the date from AmigaDOS without running the Preferences tool, follow the DATE command with a date in the form DD-MMM-YY (e.g. 25-DEC-85). To set the time, follow this with the form HH:MM (using 24-hour time, such as 13:00 for 1 p.m.). You can type DATE TOMORROW to advance the date ahead one day, or DATE YESTERDAY to back up one day. Another shortcut is to simply enter DATE dayname, as in DATE TUESDAY. If you use your Amiga frequently, this may be all you need to keep things up to date.

An interesting application of the DATE command is to determine which day of the week a certain date falls on. For example, DATE 25-DEC-86 sets the date to Christmas Day, 1986. If you then enter DATE by itself, AmigaDOS displays THURSDAY 25-DEC-86, letting you know that Christmas falls on a Thursday in 1986.
Examples:
DATE 04-JUL-76
This sets the current date to July 4, 1976. (The Amiga assumes you know which century you're living in, so there's no way to specify 1776 versus 1976 or 2076.)

## DATE 08:30 FRIDAY

This sets the time to 8:30 a.m. and advances the date to Friday. DATE FRIDAY 08:30 would also work.
DELETE This command deletes a file or group of files. Follow DELETE with the pathname specifying a file. You cannot delete a subdirectory if it contains any files. You can delete several files by separating each one with a comma, up to a maximum of ten. DELETE doesn't ask ARE YOU SURE?, so be careful. Examples:

## DELETE MASTER.BKP

This deletes the file MASTER.BKP from the current directory.

## DELETE DF1:PROGS/ALPHA,OMEGA

This deletes the file ALPHA on the PROGS subdirectory on the external drive, and also deletes the file OMEGA from the current directory. DIR (Directory) DIR and LIST are similar commands. DIR lists just file and directory names, while LIST
gives additional information (see LIST). Follow DIR by a legal directory path. Don't include the name of a file in the path. The OPT command permits special directory options. DIR OPT A lists the contents of any subdirectories along with the main directory. DIR OPT D lists only subdirectory names.

There is a special interactive directory mode which you enter with DIR OPT I. While in directory mode, the entries are displayed one at a time. Press RETURN to go on to the next entry. If the entry is a subdirectory name, you can press E to enter that subdirectory, listing its files. To exit a subdirectory, enter B. If the current entry is a file, you can type T to type its contents (CTRL-C aborts the display). You can enter the command DEL to delete the current entry (again, you can't delete a directory unless it's empty). Type $Q$ to quit the interactive mode.
Examples:
DIR
This displays the current directory. DIR DF1:DEMOS
This displays the contents of subdirectory DEMOS on the external drive.

## DIR DF1: OPT A

This displays the directory and the directory of next-level subdirectories on the external drive.
DISKCOPY To copy one disk to another with two drives, enter DISKCOPY DF0: TO DF1:. Formatting is automatic, and the copy has the same name as the original unless you use the NAME option, as in DISKCOPY DF0: TO DF1: NAME "KICKSTART BACKUP". To copy a disk with one drive, type DISKCOPY DFO: TO DFO:. You'll be prompted to alternately insert the original and destination disks.
Examples:
DISKCOPY DF1: TO DF0:
This backs up the disk in the external drive to the disk in the internal drive. Although both disks will have the same name, AmigaDOS can distinguish between them by the dates they were created.

## DISKCOPY DF0: TO DF0: NAME <br> "WORKBENCH BACKUP"

This creates a named backup of the disk in the internal drive. Several
disk swaps are required.
ENDCLI This cancels the current CLI window. Use this command only to terminate a secondary CLI or to return to the Workbench. If there is no Workbench and you close the primary CLI, everything ends, leaving you nothing to work with. Your only recourse would be to reboot the system.
FORMAT This lets you format a new disk. Follow FORMAT with the keyword DRIVE (required), a drive device, the keyword NAME, and a unique 30 -character disk name (enclosed in quotes if it contains any spaces). FORMAT customizes a blank disk for use with the Amiga drives. Don't forget that FORMAT irreversibly erases everything on the disk.
Example:
FORMAT DRIVE DF0: NAME "FINAL PROTOTYPE"
LIST This command gets you more information about a disk, directory, or file. LIST by itself displays the current directory. LIST can also be followed by a directory path and/ or a filename. LIST followed by a filename gives information only for that file. For each file, LIST displays the filename, size in bytes, file access (Readable/Writeable/Executable/Deletable), the date stamp, and the comment, if one was specified with the FILENOTE command (FILENOTE uses the form FILENOTE filename "comment.").

LIST can also be used with the keyword TO, which can redirect the listing to another device, such as the printer. With DATES, LIST displays dates as DD-MMM-YY, which is the default unless you use NODATES. You can use SINCE followed by a date to show only those files written on or after the specified date, or UPTO to list only those files created before or on the specified date. (The date follows the same format used by the DATE command).
Examples:

## LIST DF1: SINCE YESTERDAY

This displays the main directory of the external drive, including only those files which were created yesterday or today.
MAKEDIR (Make directory) Follow MAKEDIR with a new directory path. The last directory name in the

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path is the name of the new directory.
Examples:

## MAKEDIR "AIR MAIL"

This creates a new subdirectory called "AIR MAIL" (quotes used because name contains spaces) on the current directory.

## MAKEDIR DF1:DEMOS/GRAPHICS

This creates a new subdirectory called GRAPHICS within the existing subdirectory DEMOS on the disk in the external drive.
NEWCLI By itself, NEWCLI just opens up a new CLI window and transfers keyboard control to it. The original CLI is retained. You can use the mouse to move and resize the window, as usual. This new CLI can use different settings than other CLIs, such as a unique current directory. A CLI can work in the background while you switch to another process. You can customize a CLI by following it with "CON: $x / y /$ width/height/title", which lets you specify the starting position, size, and name of the new CLI window.

Although not documented, it's possible to control a CLI with another device. NEWCLI SER:, for example, starts a CLI controlled by an RS-232 device, such as a modem or terminal. This could let a remote user control his own independent DOS console.

Use ENDCLI to cancel a CLI and revert to a former one.
Example:

## NEWCLI "CON:320/100/160/50/ EXTERNAL DRIVE"

This creates a $160 \times 50$-pixel window at position 320,100 with the name "EXTERNAL DRIVE". This new window is a complete CLI. With the CD command, you can set up this window to access one drive, and a different window to access another. The parameters of the CON: device, shown here, can be used as the output of other commands as well.
PROTECT This command sets a file's protection status. Follow PROTECT by the filename, the optional keyword STATUS, and the protection desired: $r$ to allow a file to be read, w to allow a file to be written to, d to make a file deleteable, and e to make the file executable. To protect a file against a
certain type of access, omit the corresponding letter. Only actual machine-runnable object code programs should be made executable. Examples:

## PROTECT YUPPIES

This makes the file YUPPIES practically nonexistent. It shows up on the directory, but it cannot be read, written to, deleted, or executed. You can use PROTECT again to override this, of course.

## PROTECT "DON'T READ ME" <br> STATUS WD

This allows the file "DON'T READ $\mathrm{ME}^{\prime \prime}$ to be written to and deleted, but not read or executed. PROTECT provides a simple form of protection, since it can always be used to change the file's status back. It mainly protects you against your own mistakes.
RENAME Follow RENAME with the optional keyword FROM, the existing name of the file, the optional keyword TO or AS, and the name you'd like to change it to. The new name must not conflict with any existing name. The position occupied by that file on the directory may change after the rename, especially if you use a different subdirectory name for the new name.
Examples:
RENAME FROM "Templates/Amortization" TO "Templates/32yr Amortz"
This changes the name of file Amortization to " 32 yr Amortz" within the subdirectory Templates.

## rename Dog AS Cat

This changes file Dog to Cat within the current directory.
RENAME FROM Progs/Slither TO Pascal/Slither
By changing Slither's subdirectory name, we have, in effect, moved Slither from the Progs directory to the Pascal directory. (This is similar to the usage of mv in the Unix operating system.)
RUN This lets you run any executable file "in the background," that is, while another task is running. RUN is the AmigaDOS multitasking command. If you start an object module or command by just typing its name, it takes over control from AmigaDOS. Some commands don't return to AmigaDOS when they end, locking you out of the CLI. RUN lets you run any command or
program as an independent, simultaneous process, just as NEWCLI creates a simultaneous CLI. You can run multiple commands and programs by ending each line with a + sign to specify a continuation to the next line.
Example:

## RUN ed Simple

This starts the full-screen editor with the file Simple. Meanwhile, the CLI is still running. To get to it, use the mouse to select the current screen's back gadget to display AmigaDOS, then click in the AmigaDOS window to activate the CLI. You can type in the AmigaDOS window, executing commands, then switch to Ed to continue editing. Without RUN, Ed takes over until you exit.
TYPE This command prints out a file on the screen. It's generally used with text files. Displaying other types of files usually produces nonsensical streams of strange characters. Follow TYPE with the filename. To redirect TYPE to another device, include the TO option, as in TYPE README.DOC TO PRT:.

TYPE allows two options. TYPE OPT $N$ creates sequential line numbers for each line of text. You could use TYPE SAMPLE TO "NUMBERED SAMPLE" OPT N to create a line-numbered version of SAMPLE as "NUMBERED SAMPLE". TYPE OPT H displays the characters in a file as hexadecimal numbers. This is more useful when displaying machine language code or data files.
Examples:
TYPE "DF1:BASIC PROGRAMS/ PINPOINT"
This displays the BASIC program PINPOINT located in the subdirectory BASIC PROGRAMS in the external drive. In this case, quotes are required to prevent the embedded space in BASIC PROGRAMS from terminating the TYPE command.

## TYPE SYS:C/DIR OPT H

This displays the contents of the DIR command (which is stored as a file in SYS:C) in hexadecimal. (Unless you can mentally disassemble the hex dump into 68000 mnemonics, this file will make no sense.) Next month, Part 2 covers more commands in the powerful AmigaDOS.©


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