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FEATURES GALORE

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

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APROTEK

printing. The built in 2K buffer frees up your computer while printing a page or two allowing you to go to your next job.

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

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Editors Notes

The subdued pallor of the personal computer section at the Summer Consumer Electronics Show was somewhat sobering. Dozens of industry vendors simply chose not to exhibit; dozens more have disappeared in the months since the last show. Noticeable in the reduced clutter of exhibitors was the increased level of professionalism and sophistication of presentation among those present. Also noticeable was the lack of industryshaking innovation we've grown accustomed to over the last few years. Among the bright spots were our old friends at Atari, the Tramiels. They highlighted that which is best among us by promising new innovations and continued leadership at the cutting edge of truly consumer-oriented electronics. Their demonstration of an Atari/ compact disc interface which allows an entire multi-volume encyclopedia to be stored and quickly retrieved from less than one-quarter of a single compact disc is truly significant. Their proposed pricing for new Atari ST systems promises hope for fall. (See the Consumer Electronics Show article elsewhere this issue for more in information.)

Commodorians are properly pushing the 128 system and reluctantly admitting the coming of the Amiga. We were shocked to discover that apparently some at Commodore still enjoy political magazine games.

Several of our competitors had already received Amiga systems while Commodore public relations personnel were concurrently telling us that all magazines would be treated equally. It makes one wonder what motive Commodore might have for withholding access to the Amiga from the largest Commodore-related publisher in the industry. Ah, well. COM-PUTE! always perseveres, and you may rely on us to bring you continuing and timely assessments of the new Amiga. Among our articles this month on the Consumer Electronics Show, you'll find some early information on the Amiga. It looks like a pretty impressive machine.

On this increasingly hopeful note, we'll point out that the traditionally upbeat Christmas season, while viewed with caution, is expected to be a good one for the vendors who have remained in the marketplace. It's a bit of the smaller pie and fewer slices phenomena. That same principle can perhaps be extended to the magazine publishing industry. We have a small group among our competitors whose attacks on us over the years have ebbed and flowed with the success of the

various magazines they launch to compete with ours. As problems arise for whatever flagship they're currently pushing, we can detect a significant increase in the various voices they raise in criticism of us, our style, our policies, our editors, our writing. We have always chosen to remain silent in the face of these rumblings and time has always proven to be our steadfast ally. We suspect such will remain the case. In the meantime, we'll continue our efforts to always provide you with the most balanced magazines of the best quality we can publish. Thank you for your continued support.

Robert Jock

Editor in Chief

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1

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Readers Feedback

The Editors and Readers of COMPUTE

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

Modular Phone Booths

I'm writing a book—not on computers, but on radio news. Like you, we make great use of the telephone for relaying material recorded on cassette. Ours is analog voice material, and the similarity of what we do to computer applications of the phone prompted me to write.

I've tried without success to interest Ma Bell and GTE in installing modular jacks on their pay phones. This would allow us to use a simple patch cord to go from a cassette recorder output without wrenching off the phone handset cover or using an acoustic coupler, which lowers quality.

Are you aware of any attempts by computer users (or manufacturers) to get direct access to phone equipment? I would imagine this would be valuable for both groups, doing away with the need for acoustic couplers, plus their extra cost and size.

I'd appreciate hearing of any efforts you're aware of on pay phone access. It may take the clout of manufacturers, computer users, and computer publications to convince these giant phone utilities to allow direct pay phone access.

F. Gifford

We haven't heard of any such lobbying efforts among computer hobbyists, but your most likely allies would be user groups that cater to portable computer owners. For instance, there's a special interest group (SIG) on the CompuServe Information Service for users of the Radio Shack TRS-80 Model 100. As active members of a commercial telecomputing network, these people are also likely to have encountered the same problems that you have. Battery-powered lap portables with built-in direct-connect modems are wonderfully convenient for traveling journalists and business people, but as you point out, the acoustic cups necessary to link them to pay phones are bulky, clumsy, and less reliable.

However, it seems unlikely that the phone companies will bend to your demands anytime soon. For one thing, portable computer users (and radio journalists) encompass a pretty small minority at this time-too small, we suspect, to justify modifying all the pay phones in the country. More importantly, handsets attached to public phones with modular jacks would be tempting targets for thieves. Anybody could unplug the handset and run off with it. Of course, pay phones could be redesigned with a conventionally attached handset and a modular jack as an accessory. Perhaps this will happen someday when portable computers are built into wristwatches and nearly everybody has one.

By the way, while you're lobbying, you might also want to target hotels and motels—we've found that many of them don't equip their phones with modular jacks, either.

Fate Of The PCjr

Being the owner of a PCjr and with the recent bad news from IBM, it seems I have to make a decision on my future with the Junior. Hopefully you can give me some insight.

1. I could sell it and then buy a PC, but that would cost a thousand or two more for a system with similar color capabilities.

2. I could move to an Apple IIc, but I would have to start all over with my software.

3. I could make the Junior as PCcompatible as possible.

I would like more help with this third choice. I have heard of two expansion chassis, one by Quadram and another by Racore. Both add a second floppy drive, clock, parallel printer port, etc. And they add a switch to change modes from PCjr to PC. The Racore also adds an optional tenmegabyte hard disk.

Could you test these add-ons? Which is better, a second floppy drive or a hard disk? Will these chassis help to secure what I've invested in the Junior, or should I bail out altogether? Bob Hana

There's no reason to get rid of your PCjr as long as it meets your needs—and that's something only you can decide. IBM has not abandoned the PCjr; although production has been halted, IBM promises to continue supporting the computer with service and software. Since the PCjr already is fairly compatible with the PC, a wide selection of software is available and will continue to be available.

According to estimates we've seen, roughly 300,000 PCjrs have been sold. That's not a huge base compared to Commodore, TI, Apple, and Atari computers, but it's large enough to guarantee that software and expansion hardware will remain in supply in the immediate future. Still, in time, PCjr-specific products particularly from non-IBM suppliers may begin to dry up. So if there's anything you think your system might need, you should plan to buy while it remains available.

If you need to make your PCjr more PC-compatible, you must balance the cost of expanding the Junior against the cost of a new PC or compatible. There are several expansion modules on the market in addition to the products you mention which add more RAM, a second floppy disk drive, a realtime clock, parallel printer port, hard disk drive, and so on. Some of them allow more expansion than others and different combinations of options. See the September 1984 issue of COMPUTE's PC & PCjr magazine for reviews of the Tecmar jrCaptain and Legacy expansion modules.

Be aware, however, that no matter which one you pick, your PCjr won't be 100 percent PC-compatible 100 percent of the time because of some fundamental design differences. (See "PCjr Memory Compatibility," COMPUTE!, March 1985.) Usually this isn't a major concern, but you should test new software on the PCjr before buying, or at least secure return privileges in case the program doesn't work.

The question of whether a hard disk is preferable to a second floppy drive depends on your needs and your pocketbook. A hard disk is much faster and stores much more data than a floppy drive, but it

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costs a lot more, too. One thing to keep in mind is that some commercial software is copy-protected in such a way that it requires you to boot off the floppy even if you have a hard disk.

Commodore INPUT Revisited

Your answer to Scott Mefferd's letter about suppressing the Commodore IN-PUT question mark (COMPUTE!, May 1985) is incorrect. It's quite easy to suppress the question mark that INPUT usually prints. Use POKE 19,64 before the INPUT command to disable it, and POKE 19,0 to bring it back. Here is an example:

10 POKE 19,64:INPUT"ENTER WORD";A\$ 20 POKE 19.0:PRINT

You must enter some value when using this method (you can't just press RETURN). Add a PRINT statement after the input, since the cursor doesn't automatically go to the next line. You can also treat the keyboard as a peripheral, reading it with an INPUT# statement as shown here:

10 OPEN 1,0: PRINT"ENTER WORD"";:INPUT#1,A\$ 20 PRINT: CLOSE 1

David Tucci

A number of readers have written to suggest these methods, both of which work fine. The first method is simple and troublefree provided you always restore things to normal with POKE 19,0. The second method takes advantage of the fact that the keyboard is just another peripheral (device number 0) as far as the computer is concerned. You can OPEN a communication channel to the keyboard and input a string with INPUT#, the same as with other peripherals.

À third method, suggested by reader Robert Kodadek, bypasses the BASIC IN-PUT routine and calls CHRIN directly. CHRIN is a machine language routine stored in the computer's Read Only Memory (ROM) which fetches one character from the designated input device every time it is called. Since the keyboard is the computer's default input device (unless you specify otherwise), CHRIN acts much like GET, retrieving one character at a time:

10 A\$="": PRINT "ENTER WORD: "; 20 SYS 65487: A=PEEK(780): IF A<>13 THEN A\$≒A\$ + CHR\$(A):GOTO 20 30 PRINT: PRINT A\$

CHRIN stores the character's ASCII value in the microprocessor's accumulator register, which is echoed at location 780 in the Commodore 64 and VIC-20. If you have a Plus/4 or Commodore 16, substitute the address 2034 for 780 in line 20. This method is a little slower than the first two because it has to compile the string one character at a time in BASIC, terminating when it detects a carriage return (CHR\$(13)).

Missing Atari Memory?

When I run the memory test on my Atari 800XL, it seems to check only the first 40K of RAM. There are no red blocks anywhere on the screen, but it refuses to check the last 8K of user RAM. When I check RAMTOP with PEEK(106), it returns a value of 160. If I am not mistaken, 48K of RAM should return a value of 192. The only other symptom is an above-average amount of keyboard lockup. What's wrong here?

Dave Nessell

Either you did not disable BASIC on powerup by holding down the OPTION key or you have a cartridge installed. A cartridge or the built-in BASIC uses the top 8K of your 48K of memory. To free up this 8K of RAM, disable BASIC or remove the cartridge when running the memory test.

The keyboard lockups are probably unrelated to the results of the memory test. Instead, BASIC is most likely to blame. The first Atari BASIC cartridge suffered from a lockup bug that was supposedly fixed in revision B BASIC, the version built into the 600XL and 800XL. Unfortunately, the fix only made the problem worse. (See "INSIGHT: Atari," COM-PUTE!, May and June 1985.)

Atari has finally eliminated the lockup bug for good in revision C BASIC. This version is built into the new 130XE computer and is available on cartridge for earlier machines. To obtain a cartridge, send \$15 to:

Atari Corp. Customer Relations 390 Caribbean Drive Sunnyvale, CA 94088

Resetting The SID Chip

Does SYS 64738 completely reset the Commodore 64 to its power-up state? When I use this SYS after running a music program, and then run a game program, I can hear a faint lingering tone. This does not happen when I turn the computer off and on, then run the game program.

Bruce Snider

You've noticed a 64 "feature" that many programmers overlook. Though you might expect system reset to clear the 64's SID (Sound Interface Device) chip, all it does is turn the volume down. This is easy to demonstrate. Turn up the volume on your TV or monitor and enter the following line in direct mode (without a line number):

POKE 54273,20:POKE 54277,15:POKE

54278,240:POKE 54276,33:POKE 54296,15

Press RETURN after typing this line. The SID chip produces a continuous tone. Now type SYS 64738 and press RETURN, or press RUN/STOP-RESTORE. The volume cuts off (you may still hear a faint tone in the background). Enter POKE 54296,15 to turn up the volume again, and the tone comes back loud and clear, proving that the other SID registers retained the values you POKEd in.

SYS 64738 makes the computer jump into ROM and execute several reset routines. One of these ROM routines-called IOINIT-is supposed to reset the system for normal input/output operations (IOINIT also executes when you press RUN/STOP-RESTORE). Unfortunately, rather than putting zeros in all 25 of the SID chip's control registers (as it should do to turn off the whole chip), IOINIT just puts a zero in the volume register (location 54296). If other SID registers are still active, crosstalk signals may leak through to the chip's output wire, producing background noise even though the SID's volume is off.

Besides adding unwanted crosstalk, residual SID values can prevent sounds from being heard. The three low bits of location 54295 control whether any of the SID's three voices are routed through the SID filter. If any of these three bits are left on (set to 1) and the filter cutoff frequency remains at an extreme value, one or more of the voices may be distorted or inaudible.

To eliminate such problems, use the statement FOR J=54272 TO 54296: POKE J,0:NEXT at the beginning of every 64 program that uses sound. You can also execute the statement in direct mode by typing it in without a line number and pressing RETURN. Incidentally, since the Commodore 128 emulates a 64 when running in 64 mode, it suffers from the same problem; however, in 128 mode RUN/STOP-RESTORE seems to clear the SID chip correctly.

Hex Keypad For Apple MLX

Like Larry Watkins ("Readers' Feedback," May 1985), I usually enter MLX machine language listings with one hand and follow the code with the other. Is it possible to write a program for the Apple IIc that changes the keys to a numeric keypad? I'd like to see a hexadecimal arrangement and a colon you don't have to shift.

Bill Pearson

Only two line changes are required to redefine part of the keyboard as a 16-key hexadecimal keypad for "Apple MLX" (which first appeared in the June 1985 issue and is published periodically in COMPUTE!). Replace line 410 of MLX and

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add line 415 as shown here;

410 FOR I=1 TO 17: IF K <> ASC(MID\$("M,./JKL;UIOP7890", I, 1)) THEN NEXT: GOTO 420 415 A\$ = L\$ + MID\$("012345678 90ABCDEF", I, 1) + R\$: P = P + 1

Once these changes are made, Apple MLX accepts 7-8-9-0 for C-D-E-F, U-I-O-P for 8-9-A-B, J-K-L-; for 4-5-6-7 and M-,-.-/ for 0-1-2-3. You can even put stick-on numbers on the front of the redefined keys. Since you don't need to type colons in Apple MLX listings, the colon key has been left alone.

Better Atari Color Combinations

Please tell me the proper POKE or SET-COLOR command to make my Atari 800XL's text blue on darkest blue, blue on black, white on black, or any other combinations that might be easier on one's eyes. Will leaving the computer in these modes for long periods of time damage anything? Is there any way to make DOS 3.0 work in these altered text colors?

Jeb Branham

It's quite easy to change the Atari screen colors. The statement SETCOLOR 1, color,brightness sets the brightness level of text. The color value is irrelevant, since text is always the same color as the background (simply a different shade). The brightness value must be an even number from 0 (darkest) to 14 (brightest). Use SET-COLOR 2, color, brightness to control the background color. The color value can be any number from 0–15, and the brightness can be any even number from 0–14. You can also set the border color with SETCOLOR 4, color, brightness.

For instance, the statements SET-COLOR 1,0,10: SETCOLOR 2,9,0 produce light blue on dark blue. Blue text on a black background is not possible, since both screen and character color must be the same color. However, some shades of the same color look like different colors. For example, bright red-orange looks like yellow, and white is actually "bright black." Thus, SETCOLOR 1,0,10: SET-COLOR 2,0,0 gives you white text on a black screen.

Many people find it easier to read black text on a white background, since this combination simulates the appearance of type on paper. Use **SETCOLOR 1,0,2: SETCOLOR 2,0,10**. You may have to fiddle with the brightness numbers to get the contrast right. Unfortunately, these color changes are transient. The normal screen colors return when you press SYSTEM RESET, change graphics modes, or go to DOS. To change the screen colors of the DOS menu, you'd have to disassemble DOS to find the instruction which sets the colors and then alter the instruction yourself.

No color combination will damage your TV or monitor unless you leave very bright text on the screen for a significant period of time (such as overnight). Atari computers' have a built-in protection feature against burn-in: If you don't press any keys for about nine minutes, the computer automatically enters attract mode, in which the screen colors continually cycle at 50 percent brightness until you press a key.

Programming The VIC/64 User Port

I have built a breadboard system and interface to the VIC-20 user port, but am having trouble with programs to make use of it. Could you give me more information on how to program the user port?

John W. Farrow, Sr.

The user port, located on the back of the computer on the left side, gives you direct access to the computer and allows control of external parallel and RS-232 serial devices. Access to the user port is through the VIA (Versatile Interface Adapter) chips on the VIC, and the CIA (Complex Interface Adapter) chips on the 64.

Communications with RS-232 serial devices like modems are provided for in the computers' operating system via device 2, so we assume your homebrew interface makes use of the user port's eight-bit parallel data port. The parallel port can be controlled directly from BASIC with PEEK and POKE commands. When the port is being used for input, the address (37136 for the VIC, 56577 for the 64) is PEEKed. When the port is used for output, the address is POKEd.

Before data can be exchanged through the port, the function of the eight data lines must be specified by setting the data direction register for the user port (37138 for the VIC, 56579 for the 64). Each of the eight bits at this address controls the direction of data flow for the corresponding bit of the user port. When a bit in this register is set to 0, the corresponding bit in the user port is used for input. Setting a bit in the data direction register to 1 indicates that the user port bit will be used for output. Pressing RUN/STOP-RESTORE or powering up initializes all bits in the direction register to 0, setting all lines of the port for input. POKEing a value of 255 into the register will set all lines for output. Any combination of input and output lines can be specified by POKEing the value for the desired pattern of 1's and 0's into the data direction register.

Once the data direction register is set up, the desired lines of the user port can be read from or written to by PEEKing or POKEing the data register. If a line is selected for data input, the corresponding bit in the data register will hold a 0 if the line is at its low state (0 volts) and a 1 if the line is at its high state (at least 2.4 but not more than 5—volts). If the port is set for output, setting a bit in the data register to 0 causes the corresponding line on the port to be set to its low state, 0 volts. Setting a bit to 1 causes the voltage on the line to rise to its high state (usually about +5 volts). For example, the following statements set all eight lines of the VIC's user port for output, then present a high (+5V) state on each line;

10 POKE 37138,255 20 POKE 37136,255

Since applying improper voltages to the lines of the user port can damage the VIA and CIA chips—rendering your computer useless—we recommend that you use caution when experimenting with the port. If you're unfamiliar with the basics of electronics, you should connect only circuits designed by knowledgeable technicians.

For more information, and a simple peripheral device which can be controlled by the user port, refer to Chapter 5 in COMPUTE!'s First Book of Commodore 64. Additional information can also be obtained from Mapping the VIC, Mapping the Commodore 64, and Programming the VIC, from COMPUTE! Books.

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Report From The Summer

Consumer Electronics

Tom R. Halfhill, Editor

Show

Considerably less frantic than past Consumer Electronic Shows—at least in the computer section—this summer's CES nevertheless showcased some groundbreaking new products. Foremost was Atari's announcement of a mass storage device that may bring optical memory into homes, schools, and businesses by early 1986.

t would border on the outrageous to describe any Consumer Electronics Show as "quiet"—considering that 80,000 to 100,000 retailers, wholesalers, middlemen, and journalists spend four days jamming their way into convention halls for what is billed as the world's largest industry trade show.

Still, something was noticeably different about this June's CES in Chicago. The annual noise which emanates from the personal computer section in the McCormick West building had dissipated to a muffled roar.

Only two U.S. computer manufacturers were in attendance: Commodore and Atari. IBM and Apple, as is their custom, skipped the show. Atari, which a few weeks earlier had announced it was pulling out of CES, was enticed back by the show management but occu-

pied a couple of meeting rooms instead of its extravagant exhibit of days past. And the lower level of McCormick West, once the exclusive domain of a hundred computer software companies, now was halffilled with videotape exhibits and purveyors of video porn. Rarely have the effects of the muchpublicized industry shakeout been so apparent.

On the bright side, the mood was just slightly more optimistic as both Atari and Commodore moved closer to shipping actual production models of their latest personal computers. In fact, as the show opened, Atari said it had delivered the first 5,000 of its new 520STs to Canada and Europe and was expecting large-volume shipments to the U.S. by July 8. Commodore said it was only weeks away from shipping the Commodore 128, and was gearing up for a press conference in late July to officially announce its eagerly anticipated Amiga computer (see the accompanying article, "A Tantalizing Peek At The Amiga").

Several software companies announced new products for the Commodore 128, Amiga, and Atari ST series, although most seem to be cautiously hanging back until they see how the machines fare.

On the hardware front, Atari announced a mass-market version of the ST, Commodore exhibited a dual disk drive for the Commodore 128, and a British company announced it would export a 128K computer to the U.S. But the most interesting news from the show was a revolutionary new peripheral displayed for the first time by Atari: A very fast mass storage device that uses high-density optical discs. It was a dramatic demonstration that the upcoming generation of personal computers will place much of the power of a mainframe computer on a desktop. It also showed that the personal computer industry is not only far from finished, but is just getting started.

tari's big announcement was the CD-ROM, which stands for *Compact Disc-Read Only Memory*. If you've never heard of a CD-ROM before, prepare to read dozens of articles about it in coming months, because within two years CD-ROMs will probably be everywhere. (See the accompanying article, "Monster Memory.")

Atari hooked up a working prototype of a CD-ROM to a 520ST on the second morning of the show, and the Atari exhibit was packed for the next three days. Although the hardware looked rough, the software appeared to be nearly complete. In fact, Atari hopes to have the product ready for sale by late this year or early 1986 for about \$500.

The software that allows the CD-ROM to work with the 520ST is being developed by an optical typesetting company, Activenture, Inc. of Pacific Grove, California. Activenture has placed an entire 23volume, nine-million-word encyclopedia plus index on a single optical disc—and the disc is still three-quarters empty. The system is so efficient that any entry can be looked up in a matter of seconds.

When the CD-ROM is introduced, Atari and Activenture hope to have other databases available, too. Some examples might be additional encyclopedias, legal and medical references, cookbooks, phone books, and the whole Library of Congress card catalog. In

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fact, for reference works, the CD-ROM may be a significant step toward the paperless information age.

"The ink-on-paper business was fairly restrictive," says Tom Rolander, vice president for engineering of Activenture. "The only way you could look at information was in the way the original publisher had organized and presented it while laying it down on paper. When using reference materialwhich is why we're starting with encyclopedias and things like that-the degree of usefulness is based on how well we can find the information within that material. In other words, how good its indexing system is. What we have here, by connecting the computer with the CD-ROM, is the ultimate indexing tool. We'll know every reference there is to everything that's in the database."

The paperless information age, however, is encountering some resistance by those whose business depends on putting information on paper—traditional publishers. For example, Atari and Activenture had to delay announcing the name of the encyclopedia on their CD-ROM disc because the publisher didn't want any publicity until the final contract was signed. Rolander says all the publishers will probably fall in line once the first one does, but that many publishers are wary of the new technology.

"They can charge \$1,000 for a shelf-full of books, but how much will people be willing to pay for the same information on one of these?" asks Rolander, spinning a disc on his finger. "To consumers, it doesn't look like they're getting as much. Will people pay \$500? Or \$150? Or \$50? We don't know yet. This may finally determine the true value of information."

esides the CD-ROM, Atari announced two new variations of its 520ST, the 260ST and 260STD. They're identical to the 520ST except for three features: 256K RAM instead of 512K; a built-in RF modulator so they can be plugged into an ordinary TV set as well as color or monochrome monitors; and the operating system and GEM (Graphics

Environment Manager) in ROM instead of in RAM. Also, the 260STD has a built-in 3¹/₂-inch floppy disk drive. They are scheduled for release this fall for \$399 and \$499, respectively.

Atari says it plans to sell the 260ST and 260STD through massmarket channels, such as discount stores, while restricting the 520ST to specialty dealers, such as computer shops. This is a reversal of Atari's original plan to sell the 520ST through all types of outlets.

Atari also has been wavering back and forth on whether the operating system and GEM will ever be in ROM on the 520ST. When the 520ST was first announced in January, Atari said all the system software would be in ROM. But delays in debugging the operating system prompted Atari to release it on disk with initial shipments of the computer. Then there were conflicting statements about whether early 520ST owners would be able to upgrade to a ROM-based operating system later. (A RAM-based operating system takes longer to boot up, but is easier to revise; a ROMbased system boots up instantly, but can be upgraded only by replacing the ROM chips.)

At CES, Atari President Sam Tramiel told COMPUTE! that the operating system will be transferred to ROM for the 260ST/260STD, and then made available at "minimal cost" for 520ST owners with RAMbased systems. "These 18 guys back in Sunnyvale [at Atari's software department] are right now crunching the code to get it into the ROM size [192K]," said Tramiel. "TOS [Tramiel Operating System] now I think is 205K, or something like that. We feel it's not a big problem, but we've got to get it done fast."

ommodore was relatively idle at this CES. Its only new hardware announcements for the U.S. market were a dual floppy disk drive for the Commodore 128 and a dot matrix printer. Interestingly, before CES started, Commodore intended to show a hard disk drive for the 64 and 128, but pulled the product at the last minute for unknown reasons. Commodore also pulled the LCD portable lap computer first shown at the January CES; reportedly, the machine has been postponed while Commodore concentrates on bringing the 128 and Amiga to market.

The new 1572 dual disk drive combines two 1571 drives in a slimline case designed to sit atop the Commodore 128. It has the same multimode capabilities as the 1571 (Commodore 64, Commodore 128, and CP/M formats). Commodore says it should be available this summer, but no price was announced.

The new MPS 1000 is a multimode dot matrix printer. In draft mode, it prints at 100 characters per second (cps); in near-letter quality mode, it prints sharper characters at 16 cps; and in graphics mode, it has a density of 50 to 240 dots per inch. It can also print in widths ranging from 80 to 160 columns. It's compatible with the Commodore 128, 64, and many other personal computers. Like the 1572 disk drive, it's scheduled to be available this summer, but no price was announced.

Two products exhibited at the Winter CES were firmed up at this show. The Commodore 1670 direct-connect modem, which transfers data at 1200 bits per second, will sell for around \$200 and has auto dial, auto answer, auto mode selection, and auto speed switching from 300 to 1200 bps. It works with the 128, 64, SX-64, Plus/4, and VIC-20. And the Commodore two-button mouse controller first seen in January will sell for \$49.95 and should be available immediately. It works with the 128, 64, and VIC-

Commodore also showed four interesting computers for foreign markets, but apparently they won't be available in the U.S. in the near future. The Commodore 128D Integral Personal Computer is a variation on the 128 that separates the keyboard from the system unit and includes a built-in disk drive. Commodore says it will be available in Europe late this year. The PC10 and PC20 are IBM-compatible computers recently introduced in Europe. The PC10 has 256K RAM and two 360K floppy disk drives; the PC20 has 512K RAM, one floppy drive, and a ten-megabyte hard disk. And finally, the Commodore 900 Business Computer is a multitasking, multiuser workstation that uses a

Monster Memory

he CD-ROM, an acronym for *Compact Disc-Read Only Memory*, is a compact disc audio player which has been slightly modified for generalpurpose data storage and interfaced to a computer.

Compact disc players are the latest rage among audiophiles. Up to 75 minutes of digitally encoded music can be stored in the form of microscopic pits on a 4.7-inch rigid plastic disc. Inserted in a special player, the disc spins at 300 r.p.m. while a miniature laser reads the pits. The data is decoded by a microprocessor, then converted into standard audio signals which are fed into the auxiliary input or tape monitor jacks on a stereo receiver. The result is exceptionally pure music of unprecedented dynamic range and frequency response, free of surface noise and tape hiss. Furthermore, since the disc is read by a laser, not a diamond stylus, compact discs last virtually forever with no deterioration. They can also tolerate rougher handling than ordinary records and tapes.

But music isn't the only thing a compact disc can store. Any type of information can be digitized and recorded on a disc. That includes text, graphics, and computer programs. And the capacity is enormous: A single compact disc stores about 550 megabytes. A megabyte equals 1,024K, so that's roughly equivalent to 1,564 floppy disks on an IBM PC, 3,520 disks on a Commodore 1541 drive, 4,022 disks on an Apple II, 4,469 enhanced-density disks on an Atari, or 6,400 singledensity Atari disks. They're cheap, too: compact discs can be massproduced at a manufacturing cost of a few dollars each (audio discs currently retail for about \$15). Because audio CDs and CD players are already in mass production, CD-ROMs can debut at affordable prices.

A compact disc is a read-only storage medium, so you can't record data on it yourself. But CDs are ideal for storing large databases that don't have to be updated often. At CES, Atari demonstrated a sample disc that contained a 23-volume, nine-million-word encyclopedia. The encyclopedia was transferred to the CD from magnetic tape, where it was stored in punchcard format—the equivalent of 976,000 punchcards. Yet, it fits on onequarter of the space of a single CD.

To think of a CD simply as an efficient way to store mass amounts of information is to miss the point, however. Like a floppy disk drive, a CD player is a *random-access* device; it can seek and retrieve any piece of data on the disc in a few seconds without hunting through the information sequentially. Therefore, a CD-ROM can find the slightest, most obscure fact in a massive database in less time than it takes you to pull a book off a shelf and flip it open to the index.

ere's an example: Let's say you're a student researching a report on Thomas Jefferson. On the Atari CD-ROM, there are two ways to approach the task.

The first way is very similar to the usual method of looking up something in an encyclopedia. First, you boot up the CD-ROM on the Atari 520ST. This takes only a few seconds. A graphics display on the screen shows a bookshelf with a 23-volume encyclopedia. By rolling the ST's mouse controller, you move the screen pointer to the "J" volume and then click the mouse button. This brings up another screen with a graphics picture of the book you selected, opened to severalphabetical tab entries. You al move the pointer to the tab which would include Jefferson-for instance, *Japan to Jet*. Another click calls up a screen showing all the article titles within that section. When you move the pointer to the title *Jefferson*, *Thomas* and click the button again, the computer loads the article (and several preceding and following articles, as well) from the CD into memory. It takes less than four seconds for the CD-ROM to fill the 520ST's entire 512K RAM.

Now you can read the article on the screen, scrolling or flipping pages by clicking the mouse. This method of looking up subjects is recommended for those who aren't familiar with computers, because it requires almost no computer knowledge.

The second method takes greater advantage of the computer's power. Instead of looking up the subject alphabetically by yanking a graphics image of a book off a shelf, you pull down a menu and select the search screen. This screen presents a number of options; to keep it simple, you can just type Thomas Jefferson at the prompt and ask for a general search. In about four seconds, the computer reports how many times the phrase Thomas Jefferson appears in the encyclopedia. You can flip to the first occurrence by clicking the mouse. Again, in less than four seconds, the computer loads the article from the CD into memory and even highlights your search phrase within the text. You can flip to subsequent occurrences merely by clicking the mouse button.

What makes this technique so powerful is that the computer will find references to Thomas Jefferson in articles that may never have been checked using the old-fashioned method. The student may learn that Jefferson was not just a politician, but also an inventor, architect, and connoisseur of wines. Looking up the same references in even the most thoroughly cross-indexed paper encyclopedia would be much more time-consuming.

When the Atari ČD-ROM software is finished, it will allow twodimensional searches, too. You could look up every article that contains references to Thomas Jefferson *and* Thomas Paine, or Thomas



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Jefferson *or* George Washington. Other options let you limit the search for occurrences in adjacent words, single paragraphs, and word groupings of various sizes.

f you're an experienced programmer, you might be puzzled by the search times described above. Even in superfast machine language on the 520ST's 68000 microprocessor, how can the computer search through nine million words in less than four seconds?

The answer is that the computer can't. Instead, it refers to an extremely sophisticated index of search tables on the CD.

The search tables were compiled with a VAX minicomputer by Activenture, Inc., the company which is developing the CD-ROM software for Atari. First, the VAX built a dictionary by identifying every unique word in the encyclopedia—more than 140,000 words. Then it compiled search tables which cross-reference the dictionary to every occurrence of each word in the encyclopedia. In conventional book form, the finished

Report From Summer CES Continues .

Unix-compatible operating system. Although some of these higherend computers will be available in Canada, Commodore announced no plans at present to market them in the U.S.

nother new personal computer was announced at CES by a British company, Amstrad. Already available in Europe, where several hundred thousand units have been sold, the Amstrad CPC6128 is scheduled to be shipped to the U.S. later this year.

The U.S. version of the Amstrad has an 8-bit Z80A microprocessor, 128K RAM, a built-in 3-inch disk drive, CP/M compatibility, BASIC and Logo, an expansion interface, joystick port, and stereo sound output. It comes packaged in two configurations. One includes a green-screen monitor and *WordStar* word processor for \$699, and the other has an RGB color monitor, Amstrad's own word processor, and some entertainment index would occupy about 20 volumes. That means the index is nearly as long as the encyclopedia itself.

When you request a search, the 520ST simply consults the index of search tables on the disc and rapidly locates each occurrence of the search phrase. In effect, the searching has already been done for it by the VAX.

Retrieving the information is very fast, too, though not quite as fast as with hard disks. Because CDs were designed for storing music, which is played sequentially, their random-access capabilities are not as good as they could be. Still, they're much faster than most floppy disk drives. Data is stored on a CD in 270,000 records containing 2,048 bytes each; the average access time for a record is about one second. The greatest access timewhich happens when the head must move from an extreme outside track to an inside track or vice versa-is three to four seconds. To keep this from happening very often, data is recorded on a CD on the inside tracks first, moving outward. This takes advantage of the CD-ROM's very rapid track-totrack access time. To read a nearby

software for \$799.

Briefly, here are some other highlights of the Summer CES:

• Abacus Software of Grand Rapids, Michigan announced *Super C*, a C compiler for the Commodore 64 and 128. It has a full-screen editor with horizontal and vertical scrolling and is compatible with most other versions of C. Source files up to 41K long can be created.

 Commodore is releasing several titles for the 128, including Jane 2.0, an icon-based integrated package with a word processor, spreadsheet, and filing manager, all of which can be manipulated with the mouse controller; Micro Illustrator, a graphics drawing program formerly available for the 64, which takes advantage of the 128's extra memory and other features; and the Perfect series for the CP/M operating system, consisting of Perfect Writer, Perfect Calc, and Perfect Filer. All three work in the 80-column mode, are capable of sharing files, and have pop-up menus, split track, the player merely tilts a tiny mirror to refocus the laser rather than repositioning the entire head. (Each track of microscopic pits is only two microns—two *millionths* of a meter—wide).

Once the information is located, the CD-ROM feeds it to the computer at a rate of 75 records (150K) per second. To make sure the data arrives without errors, the CD-ROM's error-correction capabilities have been improved over that of a regular audio CD player. An audio player can be expected to pass one bad bit for every 10,000 bits-inaudible when listening to Beethoven or the Beatles, but not nearly good enough for computer storage. So CD-ROMs employ an error-checking and correction scheme that allocates an additional 288 bytes for each 2,048-byte record. That much overhead-more than 14 percent-would be wasteful on a floppy or hard disk, but CDs have room to burn. The improved error rate on a CD-ROM is at least as good as with a hard disk: about one bit error for every 1,000,000,000,000 to 1,000,000, 000,000,000 bits (one trillion to one quadrillion).

screens, and automatic formatting for printouts.

• Epyx, Inc. of Sunnyvale, California is releasing *Winter Games*, a sequel to *Summer Games*, for the 64, Apple, and Macintosh; two new LucasFilm games for the Atari, *The Eidolon* and *Koronis Rift; The World's Greatest Football Game* for the 64, Apple, and Atari; and the *Temple of Apshai Trilogy* for the 64, Apple, Atari, Macintosh, and IBM. (Prices will range from \$19 to \$35.)

• Batteries Included of Richmond Hill, Ontario is releasing its *PaperClip* word processor for the Apple (\$89.95) and Commodore 128 (\$119.95 with *SpellPak*); the BI-80, an 80-column video adapter on a cartridge for the Atari XL and XE series (\$79.95); an 80-column version of Atari *PaperClip* for the BI-80 (\$59.95); new versions of *Home-Pak*—a combination word processor, filer, and terminal program for the IBM PC/PCjr, Commodore 128, Apple, and Atari ST (\$49.95); an IBM version of *The Consultant* When sorcery ruled, and trolls and minotaurs still walked this Earth, a party of six intrepid adventurers set out to find the Nine Rings and use them to destroy the Dark Lord. This is your quest. This is your...

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t this writing (early June), Commodore is scheduled to unveil its long-awaited Amiga Lorraine computer at a press conference in New York in late July. Although the machine was substantially ready in June, Commodore evidently kept it off the show floor at CES to avoid stealing attention away from the Commodore 128, which was due to begin appearing on store shelves within weeks. Nevertheless, despite unprecedented secrecy and security, more and more details about the Amiga leaked out at CES press parties. Also, COMPUTE! arranged a peek at the Amiga through a helpful source. We learned that even more capabilities have been added since our first look at the computer a year ago at the June 1984 CES (see "Software Power! The Summer Consumer Electronics Show," August 1984).

The Amiga's final configuration was still subject to change before its official introduction, but here's what it will probably include:

• Motorola 68000 microprocessor for the central processing unit. This is the same 16/32-bit chip found in the Apple Macintosh and Atari ST series. It can address up to 16 megabytes of memory (1 megabyte = 1024K).

 256K of RAM (Random Access Memory), expandable to at least 512K on the system unit and more externally.

 192K of ROM (Read Only Memory) containing *Intuition*, a Macintosh-like operating system with pull-down menus, icons, hierarchical disk directories, multitasking, and mouse support. Unlike the Macintosh's operating system, however, *Intuition* can be manipulated with keyboard controls as well as the mouse. The keyboard, which is attached to the Amiga system unit with a coiled cord, includes cursor keys and a numeric keypad.

 True multitasking. Thanks to the high-speed 68000 and a number of dedicated chips for input/ output and other vital functions, the Amiga can run several programs simultaneously with no apparent sluggishness, even while simultaneously accessing the disk drive. By opening screen windows of various sizes, you can watch all the programs running at once. This is an especially useful feature for business applications-you could simultaneously work with a word processor, terminal program, database manager, and spreadsheet without stopping one program to start another.

• A built-in double-sided 3¹/₂inch disk drive that stores about 800K per disk. These are the same hard-shell microfloppy disks used by the Macintosh and Atari ST series. Up to three external drives can be added to the Amiga by daisychaining.

• Custom chips for graphics and animation. Maximum screen resolution is 640×400 pixels (screen dots), with additional graphics modes of 640×200 and 320×200 . Eighty-column text is standard, but the display is adjustable to narrower widths for greater readability on low-resolution screens.

 Composite video/mixer input that allows you to feed standard video signals into the Amiga, display them on the screen, and then superimpose the Amiga's text and graphics. The external video source could be a video camera, videocassette recorder, videodisc player, TV receiver, or even another computer. The potential of this feature is exciting: games and educational programs with superrealistic backgrounds, titles for home videotapes, and so on. Furthermore, a relatively low-cost peripheral called a frame grabber lets the Amiga digitize the incoming video signal so it can be manipulated with graphics utilities, stored on disk, and even dumped to a graphics printer.

• A palette of 4,096 colors, more than any other generalpurpose personal computer on the market. Up to 32 of these colors can be displayed at once without special tricks.

• Video outputs for TV sets, composite color and monochrome monitors, and high-resolution RGB color monitors. Reportedly, the RGB output is analog, like the Atari ST's, so it's not compatible with RGB monitors designed for the Commodore 128 and IBM PC computers. Analog RGB allows more color intensity levels than IBM-type RGB.

· An expansion port that includes every line on the system bus for almost unlimited expansion capabilities. This could include coprocessors, such as an 8088/8086 board for IBM compatibility. Reportedly, the Amiga will be an "open system." That is, to help independent hardware and software designers access the full power of the computer, Commodore is said to be preparing extremely detailed documentation on all aspects of the Amiga for general release. One insider who has seen the preliminary documentation says it's so complete you could almost build the system from scratch using the information it contains.

 Seven-level direct memory access (DMA) controller. Along with the Amiga's many dedicated chips, this lets the machine perform several tasks simultaneously with

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no apparent slowdown. It also simplifies things for programmers. An independent software developer who attended a recent Amiga symposium sponsored by Commodore in Monterey, California, told COM-PUTE! that systems-level programming on the computer is so easy that "it's more like parameter-passing than programming. You just decide what you want to do-pull data off the disk, whatever-and pass the appropriate parameters to the operating system, and the OS passes them along to the DMA controller, and everything happens during the 68000's off-phase cycle so the machine doesn't slow down at all." (The programmer's symposium, incidentally, was open only to independent developers and was sealed off by armed guards. Those who attended had to sign a strict nondisclosure agreement.)

• Built-in printer drivers to dump the Amiga's bitmapped screens onto graphics printers, including color and inkjet printers.

· Four-voice sound chip with stereo output. The Amiga's custom sound chip routes two voices to each stereo channel for high-fidelity reproduction through external stereo systems. In addition, the sound chip is the most advanced in any personal computer, surpassing even the Commodore 64's SID chip. The Amiga can closely simulate a wide variety of musical instruments, and at least a dozen instrument sounds are built insuch as guitar, pipe organ, cymbals, drums, piano, and violin. Sound envelopes (attack-decay-sustainrelease) can be modified simply by pulling down a menu and making selections with the pointer.

Digital sound sampling. At

Report From Summer CES Continues . . .

database manager (\$99.95); Battery-Pak, a seven-function desktop accessory for the Macintosh (\$49.95); and Literature Challenge: Introduction to Shakespeare, an educational program for the Apple, Commodore 64, and IBM PC (\$29.95). In addition, Batteries Included announced a new line of integrated programs for the Atari ST, Commodore Amiga, and MS-DOS computers with GEM. Called the IS line, all the programs will have

this point, it's not clear whether this feature will be standard or optional. Even if it's optional, however, insiders say it will cost much less than anything similar now on the market (the least expensive high fidelity samplers now cost around \$2,000). Digital sound sampling lets you feed sound from an external source into a computer, convert it to digital format, and then play it back, modify the waveforms, or store it on disk. With this capability, programmers and musicians no longer have to spend hours trying to simulate a musical instrument or sound effect-they can just feed the sound directly into the computer from a record player, tape deck, microphone, or instrument, and then manipulate it at will. In fact, some Amiga software developers are taking this approach to cut down development time.

• Built-in speech synthesis. The operating system includes a speech program with text-to-speech conversion. Since this is a standard feature that requires no extra hardware, you can expect many programs to take advantage of the Amiga's speech capabilities—including programs written by home users. COMPUTE! has heard the Amiga talk, and its pronunciation was more understandable than most speech synthesizers now available for personal computers.

• BASIC programming language. Unlike the Macintosh, the Amiga will come with a language for those who want to write their own programs, but it's unclear at this point if BASIC will be built into ROM or loaded from disk into RAM. Pascal and C compilers will be available soon after the computer's release. A 68000 assembler also will be offered, but it may not be as popular as assemblers on the current generation of personal computers—the compilers are so fast that few programmers are using machine language. One software developer says he has yet to see a single program written for the Amiga in machine language.

• Hard disk option. Although Commodore is said to have no immediate plans for a hard disk drive, an independent company known for its IBM peripherals is rumored to be preparing a hard disk with 10 to 20 megabytes of storage. This would probably interface to the expansion port.

f you take the word of those who have worked with the Amiga, it is the most powerful personal computer ever assembled. In terms of performance, they say it's more than a match for any business-oriented machine now on the market, and has the advanced graphics and sound features demanded by home users as well. But how much will it cost?

At the Monterey symposium, Commodore reportedly told developers that the Amiga would be sold with an RGB monitor and some software for about \$2,000. Since then, however, Commodore has encountered some negative reaction to that figure. Many observers think a lower price is necessary to dramatically undercut the Macintosh and IBM PC, and also to compete with the Atari ST series for a larger share of the intermediatepriced market. At CES, rumor had the price ranging anywhere from \$1,300 to \$1,900, possibly without an RGB monitor.

Macintosh-like graphics in color and a number of powerful features. The first program, *Portfolio*, is for stock management and will be released for the IBM PC and Atari ST this fall (\$249.95 for the IBM). Others in the series will be a word processor with built-in spelling checker, a spreadsheet and graphics package, and a database manager.

• Brøderbund Software of San Rafael, California announced three from the movie industry.

new programs to work with *The Print Shop*, its popular printer utility. They are *The Print Shop Graphics Library: Disk One, The Print Shop Graphics Library: Disk Two,* and *The Print Shop Companion.* Other new programs are *Bank Street Filer* and *Bank Street Mailer,* sequels to the *Bank Street Writer* word processor; and *Fantavision,* a special-effects generator for the Apple that uses animation technology adapted from the movie industry.

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The Beginners Page

om R. Halfhill, Editor

FOR-NEXT Loops, Part 4

Over the past few columns, we've covered some of the useful techniques possible with the FOR-NEXT statement. Even if FOR-NEXT could do nothing else than what we've demonstrated, it would be indispensable. Fortunately, it can do still more—and all it takes is an optional keyword, STEP.

With STEP, you can construct "long-legged" loops and counters by varying the step size by which the counter variable is incremented. You can even make FOR-NEXT loops that count *backward*. For the sake of illustration, let's say you want to print out all the odd numbers less than 100. Without a FOR-NEXT loop, you could take this approach:

10 X=1 20 PRINT X 30 X=X+2 40 IF X<100 THEN 20

The alternative is a little shorter and easier to follow:

10 FOR X=1 TO 100 STEP 2 20 PRINT X 30 NEXT X

Without the STEP option in the FOR statement at line 10, this program would just print all the numbers from 1 to 100 because the counter variable X would be incremented by one during each pass through the loop, as usual. STEP 2 simply tells the computer to increment the counter variable X by *two* during each pass through the loop. That is, when the loop begins, X equals 1. After the first pass, X equals 3. After the second pass, X equals 5, and so on.

No Cause For Alarm

Interestingly, although the FOR statement in line 10 tells the computer to count from 1 to 100, the counter variable X actually reaches 101. You can verify this by typing PRINT X and pressing RETURN or ENTER after the program finishes. The computer reports the final value of X is 101. But don't be alarmed—the computer isn't being disobedient. Although the final STEP 2 increases X from 99 to 101, the computer still performs only 50 loops, since the upper limit specified in the FOR statement is 100 and we're stepping by twos. The program works the same if you change line 10 to FOR X=1 TO 99 STEP 2.

For even more flexibility, the STEP option lets you loop in steps of *any* increment, including fractions and negative numbers. All of the following FOR statements are valid:

FOR X=1 TO 1000 STEP 10 FOR X=15 TO 25 STEP 0.5 FOR X=100 TO 1 STEP -1 FOR X=1 TO 0 STEP -0.1

It may not be immediately apparent why you'd want to make such strange-looking loops. Mathematical operations are one typical application, but beyond that it's hard to generalize. This kind of loop is generally used to solve certain programming problems. For instance, to make a musical note decay on an Atari, you could gradually reduce the volume parameter of the SOUND statement with a backward loop (FOR X=15 TO 0 STEP -1: SOUND 0,200,10,X: NEXT X). If the note decays too quickly, you could slow it down by reducing the volume by smaller steps (STEP -0.5 or STEP -0.2) rather than embedding a second delay loop.

As you write more programs and use FOR-NEXT loops more often, eventually it will come to you in a flash that a fractional- or backward-stepping loop is exactly the solution to your problem.

BASIC Variations

FOR-NEXT statements don't follow

the same rules on all computers, so you might need to consult your BASIC manual. In general, Microsoft BASICs (built into Commodore computers, the Apple, IBM, and others) let you omit the variable name from the NEXT statement if you want to. Instead of entering NEXT X you can just type NEXT. This makes the loop run faster. You can also close nested loops in Microsoft BASIC with a statement such as NEXT Z,Y,X instead of NEXT Z:NEXT Y:NEXT X or NEXT: NEXT:NEXT. (These options are not available in TI BASIC or Atari BASIC.)

Try to avoid jumping out of FOR-NEXT loops with GOTO and GOSUB statements. It's considered bad programming form, partly because it makes the program hard to follow. Besides that, a program that repeatedly exits loops with GOTO or GOSUB before the loops are finished can eventually cause some computers to crash with an out-ofmemory error or the like. A few versions of BASIC have a special statement that lets you exit a loop with GOTO or GOSUB without causing any problems. In Atari BASIC the statement is POP: it's not available in Microsoft BASIC.

Almost all BASICs require the counter variable in a FOR-NEXT loop to be an ordinary numeric variable; array variables and integer variables are not allowed. An exception is IBM BASIC, which does permit integer variables.

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Computers and Society

David D. Thornburg, Associate Editor

Compilers, Interpreters, And Flow: Part 2

Last month I argued that one of the reasons Logo isn't used for serious applications programming is because it's not generally available as a compiler. I'm not suggesting that programmers shouldn't have interpreters—they should. However, I am suggesting that the ideal programming environment might include an interpreter for writing and testing programs, and a compiler so the completed (and mostly debugged) programs can execute much faster.

There are many fine Logo interpreters on the market, but-as this is written-only one Logo compiler: ExperLogo from Expertelligence (for the Apple Macintosh). To illustrate the difference between these two Logo environments, let's examine a program that uses recursion to create a fractal "sponge." (If you're interested in programming fractals, by the way, you might want to explore the subject further in two of my books, Discovering Apple Logo and Beyond Turtle Graphics, both published by Addison-Wesley.)

Here's how the program is written with an interpreter, *Apple Logo II*, running on a 128K Apple IIe or IIc:

to sponge:size:limit if:size <: limit [forward:size stop] sponge:size/3:limit left 60 sponge:size/3:limit left 60 sponge:size/3:limit right 120 sponge:size/3:limit right 120 sponge:size/3:limit left 60 sponge:size/3:limit left 60 sponge:size/3:limit end

Once this procedure has been entered, it can be executed by entering its name with the appropriate values chosen for the variables. For example, the basic motif for the curve can be seen by entering:

right 90 sponge 81 81



To see a more detailed level of this curve, we could clear the screen and enter:

right 90 sponge 81 3



With the Logo interpreter, this picture takes 223 seconds to complete. However, as soon as the program is written it can be executed; there is no time delay before the program starts to run.

Interactive Rhythms

To write this program in *ExperLogo*, you enter the same source code into an edit window on the Macintosh screen. Then the code is selected and compiled. The compilation time for this program is 19 seconds on a 128K Macintosh (faster on a Fat Mac with 512K).

Once the program is compiled, it can be executed with the commands shown above. The compiled program draws the picture in 7 seconds—more than 30 times faster than the interpreted Logo. Of course, the compiled program executes faster partly because it's running on a 16/32-bit computer rather than on an 8-bit computer; but, as users of Macintosh BASIC will attest, interpreters can run slowly even on the Macintosh.

Is the speed gain important? For small programs, it may not be. But humans are funny creatures. We have certain rhythms in our interactions with each other and with our machines. If our technology is not operating at our pace, we become frustrated. For example, even though most photocopy machines operate pretty quickly, the perceived difference between a copier that takes 10 seconds for a copy and one that takes only 2 seconds is quite large. Those 8 seconds are just long enough to destroy the sense of flow.

In the case of computer programs we use every day, this sense of flow is even more important. When experimenting with graphic images such as those shown above, the sense of interactivity—of being able to tinker with the curves—is lost when each picture can take several minutes to create.

The Logo compiler from Expertelligence is most welcome, since it allows programmers to write commercially useful software with a powerful language—a language that in its interpreted form is often perceived as just a tool for children to draw pretty pictures.

Next month, I'll show that just as a compiler has made Logo a much more useful language, an interpreter is having the same effect on a language for which compilers are the norm—Pascal.

Thornburg welcomes letters from readers, but regrets that he cannot always provide personal answers. Correspondence should be sent in care of COMPUTE!.



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Buying The Right Educational Software

What types of educational software are people buying? What kind of software do they need?

In the opinion of many educators, the most important use of the computer as a learning tool lies in improving students' thinking skills through the use of programming languages like Logo; simulations and builder kits like *The Whatsit Corporation* (Sunburst) and *Operation: Frog* (Scholastic); microworlds like Rocky's Boots and Robot Odyssey I (The Learning Company); and problem-solving software like *The Pond, SemCalc, The Factory,* and *Geometric Supposer* (Sunburst).

But the sales of these products are dwarfed by the sales of drill and practice programs and learning games. A quick glance at a recent *Billboard* chart of the ten bestselling educational packages shows that eight of them are drill and practice programs and the remaining two are learning games. Of the drill and practice programs, two teach how to type, three teach basic math skills, two help students practice for the SAT college-entry exam, and one teaches basic vocabulary and spelling skills.

A look at TESS (The Educational Software Selector), published by the Educational Products Information Exchange and the Consumers Union, shows the same dominance of drill and practice programs. Of the 7,000 programs listed in TESS, almost 70 percent are drill and practice programs, and only 8.3 percent are simulation and problemsolving programs. (For more information about TESS, write to EPIE, P.O. Box 839, Water Mill, NY 11976.)

Most experts in educational computing have been critical of drill and practice programs for years. And most experts agree that problem-solving and simulation software is the most challenging and interesting software for anyone learning on a computer. If this is true, why are companies producing so much drill and practice software? And, more importantly, why do people prefer it?

Wary Adults

The answer is that most parents (and many teachers) are not ready for new kinds of software that teach new skills in new, unfamiliar ways. They don't understand how the programs work or what they're supposed to teach, or why it's important, and they don't see where the programs fit into their children's learning. And since they don't see a need for the programs, they don't buy them.

This is a natural reaction. For most people, computers are still a strange, almost alien, new medium. Many parents are still uncomfortable having a computer in their home. And many teachers, too, feel privately fearful of computers. They see the computer as a threat a means to automate them out of a job. The more the computer's role in the classroom grows, the more they see their own role being eroded.

In addition, problem-solving and thinking-skill software is an unfamiliar, new application of computers. We have a new medium (computers) trying to teach new concepts (logic and thinking skills) using new methods (microworlds, simulations, etc.). This is too much novelty for the average consumer-whether that consumer is a parent or a school system. As a result, most consumers are buying drill and practice programs and learning games because at least this way they see the computer teaching practical, necessary, and familiar skills-using a nonthreatening, understandable approach. And in the classroom, since the skills are familiar, the programs that teach them are more easily integrated into a teacher's lesson plan and curriculum. A program that teaches a child some spelling words can slip effortlessly into a curriculum, but what does a teacher do with a program that teaches a child how to think?

For the present, most parents will be buying and using drill and practice software and learning games, and ignoring problemsolving and simulation software. Does this mean that companies should stop producing these more challenging, yet less successful programs? Hardly. Instead, educators and software companies need to launch a major effort to communicate to parents and teachers the importance of the new kinds of software. To do this, software companies must demonstrate to parents and teachers why learning these skills is important, and how the software fits into their children's learning curriculum. O

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3. 4.	5.	Bank Street Writer HomePak	Brøderbund Batteries Included	Word Processor Word processing, telecommunicatsions, & data management	•	•	•	•	
5.	3.	Andrew Tobias's Managing Your Money	Meca	Home financial program				•	

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Telecomputing Today

Arlan R. Levitan

SIGs: Behind The Scenes

It appears that 1985 is rapidly becoming a banner year for electronic Special Interest Groups (SIGs). Unfortunately, rapid growth is not without its problems.

Electronic SIGs (also known as discussion forums) are like computerized clubs where people with a common interest get together online to exchange information, ideas, comments, complaints, and public domain computer programs. Usually they are operated by commercial information services such as CompuServe. Besides computeroriented SIGs, there are groups for doctors, lawyers, educators, and other professionals, not to mention enthusiasts of travel, cooking, literature, rock 'n' roll, politics, human sexuality, skiing, and ham radio. There are SIGs for every taste, and new ones are added every day.

SIGs are usually divided into three areas. The most active area is a message system subdivided into several sections by topic where users can read and leave messages. The oldest messages are overwritten when a new message is added, so each message tends to have a life of a week or less.

Each topic section also has a file access database where important messages may be stored more permanently as text files, and where users leave free copies of public domain software.

Finally, each SIG also has a conference area so online users can exchange messages in an immediate mode. Everything you type appears on the screens of others participating in the conference.

Online Bucks

SIGs generate extra income for information services because they encourage more online usage. But how valuable are SIGs to an information service's bottom line?

Frankly, most SIGs generate only a modest amount of revenue, and some don't break even. There are, however, a significant number of SIGs that are monstrous hits, largely due to the work of their sysops (system operators). In fact, each of the top SIGs generates well over a million dollars a year! That can mean big bucks for the head sysop. It's not uncommon to find the sysop (or company sponsoring the SIG) pulling down at least 5 percent of the gross-\$50,000 a year or more. The assistant sysops generally work for "fame and glory" and get free time on the SIG for their efforts.

Although SIGs used to be the sole province of CompuServe, the revenues that they've been pulling in lately have prompted Delphi, The Source, and other services to get into the act. And the competition is just beginning to heat up. The lure of substantial amounts of SIG-generated money can do funny things to people.

For example, the entire staff of the Commodore SIG on one service recently jumped ship and set up shop with a competitor. The defection wasn't a secret-the sysops used the SIG message base to let members know where they had gone. And within the last year, the head sysop of another popular SIG had to contend with a palace coup staged by his assistant sysops. After the smoke cleared, there were two SIGs instead of one-a SIG headed by the original sysop and another by the rebels. Keeping the SIG peace might soon be a job for the United Nations.

Fortunately, most SIGs are very well run and perform a valuable function, acting as information clearinghouses. But as useful as they may be, there's no point in paying through the nose to enjoy the benefits of regular involvement in a SIG. Here are some general tips that can help you save money when participating in a SIG.

Be Selective

Don't try to read every new item in the message area. Many of the more popular SIGs can turn over a thousand messages or more in three or four days. Pick one or two sections with topics that appeal to you and stick with them.

Many SIGs let you read streams of messages without pausing for a response from you between items. To take full advantage of this feature, download the messages you want and read them offline. If you wish to reply to a message or leave a new one of your own, write your text offline as well; you can send the entire message in a matter of seconds rather than pecking away online. (See last month's column for hints on this technique.)

Unless you have a burning question that can't be answered by the folks who access the message section, pass up regularly attending special online conferences. Complete transcripts of the conferences are usually available in the file access areas shortly afterward. Given the speed that most people type, the text of a two-hour conference can usually be downloaded in about five minutes. If you can't resist conferences, don't bother to sign on at 1200 or 2400 bps if the service charges hourly premiums for these higher speeds. Ol' 300 baud is just fine for conferences and will keep the hourly rate you pay at a minimum.

Finally, don't ignore using the public domain program library of your local computer user group as an alternative to downloading files from SIGs. An entire diskful of programs from a user group usually costs no more than an hour of time on a SIG.



Atari Input/Output

Much of what I'm about to discuss this month has appeared in this column before. And the bulk of this information can also be found in the *Atari Technical Reference Manual*—presuming you can read "techlish." But this intro is necessary so we can start talking about the meat of our subject next month.

Still with me? Let's go. Atari's operating system (OS)-which, like the OS in any eight-bit computer, takes up the bulk of Read Only Memory (ROM)-is really a thing of beauty. In fact, it may be the only consistent OS to be found in any microcomputer, short of those sporting UNIX or its derivatives. CP/M and MS-DOS are such kludges that most commercial programs bypass the OS. (That's why there are so many "almost PCcompatibles.") The Commodore 64's operating system comes close, but its disk input/output is difficult at best. And Apple's ProDOS manual states that "users desiring to perform I/O to devices other than the disk drive are on their own!"

Atari users, on the other hand, enjoy a system with such complete support that, for most programs, all necessary input/output operations can be executed by calling a single subroutine! That subroutine is called, appropriately, Central Input/Output (CIO). By calling CIO with the proper values in certain memory locations and the proper pointer in the 6502's X register, your programs can perform such diverse operations as formatting a disk, drawing a line on the graphics screen, fetching a keystroke from the keyboard, sending output to the printer, or reading 25,000 bytes from a disk file.

Yet, CIO is invisible to most Atari users. For example, many of the capabilities which magazine and newsletter articles attribute to BASIC are not part of BASIC at all. None of the graphics (including the so-called BASIC graphics modes) in Atari BASIC are actually performed by BASIC. Instead, BASIC simply translates the graphics command into a call to CIO. Atari developed this system in 1978, and it wasn't until the Macintosh appeared that such a revolutionary concept was repeated in a popular computer.

Generally, you have to become a machine language programmer to appreciate and use all the features of CIO. So why read any of this, then? Because calls to CIO can't perform *every* input/output task possible on Atari computers. What can't CIO do? First, let's take a glance at what it can do.

Calling CIO

When CIO is called by a program, it expects the X register to contain a pointer to an *Input/Output Control Block* (IOCB). IOCBs are blocks of memory 16 bytes long which control CIO functions. The pointer value for the X register is easily calculated—it's actually the BASIC file number (as in OPEN #1,4, 0,"K:") multiplied times 16, because there are 16 bytes per IOCB. One of the bytes within the IOCB then tells CIO what function the program is requesting.

There are seven fundamental functions available: OPEN, CLOSE, STATUS, PRINT, INPUT, Block PUT, and Block GET. In addition, there are some *extended functions*. BASIC programmers are familiar with these because of the XIO statement, which allows you to call the functions from BASIC. But several other BASIC statements (including NOTE, POINT, DRAWTO, and LOCATE) access the CIO extended functions, too.

After CIO examines the IOCB and determines which function is being requested, it decides which device (keyboard, disk, screen, etc.) should service the request. Then it calls an appropriate routine within the *device driver* for that device. (For example, the Disk Operating System—or more properly, the File Management System—is the device driver for the disk drive.) If the request is for an extended function, it is passed on unchanged to the device driver.

Well, with 256 possible command values, you would think that there isn't any request, however bizarre, which couldn't be serviced via CIO. In theory, true. In reality, you have to stop adding functions somewhere or you run out of memory. Thus Atari's CIO-based graphics have no function for drawing a circle, and DOS provides no command to format a disk without also writing a boot and directory.

If you want to draw a circle, you can write a routine to calculate and PLOT points or change screen memory directly. If you want to mess with the disk drive, though, you have to learn about another routine within the Atari ROMs, *Serial Input/Output*.

The Mysterious SIO

SIO—which lets Atari computers talk to devices (such as printers and disk drives) which hook up to the serial bus—has acquired an undeserved aura of mystery. Actually, though, in some ways it is easier to call SIO than it is to call CIO!

For example, there is only one SIO "device" and only one Device Control Block (DCB). So even the X register pointer required by CIO isn't necessary when calling SIO. Intrigued? I hope so, because it's time to sign off for now. But after this brief overview, we're ready for next month's column: We'll show how to write a program to call SIO.

C


BM Personal Computing

Donald B. Trivette

New Life For Aging PCs

This month's COMPUTE! is full of new wares from the Summer Consumer Electronics Show. But most of us can't afford to toss out the old and bring in the new—at least not yearly—so let's look at an interesting alternative.

One way to give new life to an aging PC is with a PCturbo board by Orchid Technology (47790 Westinghouse Drive, Fremont, CA 94539). PCturbo, which installs in one of the PC's expansion slots, contains a whole new computer and a whole new memory. It's like having a new computer inside an old computer. The old computer is the original IBM PC with its memory and Intel 8088 microprocessor. The new computer is completely contained on the PCturbo board; it has an Intel 80186 microprocessor with up to 640K RAM.

You don't lose your old PC in the bargain—a PC with PCturbo is like two separate computers. In PC mode, the computer runs just as it always did. But in PCturbo mode, the machine zips through most programs three to four times faster. Two new DOS-like commands— TURBO and GOPC—switch from one mode to another.

The PCturbo board executes all the usual program instructions, but handles input/output in a special way. For example, when a disk operation generates an input/output interrupt, the PCturbo's 80186 processor passes the I/O task along to the slower 8088 processor. That means the 80186 can run a program at full speed without stopping to process time-consuming interruptions from the keyboard, screen, disk, and printer.

Nor is the PC's original memory left idle. Software supplied with PCturbo allows that memory to be used as one or more electronic RAM disks and as a *disk cache* (pro-

nounced like "cash"). Disk caching has been around for years as a way to speed up I/O on mainframe computers. No matter how fast disk drives are, memory is three to four times faster. The PCturbo diskcaching software automatically moves blocks of data (called sectors) from the disk to the cache (the old PC memory) so the data will be there when needed. In fact, the caching software anticipates requests: It moves the next disk sector into memory as well. All this is completely transparent to the application software-it still thinks it's reading and writing data on a floppy disk.

A Dramatic Speed-Up

How well does disk-caching work? To find out, I plugged a PCturbo board into my three-year-old 320K PC and invited over a friend.

Henry and his wife own an interior design firm; they use their PC with Lotus 1-2-3 to keep track of chairs, tables, wallpaper, fabrics, taxes, and all the other charges for a job. I had heard Henry complaining about the spreadsheet for a modest residence he is doing for a surgeon. The spreadsheet is 28 columns wide by 389 rows deep-about 170,000 opulent bytes. When something is added—say a Ming vase-it takes the program 15.5 seconds to recalculate. (We all should have to spend a half-million dollars at four items per minute!) With the computer in PCturbo mode, the recalculations were cut to six seconds. That's a speed increase of 250 percent (or six more items per minute).

My own problems more often involve checking the spelling in a manuscript rather than spending money more rapidly. I recalled a 2,049-word article (it took the PC three seconds to count the number of words; PCturbo, one second) and set *Word Proof*, the IBM spelling checker, to work. In 41 seconds, PCturbo verified that the article had no errors; in regular PC mode, the job took 107 seconds. To speed things up even more, I moved *Word Proof's* 125,000-word dictionary from a floppy disk to an electronic RAM disk created in the regular PC memory. PCturbo polished off all 2,049 words in 18 seconds (almost 114 words per second); the PC by itself took 77 seconds—more than four times longer.

And how much does it cost to find spelling errors faster than Superman? The invoice from Orchid Technology is \$747 for the PCturbo board with 256K of memory, and \$375 for the optional 384K memory module to reach a total 640K. The fully loaded board— PCturbo with 640K—costs \$1,122. Not bad for an accessory that almost turns a three-year-old PC into a PC AT.

Almost, that is, because the PC won't do a few things in PCturbo mode. IBM BASIC is an IBM proprietary product built into a chip on the PC's main circuit board; it's not available to PCturbo, so you must switch to PC mode to run BASIC or BASICA. But compiled BASIC runs just fine with PCturbo. Also, the PCturbo board I tested wouldn't run communications programs (it couldn't find the modem). However, Orchid says it has a solution to that in the works. Somehow it's comforting to know there's lots of life left in the old PC.

Odds And Ends

The second edition of IBM's Directory of Personally Developed Software has been out for several months. To get a free copy, call 1-800-IBM-PCSW (a.k.a. 1-800-426-7279). The new directory lists 58 software products ranging in price from \$15 to \$150, although most cost about \$20. There are some real bargains here. Programming the TI

Trivia Quiz

There has been quite a big fuss about the trivia-type question and answer games—Trivial Pursuit and the various takeoffs. I'm certain that you've also seen ads for computer versions of these board games. Have you ever wanted to buy one? Wait! Write your own. This month's program, "Trivia Quiz," gives you the basic structure for a question and answer game.

C. Reaena

The main part of either the board games or the computer versions is the bank of questions. Of course, we can't publish a program with questions already included because it would take up the whole magazine. To make your own game, you must invent your own questions. Teachers can use this program for a basic essay-type quiz on any subject, and families can think up questions that appeal to their interests.

The computer is used to shuffle the questions, or to randomly choose one question at a time and give its corresponding answer. Once a question comes up, it is not used again.

I've previously published programs for a matching quiz and a multiple-choice quiz. This program creates a fill-in-the-answer or essay quiz. You can even print out copies of tests that have the questions in a different order for each person.

Modifying The Program

In each of the program's DATA statements, first write a question, then type a comma, then put the answer. Remember to adjust the spacing so it looks nice on the screen (no words split across screen boundaries). If you need commas within the question or the answer, you'll need to use quotes. Just to give you an idea, the sample program contains questions from nursery rhymes and fairy tales. Adjust the DIMension statement for the number of questions you put in your DATA statements. For an example, I've used only 20 questions. You'll probably want many more for a trivia quiz. Also define N in line 120 for the number of possible questions.

After the computer chooses and prints a question, the player inputs the answer. The computer then prints the correct answer. The computer does not keep score, however, because you may want to accept several forms of the answer. For instance, you could accept the answer to the question of what Little Miss Muffet ate as "curds and whey," "her curds and whey," or even "cottage cheese"—but you would not accept "porridge."

Trivia Quiz simply asks the questions, so any number of people can play. You may want to expand the program to ask questions of each player in turn, to add scoring, or to make a more complex game. Of course, you can add graphics and sound, too.

If you wish to save typing effort, send a blank cassette or disk, a stamped, self-addressed mailer, and \$3 to:

> C. Regena P.O. Box 1502 Cedar City, UT 84720

Please be sure to specify that you want the TI version of Trivia Quiz.

Answers To Reader Questions

I cover TI BASIC exclusively in this column because most COMPUTE! readers have console BASIC only. For other programming languages and hardware information, a good newsletter is published by the 99'ers User Group Association, 3535 South H Street, #93, Bakersfield, CA 93304. This is a nonprofit organization that communicates with hundreds of local user groups.

User groups are still going strong and are your best source of information and help. Many publish excellent newsletters (sorry, too numerous to mention here, and I wouldn't want to slight anyone).

New software is still being produced for the TI—I guess because there are over two million TIs out there. Most new programs are entertainment and educational titles. And yes, the Extended BASIC module remains available.

Hardware also is abundant. There are separate units for each peripheral, which saves you money if you need only one item. There are also combinations. One attractive unit I've used is CorComp's expansion unit that contains an RS-232 interface, 32K memory expansion, and a disk controller, all in a box about six inches wide that connects to the side of the console. It works just like the TI Peripheral Expansion Box but without the bulk and the noisy fan. My only complaint is that the disk drive connector isn't the same as the TI disk drive ribbon cable, but I understand Radio Shack has the necessary connections.

Next month I'll discuss how to use peripherals in your programming.

Trivia Quiz

100	REM TRIVIA QUIZ
110	DIM 5\$(20), A\$(20)
120	N=2Ø
130	CALL CLEAR
140	PRINT TAB(8); "TRIVIA QU
	IZ"
150	PRINT :: "A QUESTION WIL
	L BE SHOWN. "
160	PRINT :: "TYPE THE ANSWE
	R (WITHOUT"
170	PRINT : "COMMAS) THEN PR
	ESS (ENTER)."
18Ø	PRINT :: "THE CORRECT AN
	SWER IS SHOWN."
190	PRINT :: "PRESS THE SPAC
	E BAR TO"
200	PRINT : "CONTINUE."
210	FOR C=1 TO N
220	READ S\$(C), A\$(C)
230	NEXT C

Cwww.commodore.ca

	24Ø	PRINT ::: "PRESS ANY KEY	:
	25Ø	CALL KEY (Ø, K, S)	
	260	IF SK1 THEN 250	
	27Ø	FOR C=1 TO N	
	280	CALL CLEAR	
	290	RANDUMIZE	
	300	REINI (N#KND) +1	
	320	PRINT S\$(R) ::	
	330	CALL SOUND (100, 1497, 2)	
	340	INPUT B\$	1
	350	PRINT :A\$(R)	1
	360	CALL KEY (Ø,K,S)	1
	37Ø	IF K<>32 THEN 360	
l	38Ø	S\$(R)=""	h
	390	NEXT C	
	400	CALL CLEAR	1
	410	REM FOI QUESTIONS HERE	
	420	DATA WHO LOST THEIR MIT	
	420	TENS2, THE THREE LITTLE	
		KITTENS	
	430	DATA WHO WERE THE THREE	
		MEN IN A TUB?, "THE BUT	
		CHER, THE BAKER, THE CA	
		NDLESTICK MAKER"	1
	440	DATA WHEN WILL THE CRAD	
	1000	LE ROCK?, WHEN THE WIND	
		BLOWS	1
	450	DATA WHAT DID JACK AND	
		JILL (6 SPACES) FETCH?, A	1
		PAIL OF WATER	
	460	TATLES THE EARMER'S WI	
1		FE	
	470	DATA HOW MAY BAGS OF WO	
		OL DID THEBLACK SHEEP H	
		AVE?, THREE	
	480	DATA WHO VISITED THE TH	
		REE BEARS'HOME?, GOLDILO	I
		CKS	
	490	DATA WHO CHOKED ON AN A	
	_	PPLE?, SNOW WHITE	
	500	DATA WHO SANG FOR HIS S	
		UPPER?, LITTLE TUMMY TUC	
	510	DATA WHAT DID THE THREE	
l	JID	PIGS USE TO BUILD THEI	
		R HOUSES?. "STRAW. STICK	
		S. BRICKS"	
	520	DATA WHO USED HER LONG	
		HAIR TO (3 SPACES) SEE TH	
		E PRINCE?, RAPUNZEL	
	530	DATA WHAT DID JACK FIND	
		IN HIS (3 SPACES) CHRIST	
		MAS PIE?, A PLUM	
	540	DATA WHAT DID LITTLE MI	
		D WHEY	
	550	DATA WHO WAS LITTLE RED	1
	550	RIDING(3 SPACES)HOOD G	
		DING TO VISIT? HER GRAN	
		DMOTHER	
	560	DATA WHAT COULDN'T JACK	
		SPRAT(4 SPACES)EAT?, FA	
	and the	T	
	57Ø	DATA WHO STOLE A PIG AN	
		D AWAY DIDRUN?, "TOM, TH	1
	FOR	E PIPER'S SUN"	
	280	ALL GRACEGICANDI SETTORS	
		JACK	
	590	DATA WHO SLEPT WITH HIS	
	270	STOCKINGSON? MY SON 10	
		HN	
	600	DATA WHOSE FOOT FIT THE	1
		GLASS (4 SPACES) SLIPPER	1
		?,CINDERELLA	
	610	DATA WHAT KIND OF MEAT	
		DID ONE OFTHE LITTLE PI	
		COTEC HAUES DOACT DEEE	1

GGIES HAVE?, ROAST BEEF

0

TI Webster Dines Out

In line 480 of this game program from the June issue (Program 6, p. 57), the DISPLAY AT(3,22) should be DISPLAY AT(23,22). Reader Andrew Sonon supplied this correction, which moves the score indication to its proper place on the screen.

Apple MLX Error Messages

Although there are no errors in the "Apple MLX" listing from the June issue (p. 114), a number of readers have encountered DISK ERROR messages at unusual times. During normal operation of the program, the only errors that should occur are ones involving disk access; line 100 traps these errors. However, a side effect of this error trapping is that typing mistakes you make while entering MLX can also produce the message in line 610. Thus, if MLX gives you a DISK ERROR message when you are not accessing the disk, you need to check for a typing mistake in the MLX program. Lines 330-340 are a common problem area. Make sure you have not confused the letter O (used in the variable names O\$ and O in those lines) with the number zero, which also appears in line 340. In COMPUTEI's listings, a zero always has a diagonal slash through it.

Commodore Disk Editor

The POKE 1024, PEEK(254) in line 260 of this disk utility program from the June issue (p. 98) prevents you from changing the value of the first byte in a sector. This is the track number for the next sector in the file, so you may not need to change its value very often. However, you can modify the program to allow editing of the first byte by replacing the GOTO 260 at the end of line 310 with WAIT 198,255: GOTO 280.

Editing Enhancement For Softball Statistics

CAPUTE!

This record-keeping program from the July issue (p. 30) works as published for all the listed computers. However, the data input process can be simplified by allowing corrections for each player's statistics. To accomplish this, make the following changes to the general program (Program 1):

545 PRINT 546 PRINT "EVERYTHING OK (Y/N) 7" 547 INPUT A\$ 548 IF A\$<>"N" AND A\$<>"Y" THE N 545 549 IF A\$="N" THEN 420

TI-99/4A users should also make the following additional changes:

```
548 IF (A$<>"N")*(A$<>"Y") THE
N 545
```

Atari users should also make the following additional changes:

```
250 NEXT I:PRINT "(DOWN)E
verything OK (Y/N)?":
GOSUB 630:IF A$="N" T
HEN 210
255 GOSUB 460
```

Mindbusters For Atari DOS 3.0

To use the Atari version of this thinking game from the April issue (p. 50) with DOS 3.0, you must delete the DIM K(255) in line 5 and make the following changes to line 1:

1 DIM K(255):FOR I = 0 TO 255: K(I) = 0: NEXT I: GOTO 5

Archon II: Adept

Arthur Leyenberger

Requirements: Commodore 64 or 128; Atari 400/800 or XL with at least 48K RAM; or an Apple II-series computer with at least 48K RAM. All versions also require a disk drive and a joystick.

In any entertainment business, whether it is movies, books, or videogames, there is a natural tendency to produce sequels to existing hits. Making sequels can be approached in a number of ways. Often the sequel is just more of the same thing, such as *Jaws II* and *Jaws 3-D*; the hope is that there will be continued demand for more of the same thing. The risk in this approach is that people may eventually grow tired of the old formula.

Another approach is to use the same basic theme of the original, but add something new or better to the sequel—as in the successful *Star Wars* and *Star Trek* films. This is also the case with *Archon II: Adept*, a new game from Free Fall Associates, published by Electronic Arts.

Adept was designed to be a game that has the same mixture of strategy, action, and play mechanics as the original Archon. But it is sufficiently different to please both new players and long-time Archon devotees.

Casting Magic Spells

Adept is basically a game of magic, focusing on energy and resource management. Unlike Archon, it allows people of different skill levels to compete more equally. The combination of strategic board play and individual combat means that people who don't have fantastic reflexes have a reasonable chance of winning.

Each side starts with four Adepts, similar to the Wizard and the Sorceress pieces in *Archon*. The game begins with one Adept on each of the four elements: Earth, Water, Air, and Fire. The elements are represented by colored bands on the screen. Your pieces are shown vertically on each side of the screen, with the more powerful, flexible pieces at the top.

Reviews

The more powerful pieces require more energy to manipulate. Choosing the beginner level gives you the most energy while choosing the advanced level gives you the least. The play level also affects the speed of the pieces in combat. Each piece can cast spells, and every spell costs magical energy. You can cast as many spells as you want with any piece as long as you can afford it. To gain magical energy, you must occupy "power points." If you occupy all of the power points, you win the game.

You shape your magical army depending on such factors as your skill with a particular piece, a certain strategy, or the pieces you like. Each side has four different elemental pieces that can be called upon. They are strongest in their own element but can be played in any element. Some of the pieces are common to both sides, while others are unique.

When you choose a piece, you are shown the amount of energy you currently have as well as how much energy it costs to use that piece or cast a spell. Although many of the spells are familiar to the experienced *Archon* player, some have new twists. For example, the Imprison spell lets you trap an enemy piece as long as you have the energy to pay for it. Casting and maintaining this spell costs energy during every turn, so imprisoning everyone in sight would soon drain your resources and lose you the game.

Apocalypse Now

All of the spells can be cast repeatedly, with one exception: the Apocalypse. You can cast this spell only once, since it begins a battle that ends the game. It is a one-on-one, winner-take-all battle that is shaped by your strategic position: the amount of energy, number of pieces, and surviving Adepts you have left. The result can be either a wellmatched or very one-sided battle.

This go-for-broke spell typically is cast in two situations. One is if you are way ahead and, for some reason, are having trouble occupying the last power point. The other situation is when you're in danger of losing the game and have no other way out. Since the Apocalypse spell is expensive, casting it in a weak position weakens you still more.

Adept contains a wider variety of creatures than are found in Archon. Each piece has a unique weapon and performs best in a certain element. For example, the Juggernaut is best suited to Air and uses itself as a missile. When fired, it glows and charges across the screen. While in motion, it is invulnerable and destroys anything in its path. Using the Juggernaut in the water, however, significantly slows it down and makes it more vulnerable to attack.

In 1983, Archon ranked at the top of almost every gamer's list. It still belongs in the videogame hall of fame. Archon II: Adept is even better than Archon and should rank even higher with experienced Archon devotees as well as with players new to the world of magic and strategy.

Archon II:Adept Electronic Arts 2755 Campus Drive San Mateo, CA 94403 \$33 (Commodore & Atari) \$40 (Apple)

WordPerfect For IBM

Richard Mansfield, Senior Editor

Requirements: IBM PC or compatible with at least 192K of RAM, two disk drives, DOS 2.0 or higher, and a printer. Not compatible with the PCjr.

This is an excellent word processor. In addition to performing all the usual tasks with speed and efficiency, *Word-Perfect* includes many features which are either rare or unique.

Perhaps its best single feature is that it gives you a blank screen to write on—no distractions from control codes, command lines, or other clutter. Just a couple of unobtrusive numbers in the lower-right corner to identify the col-

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Sophisticated and efficient are good words to describe this program. While it is easy to use, it contains so many features and advanced commands that even the most demanding writers should find what they need. Statistical typing, math calculation, automated outline numbering, automated compilation of tables of contents—the list goes on. If you need some arcane function, you're likely to find it in *WordPerfect*. If you simply need a powerful, sensible writing machine, you owe it to yourself to consider this fine tool.

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Adventures In Narnia For Apple And 64 C. Regena

Requirements: Commodore 64 with a disk drive; or an Apple II-series computer with at least 48K RAM and a disk drive.

Adventures in Narnia is an adventure game based on the book The Chronicles of Narnia by C.S. Lewis. When we first opened the package, my son exclaimed, "Hey, I've read that book!" Inside is a paperback entitled The Lion, the Witch and the Wardrobe, a popular story in the Chronicles series which was the inspiration for Adventures in Narnia. The characters in the game are the same as those in the book. You don't have to read the book to play the game, but if you play the game and enjoy it, you'll probably want to read the book.

Adventures in Narnia is actually a combination adventure, arcade, and board game. It even comes with a deck of game cards and a pair of dice. Highresolution computer graphics replace the traditional board, but sometimes during the arcade action you bump into something that requires you to roll the dice or choose a card. Adventures in Narnia was designed to use the computer, but still resemble a board game and bring human interaction into play. As a result, the game is not always machine-controlled. Its authors point out that the computer waits while you "think, discuss, decide." You can "strategize and argue (without penalty) in the middle of the game, allowing the fun and humor of dialogue that is missing in normal videogames."

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Other adventures are available in this series as well—such as *Dawn Treader*, based on the story *The Voyage* of the "Dawn Treader."

Dodging Evil Dwarfs

The game actually is a two-part adventure with two different arcade screens. In the first adventure, you start out in the wardrobe and try to gain points and strength. In the second adventure, you use the strength to reach a character called Aslan the Lion.

You start the game by shuffling the cards and placing them near the computer. Your player is at the right side of the screen among randomly placed bushes, flowers, and beavers. Evil dwarfs dart about, and you have to avoid them. Dwarfs can also hide in the bushes, so you don't want to hit a bush. You can gather flowers to gain points, and you can meet a friendly beaver to gain strengths (indicated by hearts at the top of the screen). The evil dwarfs patrol Narnia and go around stomping on flowers and beavers to prevent your success.

The game action is quick. If you hit a dwarf (or a moving bush), you're sent to a dwarf battle. The dwarf thinks of a random number, and you must roll the dice to beat his number. If you win, you get 500 points, but if you lose, you sacrifice one strength.

From time to time, Edmund and the Witch appear on the screen. Your job is to intercept Edmund to prevent him from reaching the Witch. The first adventure ends if the Witch captures Edmund, or if you get ten heart strengths, or if your time runs out. Then the next adventure starts.

Inside The Ice Maze

The second adventure takes place in the Ice Maze with your character at the lower-right corner of the screen and Aslan the Lion at the upper left. Your object is to get to Aslan, but the Witch sends evil crystals through the maze to stop you. If you get hit by a crystal, you're sent back to the beginning and you lose one heart. If you lose all the hearts and get hit again, you lose the game.

The gravity chutes are another hazard. Snow is falling inside these chutes, and if you step into one, you'll tumble to the bottom and find yourself sealed inside the maze.

If you run into a door, you're sidetracked to a subadventure. Since the game action is fast, you'll probably run into some doors by accident. Once in a subadventure, you're directed to pick a card. Then you enter the card's code into the computer. If your card is Aslan the Lion, you automatically gain one heart strength. If you draw a Zap card, you're automatically sent back to the beginning of the maze and you lose one strength. Other cards—such as Fenris Ulf the Wolf, Cair Paravel the Castle, and Jadis the Witch—require you to roll the dice to determine your consequences, which can be good or bad. After the subadventure, you return to the maze for another crack at Aslan the Lion.

You lose the game if the Witch steals all your hearts with her ice crystals or if time runs out. You win the game by reaching Aslan the Lion. Your final score is determined by the running score on the screen plus 1000 points for foiling the Witch, 1000 points for each remaining heart, and the remaining time multiplied by 10.

The instruction booklet that comes with this package is very good. It presents all aspects of the game so you can identify each object and recognize whether it is good or bad. Color screen photos are accompanied with explanations for each possibility. And as you play the game, the screen instructions also are easy to understand.

If you own more than one computer, note that the Apple and 64 versions of this program are on flip sides of the same disk.

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This feature-packed utility makes it a breeze to create your own short cartoons or animation sequences on the computer screen. The original version is for the IBM PC with BASICA and color/graphics adapter, or Enhanced Model PCjr with Cartridge BASIC. We've added versions for the Atari 400/800, XL, and XE with at least 32K RAM for disk or 24K RAM for tape; Commodore 64 and 128 (in 64 mode); TI-99/4A with Extended BASIC; and Apple II-series computers with at least 48K RAM. The Atari and 64 versions also require a joystick.

Computer animation can be marvelous to behold but a drudge to produce. Whether you're working in BASIC or machine language, creating objects and manipulating them on the screen can mean fumbling for hours with PEEKs, POKEs, bits, bytes, and other tedious details.

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If you're using the IBM PC/PCjr version of Animator, type in and save Program 1, then run it and follow the instructions below. If you have an Atari, 64, TI, or Apple, you should also read the following instructions as a general guide to using Animator. Then refer to the typing instructions and programming notes specific to your computer for additional details.

Drawing An Image

When you run Animator, it displays an editing screen with 20 numbered frames. You can draw as many as 20 pictures, one in each frame, then flip rapidly through the frames to create animation. The frame number displayed at the upper left of the screen shows which frame you're currently working on. Normally, Animator begins the animation with frame 1 and ends with frame 20. But you can start and end the animation wherever you like. For example, a short sequence might start with frame 1 and end with frame 3. To view only part of a long sequence, you might start at frame 12 and end at frame 18, and so on. The frame number is controlled by pressing the right and left arrow keys.

The frame number also determines which frame you'll be working on when you go to the editing screen. Let's start with a simple example. Make sure the frame number is set to 1, then press the 2 key to select the editing function and press Enter at the next prompt.



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After a brief pause, Animator displays a drawing grid with a blinking cursor. Edit mode has three main functions, selected by pressing different keys. Press D to draw with the cursor, E to erase, and M to move the cursor without disturbing anything on the screen.

Draw a simple shape on the grid to become familiar with these basic functions. As you'll see, Animator displays the shape in its actual size to the left of the drawing grid. An inverse function lets you reverse everything on the gridevery dot becomes a blank, and vice versa (be patient-it takes Animator about a minute to complete this process).

Once the picture is finished, you can press S to save it and return to the main screen. Note that you must save a picture with S to put it in the frame. If you exit the edit mode by pressing Q, the new picture is lost and Animator uses whatever that frame previously contained. Try drawing a simple shape and saving it with S (since this is just for practice, any scribble will do). When you return to the main screen, Animator displays the picture in frame 1.

Frame By Frame

Now you're ready to draw the next frame in the sequence. In most cases you'll want to make only slight changes from one frame to the next, to simulate smooth motion. To save time, Animator lets you copy a picture from one frame to another. Let's demonstrate this by copying the picture from frame 1 to frame 2. Set the picture number to 1 with the arrow keys, then press 2 to edit. Animator displays a prompt, inviting you to enter a frame number. To edit the current picture number, you would just press Enter. However, by entering a different number you can copy the current picture into a different frame, then change that picture to make the next frame in your cartoon.

When you enter 2 at the prompt, Animator copies the picture from frame 1 into the drawing grid. When the drawing grid appears, make some change in the picture to distinguish it from frame 1. Now press S to save the picture in frame 2 and return to the main screen. Animator displays both pictures in their respective frames.

After drawing a few frames, you're ready to bring them to life. The first step is to specify the starting and ending frame numbers. The starting number determines which frame begins the animation, and the ending number tells Animator where the series ends.

Set the starting number first. Use the arrow keys to set the frame number to 1, then press the 3 key. Now use the arrow keys to make the frame number match the last frame that contains a picture, then press the 4 key. This sets the ending number. You must always set the starting and ending numbers before selecting animation (if you don't, Animator flips through all 20 frames whether they contain pictures or not). Once these numbers are set, press the 1 key to view the sequence. Press the space bar to pause and Enter to stop it.

By selecting different speed and pause values, you can move the animated figure across the screen. The speed value can range from -15 to 15. When it is 0, the figure is animated in place; positive values move the figure from left to right, and negative values move it from right to left. The greater the value, the faster the figure moves. Press the 5 key to decrease the animation speed, and 6 to increase it.

The pause value controls the time delay between each frame of the animation. A small pause value makes the pictures change very quickly, while larger values slow down the process.

Macro Editing Features

Animator provides a few macro (large-scale) editing features to help you work with longer cartoons. The insert function lets you insert a blank frame anywhere in the series. To use it, set the frame number to the number of the frame where you want to insert a blank, then press the I key. The designated picture (and all those following it) are bumped forward one frame. Note that the picture in frame 20 is always lost when you insert.

The delete function lets you delete any frame in the series. Change the picture number to the frame you want to eliminate, then press D. All the higher numbered www.commodore.ca

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pictures move down one frame, deleting the picture in the designated frame. Frame 20 is always blank after a deletion.

The inverse function (press 9) works just like inverse in editing mode, but inverts all 20 frames at once.

To clear all 20 frames, press Q to quit or C to clear. Since these last two functions can have drastic results, Animator lets you abort either one without harm.

When you finish a sequence, press S to save it on disk. The screen clears and displays three options: You can Press A to abort the save, F to list the picture files on that disk, or any other key to continue with the save. Picture filenames are limited to eight characters (the first character cannot be a number). Do not add a three-character extension; Animator automatically appends the extension .ANI when you save or load a picture file.

Finally, Animator's program option (available *only* in the IBM PC/PCjr version) can write a separate BASIC program to display your cartoon. Press P to select this option, and sit back while Animator writes the new program to disk under the filename PRG.BAS. Afterward, Animator ends with a reminder to reload PRG.BAS and save it with a new filename. This prevents the program from being overwritten if you select this option again.

Commodore 64 Version

The 64 version of Animator is written entirely in machine language, but you can use it without understanding machine language at all. Type in and save Program 2 using the "MLX" machine language entry program printed elsewhere in this issue. Here is the information you'll need:

Starting address: 49152 Ending address: 52991

After you've saved "64 Animator," plug a joystick into port 2 and load the program with LOAD"filename",8,1 for disk or LOAD"filename",1,1 for tape. Type SYS 49152 and press RETURN to run the program.

64 Animator's main screen consists of 21 picture frames instead of 20 as found in the IBM version. It also uses sprites to animate the frames. Although the Commodore 64 normally is limited to displaying eight sprites at once, 64 Animator employs as many as 22 simultaneous sprites with the raster interrupt technique described in COMPUTE!'s First Book of Commodore 64.

When you begin the program, the frames may contain random data; Press C to clear them out. Most program functions are controlled with the joystick. Near the bottom of the screen you'll see a list of several functions (frame numbers, options, and so on, as described above in the general instructions). As you move the joystick up or down, the function you select is highlighted in reverse video. To increase or decrease the selected value, move the joystick left or right.

Press the E key to enter edit mode. The joystick moves the blinking cursor around the drawing grid, and the fire button toggles the space under the cursor on or off. To draw or erase more than one space at a time, hold the joystick button down and move the stick in the direction you want.

The current picture number is displayed to the right of the screen. You can move to a different picture within edit mode: Press the + key to increase the picture number, and the - key to decrease it. Animator always displays the current picture in actual size above the picture number. Above and to the right of the current picture is the next picture in the series, and above to the left is the previous picture. (If you haven't drawn any pictures yet, these frames may be blank or contain random shapes.)

Press I within edit mode to invert the shape (change dots to blanks, and vice versa). The cursor keys shift the entire shape one space inside the grid, either left, right, up, or down. You can also expand the picture horizontally (press X) or vertically (press Y). Expansion is toggled off by pressing the same keys, and can be used on the main screen as well.

Edit mode lets you copy a picture from one frame into another. Press the f7 function key to store the current shape in the picture buffer. Then change the picture number with + or - and press f8 (SHIFT-f7) to copy the picture from the buffer into the new frame. In this way you can quickly draw a series of shapes without leaving edit mode. The R key returns you from edit mode to the main screen.

Animating On The 64

Before watching the animation, set the starting and ending frame numbers to the appropriate range. The joystick button turns animation on and off. To change the speed during animation, move the joystick left or right. Press the f1 function key to clear everything but your animated figure off the screen (f1 also brings back the main screen). You can change the picture color by pressing the CTRL key and one of the number keys from 1-8. The colors are the same as those printed on the front of the keys. For example, press CTRL-0 to color every figure black.

Insertions and deletions work as in the IBM version, except that an insertion retains the original picture in the selected frame rather than inserting a blank. To quickly fill several frames with the same picture, press I several times.

64 Animator can save and load picture files with either disk or tape. Be sure to set the starting and ending numbers before saving, since nothing is saved outside that range. The prefix ANI. is added to picture files on disk; do not type this prefix when loading or saving. To abort a save or load, press RETURN.

It's possible to merge pictures from different files if the two files use different frame numbers. Simply load the second file after the first. The main screen now contains pictures from both files. If the files have overlapping frame numbers, the second file has priority. For example, say that you load ANI.A, which uses frames 1–3, then load ANI.B, which uses frames 3–5. Frame 3 will contain the picture from the ANI.B file.

64 Animator also lets you add sound effects in edit mode. Press D to add or clear the drum sound. Animator displays a small drum on the screen when the sound is present. To add musical notes in edit mode, press one of the number keys from 1–8 for low notes, and SHIFT plus 1–8 for high notes. A

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	Summer Siz	zle	er :	Sale
	Sale Positively Ends 9-10-85 Prices will go back to regular sale prices	List	Reg. Sale Price	Summer Sizzler Sale
1	C128 Commodore Computer Expandable to 512K, runs C-64, CPM, and 7.0 Programs. (Add \$10 Shinping)	\$349 ⁰⁰	\$ 299 09	\$ 289 ⁹⁵ *
1	151/2" Commodore 150-170 CPS Printer Near Letter Quality, Multiple Pin Tractor / Friction Feed. Best Printer Value in U.S.A. (Add \$17.50 Shipping)	^{\$} 895 ⁰⁰	\$299 ⁰⁰	^{\$} 249 ^{95*}
	Commodore-64 IEEE Interface Allows you to run Pet Peripherals on the C-64, including the One Megabyte Disk Drive and 15½" Printer	^{\$} 109 ^{°5}	^{\$} 69 ⁰⁰	\$ 65 95
	Juki Printer/Typewriter Letter Quality, daisy wheel, use as typewriter and/or printer (auto correction) (Add \$10 Shipping)	\$349°°	\$2 49 00	\$ 229 ^{95*}
	SCM 80 CPS Printer Tractor/Friction 10" Famous Name Printer does Graphics w/Interface (Add \$10 Shipping)	^s 299ºº	\$ 159 00	\$ 149 ^{95*}
1	Cardco G Plus Interface Converts Commodore to centronics for use with most printers, plus does Commodore graphics on graphic printers	^{\$} 109 ⁰⁰	\$ 5900	\$ 49 ⁹⁵
	Alphacom 40 Column Printer Thermal technology - does graphics. (Add \$10 Shipping) Alphacom C-64 or Atari Interface 58 95	\$ 99 00	\$24 ⁹⁵	\$ 22 95
	190K Slim-Line Disk Drive Cooler, 20% faster, quieter than 1541 drive (Add \$10 Shipping)	^s 249 ⁰⁰	\$ 169 00	\$ 139 ^{95*}
3	One Megabyte Disk Drive (1000K) Double sided drive hooks up to C-64 with IEEE interface, perfect as a second drive. (Add \$10 Shipping)	^{\$} 889 ⁰⁰	\$ 199 00	^{\$} 179 ^{95*}
	13" Premium Quality Color Monitor Better than 1702, with separated video inputs. (Add \$14.50 Shipping)	\$ 399 00	\$ 199 00	\$169 ^{95*}
	Voice Synthesizer Allows you to talk through your computer. Optional software lets you play talking adventure games (Zork, etc.)	\$89°°	\$4900	\$ 39 %
	80 Column Board - 4 Slot Expander Allows you to program in 80 columns, plus gives you a 4 slot switch selectable expander	^{\$} 149 ⁰⁰	\$ 79 00	\$ 59 ⁹⁵
	Auto Dial Modem with Super Smart Software Upload, Download, Print, Catalog, This Package has it all!!! Best Modem Value in the U.S.A.!!	\$1 29 ⁹⁵	\$ 59 00	\$39%
	Musicalc I Software The Best Musical Software for the C-64, allows you to change all parameters.	\$59 ⁹⁵	*29 ⁹⁵	\$ 14 ⁹⁵
	Oil Barrons Software	\$49 ⁹⁵	\$1995	\$0 95
	Better than Monopoly, comes with game board, disks and instruction manual. Strike Oil or Live in the Poor Farm	* plu	s Software	Coupon Discounts
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small note is displayed when a note is present. Clear a note by pressing 9. Control the duration of sounds from the main screen.

Press Q to exit 64 Animator. If you want to restart the program, you *must* load it again as described above. Don't reenter with SYS 49152.

Atari Version

"Atari Animator" is in two parts. First type in and save Program 3, then Program 4. If you're using cassette, substitute the following line for line 2 of program 3:

06 2 PRINT "(DOWN)PRESS RETU RN":RUN "C:PART2"

Cassette users must also save Program 4 on the same tape immediately after Program 3. After both programs have been saved, plug in a joystick and read the general instructions above. When you're ready to continue, load and run Program 3 (be sure to rewind the tape to the beginning if you're using cassette). Program 3 loads the machine language portion of Animator, then automatically loads and runs Program 4.

The main screen provides 21 picture frames. Move the joystick up or down to select any of the values displayed at the bottom of the screen, and move it right or left to increase or decrease the selected value. Press E to go to the editing screen. In edit mode, move the blinking cursor around the drawing grid with the joystick. The fire button acts like a toggle: If you press it while the cursor is on a blank square, the cursor begins drawing; if you press it while the cursor is on a filled square, the cursor begins erasing.

To the right of the drawing grid is the current frame number and the picture in actual size. You can change to a different frame while in edit mode: Press the + key to increase the frame number and the key to decrease it. Atari Animator also lets you copy a picture from one frame to another via the picture buffer. Press the G key to get (copy) the current picture into the buffer. Then change the frame number with the + or - key and press P to put (move) the picture from the buffer into the new frame. mode and return to the main screen. After setting the starting and ending frame numbers, press the fire button to begin the animation. To stop the animation, press the fire button again. While the cartoon is moving, you can change the figure's color by pressing any key (shifted keys provide additional colors).

The clear function (press C) clears the current frame in edit mode or all frames on the main screen. Atari Animator does not have automatic insert or delete functions, but you can accomplish the same thing with a series of individual get and put operations. You can save sequences on disk or tape, using any appropriate filename for disk.

Apple Version

"Apple Animator" runs on any Apple II-series computer with DOS 3.3 or ProDOS. The program requires two files on disk: the main BASIC program and a binary file (ANIMA-TOR2) that contains graphics data. Type in and save Programs 5 and 6, then run Program 5 to create ANI-MATOR2 on disk. You must run Program 5 before running Program 6 for the first time. However, you don't need to run Program 5 each time you want use Program 6 only once to create the ANIMA-TOR2 file.

After running Program 5, read the general instructions above, then load and run Program 6. The program works much like the IBM PC/PCjr version, and most of its functions are self-prompting. Use the right and left arrow keys to pick the correct frame number before editing. For instance, if the frame number is 3 when you choose the edit function, frame 3 appears on the editing screen. To copy the picture in frame 3 into a different frame, enter the desired frame number when prompted.

When the editing screen appears, move the blinking cursor left, right, up, or down by pressing the J, L, I, and K keys, respectively. To put your drawing in the current frame, exit the edit mode with the save option (the quit option restores whatever that frame previously held). The remaining functions (load, save, insert, delete, invert, etc.) work as described in the gener-

al instructions above, except that Apple Animator uses no filename extenders for picture files.

TI Version

"TI Animator" is very similar to the IBM version. Be sure TI Extended BASIC is plugged in before typing and saving Program 7.

Since the TI-99/4A screen can display only 10 frames at once, the 20 frames are divided into two groups (1–10 and 11–20) on alternate screens. Press the N key to switch back and forth. You can change the color of the screen background or foreground drawing color by pressing the B or F keys.

TI Animator can save animation files on disk or tape. When saving on tape, enter CS1 for the filename. When saving or loading from disk, be sure to type the prefix DSK1. at the beginning of each filename.

Program 1: Animator for IBM PC/PCjr

Please refer to "COMPUTEI's Guide to Typing In Programs" before entering this listing.

<pre>PK 3Ø KEY DFF:CLS:SCREEN 1:DEF S EG:POKE &H4E,1 CL 11Ø DEF SEG:POKE &H4E,2 DL 15Ø REM *** MAIN PROGRAM ** * Af 16Ø CLS:SCREEN 2:KEY DFF:FOR I=1 TO 1Ø:KEY I,"":NEXT DJ 17Ø REM *** SET UP VARIABLES *** 5D 18Ø DIM AX(144),BX(144),DX(14</pre>	OP	5 DE 47	F SEG=0:POKE 1047,PEEK(10
CL 110 DEF SEG: POKE & H4E,2 CL 1150 REM ### MAIN PROGRAM ## # AF 160 CLS: SCREEN 2: KEY OFF: FOR I=1 TO 10: KEY I, "::NEXT D) 170 REM ### SET UP VARIABLES ### 50 180 DIM AX(144), BX(144), DX(14 A), EX(144), FX(144), DX(14 A), EX(144), FX(144), CX(144), , DX(144), KX(144), DX(144), , DX(144), NX(144), DX(144), P X(144), NX(144), DX(144), SX (144), TX(144), UX(144), SX (140) UX (10) CATE 22, 1:PRINT"SARE ALL THE PICTURES"; FK 220 LOCATE 21, 1:PRINT"(S)AVE (L) OAD (C) LEA R ALL (Q) UIT (P) ROGAM"; 1:LOCATE 4, 75:FOR I=1 TO 10:PRINT"	PK	30 4	CEY OFF: CLS: SCREEN 1: DEF S
<pre>CL 119 DEF SEDIFORE WHYL,1 CL 119 DEF SEDIFORE WHYL,1 CL 150 REM *** MAIN PROGRAM ** * AF 160 CLS:SCREEN 2:KEY OFF:FOR I=1 TO 10:KEY I,"":NEXT D) 170 REM *** SET UP VARIABLES *** ED 180 DIM AX(144),BX(144),DX(144), ,GX(144),FX(144),CX(144), ,GX(144),FX(144),CX(144), ,GX(144),RX(144),CX(144),PX(144),CX(144),QX(144),QX(144),QX(144),SX(144),SX(144),GZ(144),CZ(144),GZ(144),CZ(144),GZ(14),GZ(144),GZ(144),GZ(14),GZ(144),GZ(144)</pre>	-	110	DEE CEG. DOVE LUAE 7
<pre># # # # # # # # # # # # # # # # # # #</pre>	01	150	DEM *** MATH DOGCOM **
<pre>AF 16Ø CLS:SCREEN 2:KEY OFF:FOR I=1 TD 10:KEY I,"":NEXT D) 170 REM *** SET UP VARIABLES *** BD 180 DIM AX(144),BX(144),DX(14 A),EX(144),FX(144),CX(144) ,GX(144),FX(144),CX(144), ,JX(144),KX(144),CX(144), ,JX(144),XX(144),QX(144),P X(144),QX(144),QX(144),A(2 Ø,54):NUM=1:STA=1:EN=20:S P=0:PL=1:GET(1,10)-(54,30)),UX QL 190 X=9:Y=31:LOCATE 1,39:PRIN T"SPEED= ";SP:LOCATE 1,1 :PRINT"NUMBER=";NUM;:LOCA TE 1,14:PRINT"START=";STA ;:LOCATE 1,26:PRINT"STOP= ";EN;LOCATE 1,55:PRINT"C HANGE PAUSE=";FAST BE 200 REM *** SET UP SCREEN * ** PB 210 LOCATE 22,1 :PRINT"1-ANIM ATE 2-EDIT 3-STA RT PIC. 4-END PIC. ":LOCATE 23,1:PRINT"5 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER 1:PRINT"9-INVERSE ALL THE PICTURES"; FK 220 LOCATE 21,1:PRINT"(S)AVE (L)OAD (C)LEA R ALL (Q)UIT (P)ROGAM";:LOCATE 4, 75:FOR I=1 TO 10:PRINT"</pre>	UL	1.30	*
<pre>I=1 TO 10:KEY I, "":NEXT D) 170 REM *** SET UP VARIABLES *** 6D 180 DIM A%(144), B%(144), D%(14 A), E%(144), F%(144), C%(144), G%(144), F%(144), I%(144), J%(144), J%(144), Q%(144), Q%(144), Q%(144), S%(144), Q%(144), Q%(144), G%(144), Q%(144), G%(144), G%(144), Q%(144), Q%(144), G%(144), Q%(144), G%(144), Q%(144), Q%(144), Q%(144), G%(144), G%(14), G%(144), G%(14), G%(144), G%(144), G%(14), G%(14), G%(144), G%(14)</pre>	AF	160	CLS: SCREEN 2:KEY OFF:FOR
<pre>DJ 17Ø REM *** SET UP VARIABLES *** 5D 18Ø DIM AX(144),BX(144),DX(14 A),EX(144),FX(144),CX(144) ,GX(144),FX(144),IX(144), ,GX(144),KX(144),CX(144),PX (144),QX(144),QX(144),A(2 Ø,54):NUM=1:STA=1:EN=20:S P=Ø:PL=1:GET(1,10)-(54,30)),UX SL 19Ø X=9:Y=31:LOCATE 1,39:PRIN T"SPEED= ";SP:LOCATE 1,1 :PRINT"NUMBER=";NUM;:LOCA TE 1,14:PRINT"START=";STA ;:LOCATE 1,26:PRINT"STOP= ";EN;:LOCATE 1,55:PRINT"C HANGE PAUSE=";FAST BE 20Ø REM *** SET UP SCREEN * ** PB 210 LOCATE 22,1 :PRINT"1-ANIM ATE 2-EDIT 3-STA RT PIC. 4-END PIC.":LOCATE 23,1:PRINT"5 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER 10: SWITCH 8 -SLOWER 21,1:PRINT"SIA ATE 24,1:PRINT"9-INVERSE ALL THE PICTURES"; FK 220 LOCATE 21,1:PRINT"(S)AVE (L)OAD (C)LEA R ALL (Q)UIT (P)ROGAM";:LOCATE 4, 75:FOR I=1 TO 10:PRINT"</pre>			I=1 TO 10:KEY I, "":NEXT
<pre>50 180 DIM AX(144), BX(144), DX(14 4), EX(144), FX(144), CX(144) , JX(144), KX(144), IX(144), , JX(144), NX(144), DX(144), P X(144), NX(144), DX(144), P X(144), DX(144), DX(144), SX (144), TX(144), UX(144), A(2 Ø,54) iNUM=1:STA=1:EN=20:S P=0:PL=1:GET(1,10)-(54,30)), UX 0L 190 X=9:Y=31:LOCATE 1,39:PRIN T"SPEED= ";SP;iLOCATE 1,1 iPRINT"NUMBER=";NUM;:LOCA TE 1,14:PRINT"START=";STA ;iLOCATE 1,26:PRINT"STOP= ";EN;iLOCATE 1,55:PRINT"C HANGE PAUSE=";FAST BE 200 REM *** SET UP SCREEN * ** PB 210 LOCATE 22,1 :PRINT"1-ANIM ATE 2-EDIT 3-STA RT PIC. 4-END PIC. ":LOCATE 23,1:PRINT"5 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER PIC. SWITCH 8 -SLOWER PIC. SWITCH 8 -SLOWER PIC. SWITCH 8 -SLOWER 21,1:PRINT"9-INVERSE ALL THE PICTURES"; FK 220 LOCATE 21,1:PRINT"(S)AVE (L)OAD (C)LEA R ALL (Q)UIT (P)ROGAM";:LOCATE 4, 78:FOR I=1 TO 10:PRINT"</pre>	DJ	17Ø	REM *** SET UP VARIABLES
<pre>4), EX(144), FX(144), CX(144)), GX(144), HX(144), IX(144) , JX(144), KX(144), LX(144), MX(144), NX(144), OX(144), PX (144), QX(144), QX(144), SX (144), TX(144), UX(144), A(2 Ø, 54) iNUM=1:STA=1:EN=20:S P=0:PL=1:GET(1,10)-(54,30)), UX QL 190 X=9:Y=31:LOCATE 1,39:PRIN T"SPEED= ";SP;iLOCATE 1,1 iPRINT"NUMBER=";NUM;:LOCA TE 1,14:PRINT"START=";STA ;:LOCATE 1,26:PRINT"STOP= ";EN;iLOCATE 1,55:PRINT"C HANGE PAUSE=";FAST BE 200 REM *** SET UP SCREEN * ** PB 210 LOCATE 22,1 :PRINT"1-ANIM ATE 2-EDIT 3-STA RT PIC. 4-END PIC. ":LOCATE 23,1:PRINT"5 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER 10: SWITCH 7 ATE 24, 1:PRINT"9-INVERSE ALL THE PICTURES"; FK 220 LOCATE 21, 1:PRINT" (S) AVE (L) OAD (C) LEA R ALL (Q) UIT (P) ROGAM";:LOCATE 4, 78:FOR I=1 TO 10:PRINT"</pre>	6D	180	DIM AZ(144), BZ(144), DZ(14
), 6% (144), H% (144), 1% (144) , J% (144), K% (144), L% (144), M% (144), 0% (144), Q% (144), P % (144), 0% (144), 0% (144), 9% (144), 0% (144), 0% (144), 9% (144), 1% (144), 0% (144), 9% (144), 1% (144), 1% (144), 9% (144), 1% (144), 1% (144), 4(2 Ø, 54):NUM=1:STA=1:EN=20:S P=Ø:PL=1:GET (1, 10)-(54, 30)), 0% % 190 % X=9:Y=31:LOCATE 1, 39:PRIN T"SPEED= ";SP;:LOCATE 1, 1 :PRINT"NUMBER=";NUM;:LOCA TE 1, 14:PRINT"START=";STA ;:LOCATE 1, 26:PRINT"STOP= ";EN;:LOCATE 2, 1:PRINT"1-ANIM ATE 2-EDIT 3-STA RT PIC. 4-END PIC. ":LOCATE 23, 1:PRINT"5 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER 21, 1:PRINT"9-INVERSE ALL THE PICTURES"; FK 220 LOCATE 21, 1:PRINT"(S) AVE (L) OAD (C) LEA R ALL (Q) UIT (P) ROGAM";:LOCATE 4, 78:FOR I=1 TO 10:PRINT"			4) . E% (144) . F% (144) . C% (144
<pre>,JZ(144),KZ(144),LZ(144), MZ(144),NZ(144),OZ(144),P Z(144),QZ(144),RZ(144),SZ (144),TZ(144),QZ(144),SZ (144),TZ(144),QZ(144),A(2 Ø,54):NUM=1:STA=1:EN=20:S P=0:PL=1:GET(1,10)-(54,30)),UZ 0L 190 X=9:Y=31:LOCATE 1,39:PRIN T"SPEED= ";SP;:LOCATE 1,1 :PRINT"NUMBER=";NUM;:LOCA TE 1,14:PRINT"START=";STA ;:LOCATE 1,26:PRINT"STOP= ";EN;:LOCATE 1,25:PRINT"C HANGE PAUSE=";FAST BE 200 REM *** SET UP SCREEN * ** PB 210 LOCATE 22,1 :PRINT"1-ANIM ATE 2-EDIT 3-STA RT PIC. 4-END PIC.";LOCATE 23,1:PRINT"5 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER PIC. SWITCH 8 -SLOWER PIC. SWITCH";LOC ATE 24,1:PRINT"9-INVERSE ALL THE PICTURES"; FK 220 LOCATE 21,1:PRINT"(S)AVE (L)OAD (C)LEA R ALL (Q)UIT (P)ROGAM";:LOCATE 4, 78:FOR I=1 TO 10:PRINT"</pre>), GZ (144), HZ (144), IZ (144)
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<pre>0,54):NUM=1:STA=1:EN=20:S P=0:PL=1:GET(1,10)-(54,30)),U% QL 190 X=9:Y=31:LOCATE 1,39:PRIN T"SPEED= ";SP;:LOCATE 1,1 :PRINT"NUMBER=";NUM;:LOCA TE 1,14:PRINT"START=";STA ;:LOCATE 1,26:PRINT"STOP= ";EN;:LOCATE 1,55:PRINT"C HANGE PAUSE=";FAST BE 200 REM *** SET UP SCREEN * ** PB 210 LOCATE 22,1 :PRINT"1-ANIM ATE 2-EDIT 3-STA RT PIC. 4-END PIC. ":LOCATE 23,1:PRINT"5 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER 21,1:PRINT"9-INVERSE ALL THE PICTURES"; FK 220 LOCATE 21,1:PRINT"(S)AVE (L)OAD (C)LEA R ALL (Q)UIT (P)ROGAM";:LOCATE 4, 75:FOR I=1 TO 10:PRINT"</pre>			(144) . T7 (144) . [17 (144) . A(2
<pre>P=Ø;PL=1:GET(1,10)-(54,30),U% QL 19Ø X=9:Y=31:LOCATE 1,39:PRIN T"SPEED= ";SP;:LOCATE 1,1 :PRINT"NUMBER=";NUM;:LOCA TE 1,14:PRINT"START=";STA ;:LOCATE 1,26:PRINT"STOP= ";EN;:LOCATE 1,55:PRINT"C HANGE PAUSE=";FAST BE 20Ø REM *** SET UP SCREEN * ** PB 21Ø LOCATE 22,1 :PRINT"1-ANIM ATE 2-EDIT 3-STA RT PIC. 4-END PIC.";LOCATE 23,1:PRINT"5 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER PIC. SWITCH 8 -SLOWER PIC. SWITCH 8 -SLOWER PIC. SWITCH 9 FK 22Ø LOCATE 21,1:PRINT"(S)AVE (L)OAD (C)LEA R ALL (Q)UIT (P)ROGAM";:LOCATE 4, 78:FOR I=1 TO 10:PRINT"</pre>			0.54) + NI IM=1 + STA=1 + EN=20+5
<pre>),U% QL 190 X=9:Y=31:LOCATE 1,39:PRIN T"SPEED= ";SP;:LOCATE 1,1 :PRINT"NUMBER=";NUM;:LOCA TE 1,14:PRINT"START=";STA ;:LOCATE 1,26:PRINT"STOP= ";EN;:LOCATE 1,26:PRINT"C HANGE PAUSE=";FAST BE 200 REM *** SET UP SCREEN * ** PB 210 LOCATE 22,1 :PRINT"1-ANIM ATE 2-EDIT 3-STA RT PIC. 4-END PIC.";LOCATE 23,1:PRINT"5 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER PIC. SWITCH 8 -SLOWER PIC. SWITCH";LOC ATE 24,1:PRINT"9-INVERSE ALL THE PICTURES"; FK 220 LOCATE 21,1:PRINT"(S)AVE (L)OAD (C)LEA R ALL (Q)UIT (P)ROGAM";LOCATE 4, 78:FOR I=1 TO 10:PRINT"</pre>			P=0: PI = 1: GET(1, 10) - (54, 30)
<pre>%L 190 X=9:Y=31:LOCATE 1,39:PRIN T"SPEED= ";SP;:LOCATE 1,1 :PRINT"NUMBER=";NUM;:LOCA TE 1,14:PRINT"START=";STA ;:LOCATE 1,26:PRINT"STOP= ";EN;:LOCATE 1,25:PRINT"C HANGE PAUSE=";FAST BE 200 REM *** SET UP SCREEN * ** PB 210 LOCATE 22,1 :PRINT"1-ANIM ATE 2-EDIT 3-STA RT PIC. 4-END PIC.":LOCATE 23,1:PRINT"5 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER PIC. SWITCH 7 ATE 24,1:PRINT"9-INVERSE ALL THE PICTURES"; FK 220 LOCATE 21,1:PRINT" (S) AVE (L) OAD (C) LEA R ALL (Q) UIT (P) ROGAM";:LOCATE 4, 78:FOR I=1 TO 10:PRINT"</pre>) 117
T "SPEED= ";SP;:LOCATE 1,1 :PRINT"NUMBER=";NUM;:LOCA TE 1,14;PRINT"START=";STA ;:LOCATE 1,26:PRINT"STOP= ";EN;:LOCATE 1,55:PRINT"C HANGE PAUSE=";FAST BE 200 REM *** SET UP SCREEN * ** PB 210 LOCATE 22,1 :PRINT"1-ANIM ATE 2-EDIT 3-STA RT PIC. 4-END PIC. ":LOCATE 23,1:PRINT"5 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER 21,1:PRINT"9-INVERSE ALL THE PICTURES"; FK 220 LOCATE 21,1:PRINT" (S) AVE (L) OAD (C) LEA R ALL (Q) UIT (P) ROGAM";:LOCATE 4, 78:FOR I=1 TO 10:PRINT"	01	100	Y-9. V-31.1 OFATE 1 39. PRIN
<pre>iPRINT"NUMBER=";NUM;:LOCA TE 1,14:PRINT"START=";STA ;:LOCATE 1,26:PRINT"STOP= ";EN;:LOCATE 1,55:PRINT"C HANGE PAUSE=";FAST BE 200 REM *** SET UP SCREEN * ** PB 210 LOCATE 22,1 :PRINT"1-ANIM ATE 2-EDIT 3-STA RT PIC. 4-END PIC.":LOCATE 23,1:PRINT"5 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER 21,1:PRINT"9-INVERSE ALL THE PICTURES"; FK 220 LOCATE 21,1:PRINT" (S) AVE (L) OAD (C) LEA R ALL (Q) UIT (P) ROGAM";:LOCATE 4, 75:FOR I=1 TO 10:PRINT"</pre>		170	T"SPEED= "SSPIRIOCATE 1.1
TE 1,14:PRINT "START=";STA ;:LOCATE 1,26:PRINT "STOP= ";EN;:LOCATE 1,55:PRINT"C HANGE PAUSE=";FAST BE 200 REM *** SET UP SCREEN * ** PB 210 LOCATE 22,1 :PRINT"1-ANIM ATE 2-EDIT 3-STA RT PIC. 4-END PIC.":LOCATE 23,1:PRINT"5 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER PIC. SWITCH 8 -SLOWER PIC. SWITCH 8 -SLOWER PIC. SWITCH 9 NTH PICTURES"; FK 220 LOCATE 21,1:PRINT"(S)AVE (L)OAD (C)LEA R ALL (Q)UIT (P)ROGAM";:LOCATE 4, 78:FOR I=1 TO 10:PRINT"			PRINT "NI IMPER="+ NI IM++1 OCA
<pre>iL I, I,</pre>			TE 1 14. DOINT"STORT=".STA
";EN; LOCATE 1, 55: PRINT"C HANGE PAUSE=";FAST BE 200 REM *** SET UP SCREEN * ** PB 210 LOCATE 22,1 :PRINT"1-ANIM ATE 2-EDIT 3-STA RT PIC. 4-END PIC. ":LOCATE 23,1:PRINT"5 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER PIC. SWITCH 8 -SLOWER PIC. SWITCH";LOC ATE 24,1:PRINT"9-INVERSE ALL THE PICTURES"; FK 220 LOCATE 21,1:PRINT"(S) AVE (L) OAD (C) LEA R ALL (Q) UIT (P) ROGAM";LOCATE 4, 78:FOR I=1 TO 10:PRINT"			IL DEATE 1 24-PRINT STOP
HANGE PAUSE=";FAST BE 200 REM *** SET UP SCREEN * ** PB 210 LOCATE 22,1 :PRINT"1-ANIM ATE 2-EDIT 3-STA RT PIC. 4-END PIC.":LOCATE 23,1:PRINT"5 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER 0.5 SWITCH 8 -SLOWER 21,1:PRINT"9-INVERSE ALL THE PICTURES"; FK 220 LOCATE 21,1:PRINT"(S) AVE (L) OAD (C) LEA R ALL (Q) UIT (P) ROGAM";:LOCATE 4, 78:FOR I=1 TO 10:PRINT"			"-ENAL OCATE 1 55- PRINTIC
PB 200 REM *** SET UP SCREEN * ** PB 210 LOCATE 22,1 :PRINT"1-ANIM ATE 2-EDIT 3-STA RT PIC. 4-END PIC.":LOCATE 23,1:PRINT"5 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER PIC			HONGE BOURSEN FORT
## ## PB 210 LOCATE 22,1 :PRINT"1-ANIM ATE 2-EDIT 3-STA RT PIC. PIC.":LOCATE 23,1:PRINT"5 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER PIC. SWITCH":LOC ATE 24,1:PRINT"9-INVERSE ALL THE PICTURES"; FK 220 LOCATE 21,1:PRINT" (S) AVE (L) OAD (C) LEA R ALL (Q) UIT (P) ROGAM";:LOCATE 4, 78:FOR I=1 TO 10:PRINT"	DE	-	DEM *** OFT UP CODEN *
PB 210 LOCATE 22,1 :PRINT"1-ANIM ATE 2-EDIT 3-STA RT PIC. 4-END PIC.";LOCATE 23,1:PRINT"5 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER PIC. SWITCH";:LOC ATE 24,1:PRINT"9-INVERSE ALL THE PICTURES"; FK 220 LOCATE 21,1:PRINT" (S) AVE (L) OAD (C) LEA R ALL (Q) UIT (P) ROGAM";:LOCATE 4, 78:FOR I=1 TO 10:PRINT"	BE	200	SET 444 SET UP SUREEN 4
ATE 2-EDIT 3-STA RT PIC. 4-END PIC.":LOCATE 23,1:PRINT"5 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER PIC. SWITCH";:LOC ATE 24,1:PRINT"9-INVERSE ALL THE PICTURES"; FK 220 LOCATE 21,1:PRINT" (S) AVE (L) OAD (C) LEA R ALL (Q) UIT (P) ROGAM";:LOCATE 4, 78:FOR I=1 TO 10:PRINT"	PB	21Ø	LOCATE 22,1 :PRINT"1-ANIM
RT PIC. 4-END PIC.":LOCATE 23,1:PRINT"5 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER PIC. SWITCH":LOC ATE 24,1:PRINT"9-INVERSE ALL THE PICTURES"; FK 220 LOCATE 21,1:PRINT" (S) AVE (L) OAD (C) LEA R ALL (Q) UIT (P) ROGAM":LOCATE 4, 78:FOR I=1 TO 10:PRINT"			ATE 2-EDIT 3-STA
PIC.";LOCATE 23,1;PRINT"5 -SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER PIC. SWITCH";LOC ATE 24,1:PRINT"9-INVERSE ALL THE PICTURES"; FK 220 LOCATE 21,1:PRINT" (S)AVE (L)OAD (C)LEA R ALL (Q)UIT (P)ROGAM";LOCATE 4, 78:FOR I=1 TO 10:PRINT"			RT PIC. 4-END
-SLOWER 6-FASTER 7-FASTER PIC. SWITCH 8 -SLOWER PIC. SWITCH";:LOC ATE 24,1:PRINT"9-INVERSE ALL THE PICTURES"; FK 220 LOCATE 21,1:PRINT" (S) AVE (L) OAD (C) LEA R ALL (Q) UIT (P) ROGAM";:LOCATE 4, 78:FOR I=1 TO 10:PRINT"			PIC. ":LOCATE 23, 1: PRINT"5
7-FASTER PIC. SWITCH 8 -SLOWER PIC. SWITCH";:LOC ATE 24,1:PRINT"9-INVERSE ALL THE PICTURES"; FK 22Ø LOCATE 21,1:PRINT" (S) AVE (L) OAD (C) LEA R ALL (Q) UIT (P) ROGAM";:LOCATE 4, 78:FOR I=1 TO 10:PRINT"			-SLOWER 6-FASTER
-SLOWER PIC. SWITCH";:LOC ATE 24,1:PRINT"9-INVERSE ALL THE PICTURES"; FK 220 LOCATE 21,1:PRINT"(S)AVE (L)OAD (C)LEA R ALL (Q)UIT (P)ROGAM";:LOCATE 4, 78:FOR I=1 TO 10:PRINT"			7-FASTER PIC. SWITCH 8
ATE 24,1:PRINT"9-INVERSE ALL THE PICTURES"; FK 220 LOCATE 21,1:PRINT" (S) AVE (L) DAD (C) LEA R ALL (Q) UIT (P) ROGAM";:LOCATE 4, 78:FOR I=1 TO 10:PRINT"			-SLOWER PIC. SWITCH";:LOC
ALL THE PICTURES"; FK 220 LOCATE 21,1:PRINT" (S) AVE (L) DAD (C) LEA R ALL (Q) UIT (P) ROGAM";:LOCATE 4, 78:FOR I=1 TO 10:PRINT"			ATE 24, 1: PRINT "9-INVERSE
FK 220 LOCATE 21,1:PRINT" (S) AVE (L) OAD (C) LEA R ALL (Q) UIT (P) ROGAM";:LOCATE 4, 78:FOR I=1 TO 10:PRINT"			ALL THE PICTURES";
(L) DAD (C) LEA R ALL (Q) UIT (P) ROGAM"; : LOCATE 4, 78: FOR I=1 TO 10: PRINT"	FK	220	LOCATE 21, 1: PRINT" (S) AVE
R ALL (Q) UIT (P) ROGAM"; : LOCATE 4, 78: FOR I=1 TO 10: PRINT"			(L) DAD (C) LEA
(P)ROGAM";:LOCATE 4, 78:FOR I=1 TO 10:PRINT"			R ALL (Q)UIT
78:FOR I=1 TO 10:PRINT"			(P) ROGAM"; :LOCATE 4.
Gwww.commodore.ca			78: FOR I=1 TO 10: PRINT"
	6	×14	ww.commodore.ca

Press the E key to exit the edit |

<pre>FOR I=11 TO 201PRINT" "</pre>		"; I; : NEXT: LOCATE 13, 79:
<pre>IH 230 LOCATE 20, 1:PRINT"(I)NSER T PIC. (D)ELE TE PIC."; DK 240 FOR T=1 TO 2:FOR I=1 TO 5 iLINE(A,X)-(A+15,Y),BLI NE(A+60,X)-(A+15,Y),BLI NE(A+60,X)-(A+15,Y),BLI A=A+120;NEXT:A=0:X=80;Y=10 2:NEXT DD 250 FEM 1%% FEAD PICTURES \$ ff 260 GET(1,10)-(14,30),AX:GET(121 1,10)-(174,30),CX:GET(181 ,10)-(274,30),CX:GET(241, 10)-(274,30),FX:GET(361,10) -(474,30),FX:GET(421,10) -(474,30),FX:GET(421,10) -(474,30),HX:GET(481,10)- (534,30),JX:GET(421,10) -(474,30),HX:GET(481,10)- (534,30),JX:GET(421,10) -(474,30),HX:GET(481,10)- (534,30),JX:GET(481,10)- (534,30),JX:GET(481,10)- (534,30),JX:GET(481,10)- (534,30),JX:GET(481,10)- (534,30),JX:GET(481,10),CX:GET(121,61)-(114,101),AX:GET(241,61)-(234,101),PX:GET(301,61)-(354,101),PX:GET(301,61)-(354,101),PX:GET(301,61)-(354,101),PX:GET(421,61)-(474,101),RX:GET(421,61)-(574,101),RX:GET(481,61)-(574,101),RX:GET(481,61)-(574,101),TX: LK 280 REM 1%% WAIT FOR KEY 1% f C1 290 A\$=INKEY\$:IF A\$="" THEN 2 70 ELSE IF VAL(A\$)>0 AN D VAL(A\$)<10 THEN 4300 U 300 IF A\$="P" THEN 3080 JJ 310 IF A\$</pre> CC 350 IF A\$ CD 340 REM 1%% CLEAR SCREEN 1% f CC 350 IF A\$ CD 340 REM 1%% CLEAR SCREEN 1% f CC 350 IF A\$ CD 340 REM 1%% CLEAR SCREEN 1% f A\$=INKEY\$:IF A\$="" THEN 3 70 ELSE IF A\$="Y" THEN 3 70 A\$=INKEY\$:IF A\$="" THEN 3 70 ELSE IF A\$="Y" THEN 3 70 ELSE IF A\$="Y" THEN 3 70 A\$=INKEY\$:IF A\$="" THEN 3 70 A\$= INKEY\$:IF A\$="" THEN 3 7		FOR I=11 TO 20:PRINT" "
<pre>T FPL: (D) ELE TE PIC."; DX 240 FOR T=1 TO 2:FOR I=1 TO 5 iL INE(A,X)-(A+55,Y),B:I ME(A+60,X)-(A+115,Y),B:A =A+120:NEXT:A=0:X=B0:Y=10 2:NEXT DD 250 REM 111 READ PICTURES 1 15 t1 20 GET (1,10)-(54,30),AX:GET (12 (61,10)-(114,30),BX:GET (121 (10)-(274,30),CX:GET (241, 10)-(274,30),CX:GET (361,10) (534,30),TX:GET (421,10)- (534,30),TX:GET (421,10)- (534,30),TX:GET (421,10)- (534,30),TX:GET (421,10)- (534,30),TX:GET (421,10)- (534,30),TX:GET (421,10)- (534,30),TX:GET (421,10)- (534,30),TX:GET (421,10)- (534,30),TX:GET (421,10),CX:GET (12,61)-(174,101),PX:GET (30,61)-(234,101),PX:GET (30,61)-(234,101),PX:GET (30,61)-(354,101),PX:GET (30,61)-(354,101),PX:GET (30,61)-(354,101),PX:GET (30,61)-(354,101),PX:GET (30,61)-(474,101),PX:GET (421,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (541,61)-(534,101),PX:GET (541,61)-(534,101),PX:GET (541,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (421,61)-(534,101),PX:GET (430) F A\$="N" THEN 300 N VAL(A\$)<10 THEN 450 N 300 LCATE 17,11PRINT ARE YOU SURE (Y/N)":DEF SEG:POK E 106,0 D1 370 A\$=INKEY\$:IF A\$="" THEN 3 30 ELSE IF A\$="Y" THEN 3 30 I 340 IF A\$="Y" THEN 2800 ELSE IF A\$="Y" THEN 2800 ELSE</pre>	IH 23Ø	LOCATE 20,1:PRINT"(I)NSER
<pre>NK 240 FOR T=1 TO 2:FOR I=1 TO 5 iLINE(A, X)-(A+55, Y), B:LI NE (A+60, X)-(A+15, Y), B:LI Set (X) (A) (A) (A) (A) (A) (A) (A) (A) (A) (A</pre>		TE PIC.";
<pre>NE(A+60,X) - (A+115,Y), BIA =A+120:NEXT:A=0:X=00:Y=10 2:NEXT D) 250 FEM \$\$\$ READ PICTURES \$ \$\$ NE 260 GET(1,10) - (54,30), AX:GET(121 1,10) - (174,30), DX:GET(241, 10) - (234,30), DX:GET(351,10) - (474,30), GX:GET(421,10) - (474,30), GX:GET(421,10) - (534,30), JX:GET(421,10) - (474,30), HX:GET(481,10) - (534,30), JX:GET(481,10) - (534,30), JX:GET(481,10) - (534,30), JX:GET(121,81) - (174,101), MX:GET(121,81) - (174,101), MX:GET(121,81) - (234,101), MX:GET(1301,81) - (234,101), DX:GET(301,81) - (334,101), GX:GET(301,81) - (334,101), GX:GET(301,81) - (474,101), RX:GET(141,81) - (234,101), GX:GET(141,81) - (234,101), GX:GET(141,81) - (134,101), GX:GET(141,81) - (136,10), GX:GET(141,81) - (136,10), GX:GET(141,81) - (136,10), GX:GET(141,81) - (136,10), GX:GET(141,10) - (136,10), GX:GET(141,10) - (136,10), GX:GET(141,10) - (136,10), GX:GET(141,10), GX:GET(154,10), GX:GET(141,10), GX:GET(141,10)</pre>	DK 24Ø	FOR T=1 TO 2: FOR I=1 TO 5
<pre>#A+120;NEXT:A=0;X=00;Y=10 2:NEXT D 250 REM *** READ PICTURES * ** DK 260 GET(1,10)-(114,30),BX:GET(12 1,10)-(124,30),CX:GET(121,10)-(124,30),CX:GET(241,10)-(214,30),GX:GET(421,10)-(134,30),FX:GET(421,10)-(1534,30),TX:GET(421,10)-(1534,30),TX:GET(421,10)-(1534,30),TX:GET(421,10)-(1534,30),TX:GET(421,10),CX:GET(121,81)-(174,101),KX:GET(121,81)-(174,101),CX:GET(130,181)-(134,101),QX:GET(130,181)-(134,101),QX:GET(30,181)-(134,101),QX:GET(30,181)-(134,101),QX:GET(30,181)-(134,101),QX:GET(30,181)-(134,101),QX:GET(30,181)-(134,101),QX:GET(30,181)-(1534,101),QX:GET(30,181)-(1534,101),QX:GET(30,181)-(1534,101),QX:GET(30,181)-(1534,101),QX:GET(421,81)-(1534,101),QX:GET(421,81)-(1534,101),QX:GET(421,81)-(1534,101),QX:GET(30,181)-(1534,101),QX:GET(421,10),QX:GET(421,10),QX:GET(421,10),QX:GET(421,10),QX:GET(421,10),QX:GET(420,10),QX:GET(420,10),QX:GET(420,10),QX:GET(420,10),QX:GET(420,10),QX:GET(420,10),QX:GET(420,10),QX:GET(420,10),QX:GET(420,10),QX:GET(420,10),QX:GEX(400,420,3),QA:GEX(400,420,3),QA:GEX(400,420,3),QA:GEX(400,420,3),QA:GEX(400,420),AX:GEX(400,420),AX:GEX(400,420),AX:GEX(400,420),AX:GEX(400,420),AX:GEX(400,420),AX:GEX(400,420),AX:GEX(400,420),AX:GEX(400,420),AX:GEX(400,420),AX:GEX(400,42</pre>		NE (A+60, X) - (A+115, Y), , BIA
<pre>D 250 REM *** READ PICTURES *</pre>		21 NEXT
<pre>N*** N********************************</pre>	OD 25Ø	REM *** READ PICTURES *
<pre>61,10)-(114,30), BX:GET(121 1,10)-(124,30), DX:GET(241, 10)-(234,30), DX:GET(341,10))-(414,30), GX:GET(421,10) -(474,30), HX:GET(421,10)-(534,30), JX:GET(421,10)-(534,30), JX:GET(421,10)-(534,30), JX:GET(421,10), CX:GET(181)-(14,101), LX:GET(181)-(174,101), MX:GET(191), CX:GET(191)-(14,101), DX:GET(191), CX:GET(191)-(14,101), DX:GET(191), CX:GET(191)-(14,101), DX:GET(191), CX:GET(191)-(14,101), DX:GET(191), CX:GET(191)-(14,101), DX:GET(191), CX:GET(191)-(14,101), DX:GET(191), CX:GET(191)-(14,101), CX:GET(191)-(14,101), DX:GET(191), CX:GET(191), CX:GET(192), CX:GET(191), CX:GET(192), CX:GE</pre>	DK 260	GET(1,10)-(54,30),A%:GET(
<pre>,10)-(234,30),D%:GET(241, 10)-(294,30),F%:GET(361,10))-(354,30),F%:GET(361,10))-(414,30),G%:GET(481,10)- (534,30),J%:GET(481,10)- (534,30),J%:GET(481,10)- (534,30),J%:GET(481,10),C%:GET (121,81)-(114,101),K%:GET (121,81)-(114,101),K%:GET (301,81)-(294,101),0%:GET(301,81)-(354,101),0%:GET(301,81)-(354,101),0%:GET(301,81)-(534,101),5%:GET(421,81)-(534,101),5%:GET(421,81)-(534,101),5%:GET(421,81)-(534,101),5%:GET(421,81)-(534,101),5%:GET(421,81)-(534,101),5%:GET(421,81)-(534,101),5%:GET(421,81)-(534,101),5%:GET(421,81)-(534,101),5%:GET(421,81)-(534,101),7%:GET(541,81)-(534,101),7%:GET(541,81)-(534,101),7%:GET(541,81)-(534,101),7%:GET(541,81)-(534,101),7%:GET(541,81)-(534,101),7%:GET(741,81)-(534,101),7%:GET(741,81)-(534,101),7%:GET(741,81)-(534,101),7%:GET(741,81)-(534,101),7%:GET(741,81)-(534,101),7%:GET(741,81)-(534,101),7%:GET(741,81)-(536,32):GOTO 290 CD 340 A=INKEY\$:IF A\$="" THEN 33 30 ELSE IF A\$="Y" THEN 5C REEN 0,0,0:CLS:END ELSE L OCATE 18,1:PRINT 3TRING\$(550,32):GOTO 290 CD 340 REM ### CLEAR SCREEN ## # CC 350 IF A\$</pre>		61,10)-(114,30), B%:GET(12 1,10)-(174,30), C%:GET(181
<pre>10)-(274,30),EXIGET(361,10))-(314,30),GX:GET(421,10) -(474,30),HX:GET(481,10)-(534,30),JX:GET(541,10)-(534,30),JX:GET(481,10),CX:GET((181,81)-(114,101),LX:GET(121,81)-(174,101),MX:GET(241,81)-(234,101),PX:GET(301,81)-(334,101),PX:GET(301,81)-(334,101),PX:GET(421,81)-(474,101),QX:GET(421,81)-(474,101),QX:GET(421,81)-(474,101),QX:GET(481,81)-(534,101),SX:GET(481,81)-(534,101),SX:GET(541,81)-(534,101),SX:GET(541,81)-(574,101),TX UK 280 REM \$\$ * Cl 270 A==INKEY\$:IF A\$="" THEN 2 90 ELSE IF VAL(A\$)>0 AN D VAL(A\$)(10 THEN 430 Cl 300 IF A\$="P" THEN 350 PA 320 LOCATE 18,1:PRINT"ARE YDU SURE YOU WANT TO GUIT? (Y/N)" JB 330 A\$=INKEY\$:IF A\$="" THEN 3 30 ELSE IF A\$="P" THEN 350 PA 320 LOCATE 18,1:PRINT STRING\$(50,32):GOTO 270 CD 340 REM \$\$ * CC 350 IF A\$<'C" THEN 380 HN 360 LOCATE 17,1:PRINT STRING\$(50,32):GOTO 270 CD 340 REM \$\$ * CC 350 IF A\$<'C" THEN 380 HN 360 LOCATE 17,1:PRINT "ARE YDU SURE (Y/N)":DEF SEG:POK E 106,0 DD 370 A\$=INKEY\$:IF A\$="" THEN 3 70 ELSE IF A\$="" THEN 3 70 ELSE A\$="" THEN 3 70 A\$ 70 A\$= THEN 3 70 A\$="" THEN 3 70 A\$ 70 A\$= THEN 3 70 A\$= THEN 3 70 A\$="" THEN 3 70 A\$="" THEN 3 70 A\$ 70 A\$= THEN 3 70 A\$ 70 A\$ 70 A\$= THEN 3 70 A\$ 70 A\$</pre>		,10)-(234,30),D%:GET(241,
)-(414,30),G%:GET(421,10) -(474,30),H%:GET(481,10)- (534,30),J% B 270 GET(1,81)-(54,101),K%:GET (41,81)-(174,101),K%:GET (41,81)-(234,101),C%:GET(301,81)-(234,101),O%:GET(301,81)-(354,101),O%:GET(301,81)-(414,101),O%:GET(421,81)-(474,101),R%:GET(421,81)-(474,101),S%:GET(421,81)-(594,101),S%:GET(481,81)-(594,101),T% LK 280 REM %% WAIT FOR KEY %% Cl 290 A%=INKEY%:IF A%="" THEN 2 90 ELSE IF LEN(A%)=2 THEN B30 ELSE IF LEN(A%)=2 THEN B30 ELSE IF LEN(A%)=2 THEN B30 ELSE IF VAL(A@)>0 AN D VAL(A%)<10 THEN 430 OL 300 IF A%="P" THEN 3080 JJ 310 IF A%<'P" THEN 3080 JJ 310 IF A%<'P" THEN 350 PA 320 LOCATE 18,1;PRINT"ARE YOU SURE YOU WANT TO GUIT? (Y/N)" JB 330 A%=INKEY%:IF A%="" THEN 3 30 ELSE IF A%="Y" THEN 35 7A 320 LOCATE 18,1;PRINT BRINGS(50,32);GOTO 270 CD 340 REM %%% CLS:END ELSE L OCATE 18,1;PRINT STRINGS(50,32);GOTO 270 CD 340 REM %%% CLEAR SCREEN %% % CC 350 IF A%<'C" THEN 380 HW 360 LOCATE 17,1;PRINT"ARE YOU SURE (Y/N)";DEF SEG:POK E 106,0 DJ 370 A%=INKEY%:IF A%="" THEN 3 70 ELSE IF A%="Y" THEN CL 70 ELSE IF A%="Y" THEN CL 70 ELSE IF A%="Y" THEN CL 70 ELSE IF A%="" THEN 380 HW 360 LOCATE 17,1;PRINT"ARE YOU SURE (Y/N)";DEF SEG:POK E 106,0 DJ 370 A%=INKEY%:IF A%="" THEN 3 70 ELSE IF A%="" THEN 2360 HM 400 GOTO 290 PM 380 IF A%="S" THEN 870 ELSE I F A%="L" THEN 970 OJ 390 IF A%="S" THEN 870 ELSE I F A%="L" THEN 970 DJ 370 A%=INKEY%:IF A%="" THEN 2360 HM 400 GOTO 290 PM 380 IF A%="S" THEN 870 ELSE I F A%="L" THEN 2360 HM 400 GOTO 290 PM 380 IF A%="S" THEN 870 ELSE I F A%="L" THEN 2360 HM 400 GOTO 290 PM 380 IF A%==S" THEN BEP:GOTO 290 ELSE FAST=FAST-1:LOCA TO 290 ELSE FAST=FAST-1:LOCA TO 290 ELSE FAST=FAST-1:LOCA TO 290 ELSE FAST=FAST-1:LOCA TO 290 F14 10 IF FAST=0 THEN BEP:GOTO 290 JL 420 IF FAST=150 THEN BEP:GOTO 290 F1 430 ON VAL(A%) GOTO 520,1080, 470,500,480,450,410,420,3 040 FH 440 GOTO 290 PM 480 IF SP=-15 THEN BEP ELSE S P=SP+1:LOCATE 1,20:PRINT STA:GOTO 290 PM 480 IF SP=-15 THEN BEP ELSE		Ø) - (354, 30), F%1GET (361, 10
<pre>(534,30),1%.GET(451,10)-(594,30),J% B 270 GET(1,B1)-(54,101),K%:GET (61,81)-(174,101),K%:GET (121,81)-(174,101),M%:GET (121,81)-(234,101),0%:GET (361,81)-(354,101),0%:GET (361,81)-(354,101),0%:GET (361,81)-(354,101),7%:GET (361,81)-(594,101),7%:GET (361,81)-(594,101),7%:GET (361,81)-(594,101),7% LK 280 REM *** WAIT FOR KEY ** * Cl 290 A*=INKEY*:IF A*="" THEN 2 90 ELSE IF LEN(A\$)=2 THEN B30 ELSE IF VAL(A\$)>0 AN D VAL(A\$)<10 THEN 350 PA 320 LOCATE 18,1:PRINT"ARE YOU SURE YOU WANT TO GUIT? (Y/N)" JB 330 A*=INKEY*:IF A*="" THEN 3 30 ELSE IF A*="Y" THEN 350 PA 320 LOCATE 18,1:PRINT"ARE YOU SURE YOU WANT TO GUIT? (Y/N)" JB 330 A*=INKEY*:IF A*="" THEN 3 30 ELSE IF A*="Y" THEN 350 PA 320 LOCATE 18,1:PRINT STRING\$(50,32):GOTO 290 CD 340 REM *** CLEAR SCREEN ** * CC 350 IF A*<"C" THEN 380 HW 360 LOCATE 17,1:PRINT ARE YOU SURE (Y/N)":DEF SEG:POK E 106,0 DD 370 A*=INKEY*:IF A*="" THEN 3 70 ELSE IF A*="Y" THEN 3 70 ELSE IF A*="T THEN 3 70 ELSE FAST=FAST-1:LOCA 75 A*="I" THEN 800 ELSE I 75 A*=TIT A*=TIT A*=TIT A* 75 A*=TIT A*=TIT A* 75 A*= THEN A* 75 A* 75 A*= THE</pre>)-(414,30), G%: GET(421,10) -(474,30), H%; GET(481,10)-
<pre>574,30),3% EB 270 GET(1,81)-(154,101),K%:GET</pre>		(534, 30), IX: GET (541, 10) - (
<pre>(61,81)-(114,101),L2:GET(121,81)-(174,101),M2:GET(121,81)-(234,101),N2:GET(301,81)-(354,101),P2:GET(301,81)-(354,101),P2:GET(421,81)-(474,101),R2:GET(421,81)-(574,101),R2:GET(421,81)-(574,101),R2:GET(541,81)-(574,101),R2:GET(541,81)-(574,101),R2:GET(541,81)-(574,101),R2:GET(90 ELSE IF LEN(A\$)=2 THEN 830 ELSE IF VAL(A\$)>0 AN D VAL(A\$)<10 THEN 3000 J0 310 IF A\$<"P" THEN 3000 J0 310 IF A\$<"P" THEN 3000 J0 310 IF A\$<'P" THEN 350 PA 320 LOCATE 18,1:PRINT"ARE YOU SURE YOU WANT TO QUIT? (Y/N)" JB 330 A\$=INKEY\$:IF A\$="" THEN 3 30 ELSE IF A\$="Y" THEN 5C REEN 0,0,0:CLS:END ELSE L OCATE 18,1:PRINT STRING*(50,32):GOTO 270 CD 340 REM \$\$\$\$ CLEAR SCREEN \$\$ \$ CC 350 IF A\$<'PC" THEN 380 HN 360 LOCATE 17,1:PRINT"ARE YOU SURE (Y/N)":DEF SEG:POK E 106,0 DD 370 A\$=INKEY\$:IF A\$="" THEN 3 70 ELSE IF A\$="Y" THEN CL S:GOTO 190 ELSE LOCATE 17 ,1:PRINT STRING\$(66,32):G OTO 270 PM 380 IF A\$="D" THEN 970 ELSE I F A\$="L" THEN 970 CD 390 IF A\$="D" THEN 970 ELSE I IF A\$="S" THEN 870 ELSE I IF A\$="S" THEN 870 ELSE I IF A\$="1" THEN 970 DI 370 IF A\$="D" THEN 2800 ELSE I IF A\$="S" THEN 870 ELSE I IF A\$="S" THEN 8200 ELSE IF A\$="S"</pre>	EB 27Ø	594, 30), J% GET(1, 81) - (54, 101), K%; GET
<pre>121,81,-1,4,101),MX:BET(181,81)-(234,101),MX:BET(301,81)-(354,101),PX:BET(301,81)-(354,101),QX:BET(421,81)-(474,101),RX:BET(421,81)-(574,101),RX:BET(421,81)-(574,101),RX:BET(421,81)-(574,101),RX:BET(541,81)-(574,101),RX:BET(541,81)-(574,101),RX:BET(541,81)-(574,101),RX:BET(1290 A*=INKEY\$:IF A*="" THEN 2 90 ELSE IF LEN(A*)=2 THEN B30 ELSE IF VAL(A*)>0 AN D VAL(A*)(10 THEN 430 0L 300 IF A*="P" THEN 3080 J0 310 IF A*="P" THEN 350 PA 320 LOCATE 18,1:PRINT"ARE YOU SURE YOU WANT TO QUIT? (Y/N)" JB 330 A*=INKEY\$:IF A*="" THEN 3 30 ELSE IF A*="Y" THEN 35 70 A*=INKEY\$:IF A*="" THEN 35 REEN 0,0,0:CLS:END ELSE L DCATE 18,1:PRINT STRING*(50,32):GOTO 290 CD 340 REM *** CLEAR SCREEN ** * CC 350 IF A*<>"C" THEN 380 HW 360 LOCATE 17,1:PRINT"ARE YOU SURE (Y/N)":DEF SEG:POK E 106,0 DD 370 A*=INKEY\$:IF A*="" THEN 3 70 ELSE IF A*="Y" THEN CL S:GOTO 190 ELSE LDCATE 17 ,1:PRINT STRING*(66,32):G OTO 290 PM 380 IF A*="S" THEN 870 ELSE I F A*="L" THEN 970 OD 390 IF A*="S" THEN 870 ELSE I F A*="L" THEN 2360 HM 400 GOTO 290 DF 410 IF FAST=0 THEN BEP:GOTO 290 LF A*="S" THEN BEP:GOTO 290 JL 420 IF FAST=150 THEN BEP:GOTO 290 KP 430 ON VAL(A*) GOTO 520,1080, 470,500,480,450,410,420,3 0440 FH 440 REM *** SET SPEED *** CI 450 IF SP=15 THEN BEP ELSE S P=SP+1:LOCATE 1,20:PRINT STA:GOTO 290 PM 480 IF SP=-15 THEN BEP ELSE </pre>		(61,81)-(114,1Ø1),L%IGET(
<pre>241,81)-(294,101),0%:0ET(</pre>		121,81)-(174,101),M216E1(181,81)-(234,101),N216ET(
 JBJ, GJ, GJ, 103, 101, 7, 218ET(361, 81) - (474, 101), 02:GET(421, 81) - (534, 101), 72:GET(541, 81) - (534, 101), 72 LK 280 REM ### WAIT FOR KEY ## * Cl 290 A\$=INKEY\$:IF A\$="" THEN 2 90 ELSE IF LEN(A\$)=2 THEN B30 ELSE IF VAL(A\$)>0 AN D VAL(A\$)<10 THEN 350 PL 320 LOCATE 18, 1:PRINT"ARE YOU SURE YOU WANT TO QUIT? (Y/N)" JB 330 A\$=INKEY\$:IF A\$="" THEN 3 30 ELSE IF A\$="Y" THEN 350 PL 320 LOCATE 18, 1:PRINT "ARE YOU SURE YOU WANT TO QUIT? (Y/N)" JB 330 A\$=INKEY\$:IF A\$="" THEN 3 30 ELSE IF A\$="Y" THEN SC REEN 0,0,0:CLS:END ELSE L OCATE 18, 1:PRINT STRING\$(50,32):GOTO 290 CD 340 REM ### CLEAR SCREEN ## * CC 350 IF A\$<>"C" THEN 380 HM 360 LOCATE 17, 1:PRINT "ARE YOU SURE (Y/N)":DEF SEG:POK E 106,0 DD 370 A\$=INKEY\$:IF A\$="" THEN 3 70 ELSE IF A\$="Y" THEN CL S:GOTO 190 ELSE LOCATE 17 ,1:PRINT STRING\$(66,32):G OTO 290 PM 380 IF A\$="S" THEN 870 ELSE I F A\$="L" THEN 970 ELSE I F A\$="L" THEN 970 ELSE I F A\$="L" THEN 970 ELSE I F A\$="L" THEN 8200 ELSE I A\$00 IF A\$="D" THEN 2800 ELSE I F A\$="L" THEN 8200 ELSE I F A\$="L" THEN 970 OD 370 IF A\$="D" THEN 8200 ELSE I F A\$="L" THEN 970 OD 370 IF A\$="D" THEN 8200 ELSE I F A\$="L" THEN 970 OD 370 IF A\$="D" THEN 8200 ELSE I F A\$="L" THEN 970 OD 370 IF A\$="D" THEN 8200 ELSE I F A\$="L" THEN 970 OD 370 IF A\$="D" THEN 8200 ELSE I F A\$="L" THEN 970 OD 370 IF A\$="D" THEN 8200 ELSE I F A\$="L" THEN 9200 I 420 IF FAST=150 THEN BEEP:GOT 2700 VA 420 IF FAST=150 THEN BEEP:GOT 2700 KP 430 ON VAL(A\$) GOTO 520,1080, 470,500,480,450,410,420,3 040 FH 440 REM ### SET SPEED ### C1 450 IF SP=15 THEN BEEP ELSE S P=SP+1:LOCATE 1,20:PRINT SP II 460 GOTO 290 N 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 N 470 STA=NUM:LOCATE 1,20:PRINT 		241,81)-(294,101),0%:GET(
 421,81)-(474,101),RX:GET(481,81)-(534,101),SX:GET(541,81)-(574,101),TX LK 280 REM *** WAIT FOR KEY *** * Cl 270 A*=INKEY*:IF A*="" THEN 2 70 ELSE IF LEN(A*)=2 THEN 830 ELSE IF VAL(A*)>0 AN D VAL(A*)<10 THEN 430 OL 300 IF A*="P" THEN 3080 J0 310 IF A*<"C" THEN 350 PA 320 LOCATE 18,1:PRINT"ARE YOU SURE YOU WANT TO QUIT? (Y/N)" JB 330 A*=INKEY*:IF A*="" THEN 3 30 ELSE IF A*="Y" THEN 350 PA 320 LOCATE 18,1:PRINT STRING*(50,32):GOTO 270 CD 340 REM *** CLEAR SCREEN ** * CC 350 IF A*<"C" THEN 380 HN 360 LOCATE 17,1:PRINT"ARE YOU SURE (Y/N)":DEF SEG:POK E 106,0 DD 370 A*=INKEY*:IF A*="" THEN 3 70 ELSE IF A*="Y" THEN 3 70 ELSE IF A*="Y" THEN 3 70 ELSE IF A*="Y" THEN CL S:GOTO 190 ELSE LOCATE 17 ,1:PRINT STRING*(66,32):0 OTO 290 PM 380 IF A*="S" THEN 870 ELSE I F A*="S" THEN 880 FH 440 GOTO 290 JL 420 IF FAST=150 THEN BEEP:GOTO 290 ELSE FAST=FAST-1:LOCA TE 1,68:PRINT FAST;:GOTO 290 ELSE FAST=FAST+1:L CCATE 1,68:PRINT FAST;:GO TO 290 F4 340 ON VAL(A*) GOTO 520,1080, 470,500,480,450,410,420,3 040 FH 440 REM *** SET SPEED *** CI 450 IF SP=15 THEN BEEP ELSE S P=SP+1:LOCATE 1,20:PRINT SP I 460 GOTO 290 D 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 P 480 IF SP=-15 THEN BEEP ELSE 		361,81)-(414,101),Q%:GET(
 541,617-(334,1017,37,1001) 541,617-(334,101),7% LK 280 REM ### WAIT FOR KEY ## CI 290 A*=INKEY*: IF A*="" THEN 2 90 ELSE IF VAL(A*)>2 THEN 830 ELSE IF VAL(A*)>0 AN D VAL(A*)<10 THEN 4300 0L 300 IF A*="P" THEN 3080 J10 IF A*<>"0" THEN 3080 J20 A*=INKEY*: IF A*="" THEN 3 30 ELSE IF A*="Y" THEN 5C REEN 0,0,0:CLS: END ELSE L OCATE 18,1:PRINT STRING*(50,32):00TO 290 CD 340 REM ### CLEAR SCREEN ## # CC 350 IF A*<>"C" THEN 380 HM 360 LOCATE 17,1:PRINT"ARE YOU SURE (Y/N)":DEF SEG:POK E 106,0 J270 A*=INKEY*: IF A*="" THEN 3 70 ELSE IF A*="Y" THEN CL S:00TO 190 ELSE LOCATE 17 ,1:PRINT STRING*(46,32):0 OTO 290 PM 380 IF A*="S" THEN 870 ELSE I F A*="L" THEN 990 O390 IF A*="S" THEN 870 ELSE I F A*="L" THEN 990 O390 IF A*="S" THEN 870 ELSE I F A*="L" THEN 990 O390 IF A*="D" THEN 2800 ELSE I F A*="L" THEN 990 O390 IF A*="S" THEN 870 ELSE I F A*="L" THEN 990 O390 IF A*="S" THEN 870 ELSE I F A*="L" THEN 990 O390 IF A*="S" THEN 8070 ELSE I F A*="L" THEN 990 O390 IF A*="S" THEN 8070 ELSE I F A*="L" THEN 990 O390 IF A*="S" THEN 8070 ELSE I F A*="L" THEN 990 CD 290 V1 400 GOTO 290 V400 IF FAST=150 THEN BEEP: GOTO 290 ELSE FAST=FAST=1:LOCA TE 1,68:PRINT FAST;:GOTO 290 V430 ON VAL(A*) GOTO 520,1080, 470,500,480,450,410,420,3 Ø40 FH 440 REM ### SET SPEED ### CI 450 IF SP=15 THEN BEEP ELSE S P=SP+1:LOCATE 1,20:PRINT STA:GOTO 290 V400 IF SP=-15 THEN BEEP ELSE 		421,81) - (474,101), R%: GET (
LK 280 REM *** WAIT FOR KEY ** * C1 270 A\$=INKEY\$:IF A\$="" THEN 2 90 ELSE IF LEN(A\$)=2 THEN 830 ELSE IF VAL(A\$)>0 AN D VAL(A\$)<10 THEN 430 01 300 IF A\$="P" THEN 3080 J0 310 IF A\$<>"0" THEN 350 PA 320 LOCATE 18,1:PRINT"ARE YOU SURE YOU WANT TO QUIT? (Y/N)" JB 330 A\$=INKEY\$:IF A\$="" THEN 3 30 ELSE IF A\$="Y" THEN SC REEN 0,0,0:CLS:END ELSE L OCATE 18,1:PRINT STRING\$(50,32):GOTO 270 CD 340 REM *** CLEAR SCREEN ** * CC 350 IF A\$<>"C" THEN 380 HM 360 LOCATE 17,1:PRINT"ARE YOU SURE (Y/N)":DEF SEG:POK E 106,0 DD 370 A\$=INKEY\$:IF A\$="" THEN 3 70 ELSE IF A\$="Y" THEN CL S:GOTO 170 ELSE LOCATE 17 ,1:PRINT STRING\$(66,32):G OTO 270 PM 380 IF A\$="S" THEN 870 ELSE I F A\$="L" THEN 970 DD 370 IF A\$="D" THEN 2800 ELSE I F A\$="I" THEN 970 DD 370 IF A\$="S" THEN 870 ELSE I F A\$="I" THEN 970 DD 370 IF A\$="S" THEN 870 ELSE I F A\$="I" THEN 970 DD 370 IF A\$="S" THEN 870 ELSE I F A\$="I" THEN 970 DD 370 IF A\$="S" THEN 870 ELSE I F A\$="I" THEN 970 DD 370 IF A\$="S" THEN 870 ELSE I F A\$="I" THEN 970 DJ 400 GOTO 290 DF 410 IF FAST=0 THEN BEEP:GOTO 290 290 JL 420 IF FAST=150 THEN BEEP:GOTO 290 JL 420 IF SP=15 THEN BEEP ELSE S P=SP+1:LOCATE 1,46:PRINT SP 11 460 GOTO 290 DI 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PM 480 IF SP=-15 THEN BEEP ELSE		541,81)-(594,101),5%16ET(
C1 290 A*=INKEY*: IF A*="" THEN 2 90 ELSE IF LEN(A*)=2 THEN B30 ELSE IF VAL(A*)>0 AN D VAL(A*)<10 THEN 430 OL 300 IF A*="P" THEN 3080 J3 310 IF A*<>"0" THEN 350 PA 320 LOCATE 18,1:PRINT"ARE YOU SURE YOU WANT TO QUIT? (Y/N)" J3 330 A*=INKEY*: IF A*="" THEN 3 30 ELSE IF A*="Y" THEN 5C REEN 0,0,0:CLS:END ELSE L OCATE 18,1:PRINT STRING*(50,32):GOTO 290 CD 340 REM *** CLEAR SCREEN ** * CC 350 IF A*<>"C" THEN 380 HN 360 LOCATE 17,1:PRINT"ARE YOU SURE (Y/N)":DEF SEG:POK E 106,0 DD 370 A*=INKEY*: IF A*="" THEN 3 70 ELSE IF A*="Y" THEN CL S:GOTO 190 ELSE LOCATE 17, 1:PRINT STRING*(66,32):G OTO 290 PM 380 IF A*="S" THEN 870 ELSE I F A*="L" THEN 990 OD 390 IF A*="D" THEN 2800 ELSE I F A*="L" THEN 990 DD 370 IF FAST=0 THEN BEP: GOTO 290 ELSE FAST=FAST-1:LOCA TE 1,68:PRINT FAST;:GOTO 290 J1 420 IF FAST=0 THEN BEP: GOTO 290 J2 420 IF FAST=150 THEN BEP: GOTO 290 J1 420 IF FAST=150 THEN BEP ELSE S P=SP+1:LOCATE 1,46:PRINT SP 11 460 GOTO 290 D1 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 P1 480 IF SP=-15 THEN BEP ELSE	LK 28Ø	REM ### WAIT FOR KEY ##
 90 ELSE IF LEN(A%)=2 THEN B30 ELSE IF VAL(A%)>0 AN D VAL(A%)<10 THEN 3080 01 310 IF A%="P" THEN 3080 03 310 IF A%<>"Q" THEN 350 PA 320 LOCATE 18,1:PRINT"ARE YOU SURE YOU WANT TO QUIT? (Y/N)" 33 30 A%=INKEY%:IF A%="" THEN 3 30 ELSE IF A%="Y" THEN 5C REEN 0,0,0:CLS:END ELSE L OCATE 18,1:PRINT STRING%(50,32):GOTO 290 CD 340 REM *** CLEAR SCREEN ** * CC 350 IF A%<>"C" THEN 380 HH 360 LOCATE 17,1:PRINT"ARE YOU SURE (Y/N)":DEF SEG:POK E 106,0 DD 370 A%=INKEY%:IF A%="" THEN 3 70 ELSE IF A%="Y" THEN CL S:GOTO 190 ELSE LOCATE 17 ,1:PRINT STRING%(66,32):G OTO 290 PM 380 IF A%="S" THEN 870 ELSE I F A%="L" THEN 970 ELSE I F A%="S" THEN 870 ELSE I F A%="S" THEN 870 ELSE I F A%="L" THEN 2800 ELSE I F A%="S" THEN 870 ELSE I F A%="S" THEN 850 F 410 IF FAST=50 THEN BEEP:GOTO 290 ELSE FAST=FAST-1:LOCA TE 1,68:PRINT FAST;:GOTO 290 VA20 IF FAST=150 THEN BEEP:GO TO 290 VA30 ON VAL(A%) GOTO 520,1080, 470,500,480,450,410,420,3 040 FH 440 REM *** SET SPEED *** CI 450 IF SP=15 THEN BEEP ELSE S P=SP+1:LOCATE 1,46:PRINT SP 1460 GOTO 290 VA70 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 P 480 IF SP=-15 THEN BEEP ELSE 	CI 29Ø	As=INKEYs: IF As="" THEN 2
 D VAL (A\$)<10 THEN 430 0L 300 IF A\$="P" THEN 3080 310 IF A\$<>"0" THEN 350 PA 320 LOCATE 18,1;PRINT"ARE YOU SURE YOU WANT TO GUIT? (Y/N)" JB 330 A\$=INKEY\$:IF A\$="" THEN 3 30 ELSE IF A\$="Y" THEN SC REEN 0,0,0:CLS:END ELSE L OCATE 18,1:PRINT STRING\$(50,32):GOTO 290 CD 340 REM *** CLEAR SCREEN ** * CC 350 IF A\$<>"C" THEN 380 HM 360 LOCATE 17,1:PRINT"ARE YOU SURE (Y/N)":DEF SEG:POK E 106,0 DD 370 A\$=INKEY\$:IF A\$="" THEN 3 70 ELSE IF A\$="Y" THEN CL S:GOTO 190 ELSE LOCATE 17 ,1:PRINT STRING\$(66,32):G OTO 290 PM 380 IF A\$="S" THEN 870 ELSE I F A\$="L" THEN 990 OD 370 IF A\$="D" THEN 2800 ELSE I F A\$="L" THEN 990 OD 370 IF A\$="D" THEN 2800 ELSE I F A\$="L" THEN 870 ELSE I F A\$="I" THEN 870 ELSE I F A\$="S" THEN 870 ELSE I F A\$="L" THEN 990 OD 390 IF A\$="S" THEN 870 ELSE I F A\$="S" THEN 850 DF 410 IF FAST=0 THEN BEEP:GOTO 290 ELSE FAST=FAST-1:LOCA TE 1,68:PRINT FAST;:GOTO 290 JL 420 IF FAST=150 THEN BEEP:GO TO 290 KP 430 ON VAL(A\$) GOTO 520,1080, 470,500,480,450,410,420,3 040 FH 440 REM *** SET SPEED *** CI 450 IF SP=15 THEN BEEP ELSE S P=SP+1:LOCATE 1,46:PRINT SP 11 460 GOTO 290 D 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PP 480 IF SP=-15 THEN BEEP ELSE 		830 ELSE IF VAL (A\$)=2 THEN
 U. 300 IF A\$="P" THEN 3000 J0 310 IF A\$<"C" THEN 350 PA 320 LOCATE 18, 1; PRINT "ARE YOU SURE YOU WANT TO QUIT? (Y/N)" J8 330 A\$=INKEY\$: IF A\$="" THEN 3 30 ELSE IF A\$="Y" THEN 5C REEN 0,0,0:CLS:END ELSE L DCATE 18, 1: PRINT STRING\$(50,32):GOTO 290 CD 340 REM \$\$\$\$ CLEAR SCREEN \$\$\$ \$\$ CC 350 IF A\$<>"C" THEN 380 HW 360 LOCATE 17, 1: PRINT "ARE YOU SURE (Y/N)":DEF SEG:POK E 106,0 DD 370 A\$=INKEY\$: IF A\$="" THEN 3 70 ELSE IF A\$="Y" THEN CL S:GOTO 190 ELSE LOCATE 17 ,1: PRINT STRING\$(66,32):G OTO 290 PM 380 IF A\$="S" THEN 870 ELSE I F A\$="L" THEN 990 OD 390 IF A\$="D" THEN 2800 ELSE I F A\$="I" THEN 990 OD 390 IF A\$="D" THEN 2800 ELSE I F A\$="I" THEN 870 ELSE I F A\$="I" THEN 850 0 390 IF A\$=TO THEN BEEP: GOTO 290 ELSE FAST=FAST-1:LOCA TE 1,68:PRINT FAST;:GOTO 290 JL 420 IF FAST=150 THEN BEEP: GO TO 290 KP 430 ON VAL(A\$) GOTO 520,1080, 470,500,480,450,410,420,3 040 FH 440 REM \$\$\$ SET SPEED \$\$\$ P=SP+1:LOCATE 1,46:PRINT SP I1 460 GOTO 290 D 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PP 480 IF SP=-15 THEN BEEP ELSE 		D VAL (A\$) <10 THEN 430
 PÅ 320 LOCATE 18, 1: PRINT"ARE YOU SURE YOU WANT TO QUIT? (Y/N)" JB 330 A\$=INKEY\$: IF A\$="" THEN 3 30 ELSE IF A\$="Y" THEN 3C REEN 0,0,0; CLS: END ELSE L OCATE 18, 1: PRINT STRING\$(50,32): GOTO 290 CD 340 REM \$\$\$\$ CLEAR SCREEN \$\$\$ \$\$ CC 350 IF A\$<!--"C" THEN 380</li--> HH 360 LOCATE 17, 1: PRINT "ARE YOU SURE (Y/N)": DEF SEG: POK E 106,0 DD 370 A\$=INKEY\$: IF A\$="" THEN 3 70 ELSE IF A\$="" THEN 2 106,0 DD 370 A\$=INKEY\$: IF A\$="" THEN 5 100 190 ELSE LOCATE 17 1: PRINT STRING\$(66,32): 0 0TO 290 PM 380 IF A\$="S" THEN 870 ELSE I F A\$="L" THEN 990 O 390 IF A\$="D" THEN 2800 ELSE I F A\$="L" THEN 990 O 390 IF A\$="D" THEN 2800 ELSE I F A\$="L" THEN 970 ELSE I F A\$="L" THEN 970 O 390 IF A\$="D" THEN 2800 ELSE I F A\$="L" THEN 787; 160TO 290 ELSE FAST=FAST-1:LOCA TE 1,68: PRINT FAST; 160TO 290 JL 420 IF FAST=150 THEN BEEP: GO TO 290 KP 430 ON VAL(A\$) GOTO 520,1080, 470,500,480,450,410,420,3 040 FH 440 REM \$\$\$ SET SPEED \$\$ P=SP+1:LOCATE 1,46: PRINT SP II 460 GOTO 290 D 470 STA=NUM:LOCATE 1,20:PRINT STA: GOTO 290 PP 480 IF SP=-15 THEN BEEP ELSE 	JO 310	IF A\$<>"Q" THEN 3080
JB 330 A\$=INKEY\$: IF A\$="" THEN 3 JØ 230 A\$=INKEY\$: IF A\$="" THEN 3C REEN 0,0,0:CLS:END ELSE L DCATE 18,1:PRINT STRING\$(DCATE 18,1:PRINT STRING\$(50,32):GOTO 290 CD 340 REM *** CLEAR SCREEN ** * CC 350 IF A\$<>"C" THEN 380 HN 360 LOCATE 17,1:PRINT ARE YOU SURE (Y/N)":DEF SEG:POK E 106,0 DD 370 A\$=INKEY\$: IF A\$="" THEN 3 70 ELSE IF A\$="Y" THEN CL SIGOTO 190 ELSE LOCATE 17 1:PRINT STRING\$(66,32):0 OTO 290 PM 380 IF A\$="S" THEN 870 ELSE I F A\$="L" THEN 970 O390 0390 IF A\$="S" THEN 870 ELSE I F A\$="L" THEN 970 O390 0390 IF A\$="S" THEN 870 ELSE I F A\$="L" THEN 970 O390 0390 IF A\$="S" THEN 870 ELSE I F A\$="I" THEN 2800 ELSE IF IF A\$="S" THEN 870 ELSE I F A\$="S" THEN 870 ELSE I F A\$="S" THEN 8670 ELSE I IF FAST=150 THEN BEEP: GOTO 290 D1 420 IF FAST=150 THEN BEEP: GOTO D290 IF A\$=PNINT FAST;:GO	PA 320	LOCATE 18, 1: PRINT"ARE YOU
 JB 330 A\$=INKEY\$:IF A\$="" THEN 3 30 ELSE IF A\$="" THEN 3C REEN 0,0,0LCS:END ELSE L OCATE 18,1:PRINT STRING\$(50,32):GOTO 290 CD 340 REM *** CLEAR SCREEN ** * CC 350 IF A\$<>"C" THEN 380 HM 360 LOCATE 17,1:PRINT"ARE YOU SURE (Y/N)":DEF SEG:POK E 106,0 DD 370 A\$=INKEY\$:IF A\$="" THEN 3 70 ELSE IF A\$="Y" THEN CL S:GOTO 190 ELSE LOCATE 17 ,1:PRINT STRING\$(66,32):G OTO 290 PM 380 IF A\$="S" THEN 870 ELSE I F A\$="L" THEN 990 OD 370 IF A\$="D" THEN 2800 ELSE I F A\$="I" THEN 990 OD 370 IF A\$="D" THEN 2800 ELSE I F A\$="I" THEN 990 OD 390 IF A\$="S" THEN BEEP:GOTO 290 ELSE FAST=FAST-1:LOCA TE 1,68:PRINT FAST;:GOTO 290 JL 420 IF FAST=150 THEN BEEP: GO TO 290 JL 420 IF FAST=150 THEN BEEP: GO TO 290 JF 430 ON VAL(A\$) GOTO 520,1080, 470,500,480,450,410,420,3 040 FH 440 REM *** SET SPEED *** CI 450 IF SP=15 THEN BEEP ELSE S P=SP+1:LOCATE 1,46:PRINT SP II 460 GOTO 290 D 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PP 480 IF SP=-15 THEN BEEP ELSE 		(Y/N)"
REEN 0, 0, 0: CLS: END ELSE L OCATE 18, 1: PRINT STRING\$(50,32): GOTO 290 CD 340 REM *** CLEAR SCREEN ** * CC 350 IF A\$<>"C" THEN 380 HN 360 LOCATE 17, 1: PRINT "ARE YOU SURE (Y/N) ": DEF SEG: POK E 106,0 DD 370 A\$=INKEY\$: IF A\$="" THEN 3 70 ELSE IF A\$="" THEN CL S: GOTO 190 ELSE LOCATE 17 , 1: PRINT STRING\$(66,32): G OTO 290 PM 380 IF A\$="S" THEN 870 ELSE I F A\$="L" THEN 990 OD 390 IF A\$="D" THEN 2800 ELSE IF A\$="I" THEN 980 ELSE FAST=FAST-1: LOCA TE 1, 68: PRINT FAST; : GOTO 290 JL 420 IF FAST=150 THEN BEEP: GO TO 290 JL 420 IF FAST=150 THEN BEEP: GO TO 290 KP 430 ON VAL(A\$) GOTO 520, 1080, 470, 500, 480, 450, 410, 420, 3 040 FH 440 REM *** SET SPEED *** CI 450 IF SP=15 THEN BEEP ELSE S P=SP+1: LOCATE 1, 20: PRINT SP II 460 GOTO 290 PM 480 IF SP=-15 THEN BEEP ELSE	JB 33Ø	AS=INKEYS: IF AS="" THEN 3
OCATE 18, 1:PRINT STRING\$(50,32):GOTO 290 CD 340 REM *** CLEAR SCREEN ** * CC 350 IF A\$<>"C" THEN 380 HW 360 LOCATE 17, 1:PRINT"ARE YOU SURE (Y/N)":DEF SEG:POK E 106,0 DD 370 A\$=INKEY\$:IF A\$="" THEN 3 70 ELSE IF A\$="Y" THEN CL S:GOTO 190 ELSE LOCATE 17 ,1:PRINT STRING\$(66,32):G OTO 290 PM 380 IF A\$="D" THEN 870 ELSE I F A\$="L" THEN 970 CO 370 IF A\$="D" THEN 2800 ELSE I F A\$="I" THEN 2800 ELSE IF A\$="I" THEN 2800 ELSE IF A\$="I" THEN 2800 ELSE IF A\$="I" THEN 2800 ELSE IF A\$="S" THEN BEEP:GOTO 290 ELSE FAST=FAST-1:LOCA TE 1,68:PRINT FAST;:GOTO 290 JL 420 IF FAST=150 THEN BEEP: GO TO 290 KP 430 ON VAL(A\$) GOTO 520,1080, 470,500,480,450,410,420,3 0440 FH 440 REM *** SET SPEED *** CI 450 IF SP=15 THEN BEEP ELSE S P=SP+1:LOCATE 1,46:PRINT SP II 460 GOTO 290 DV 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PP 480 IF SP=-15 THEN BEEP ELSE		REEN Ø,Ø,Ø:CLS:END ELSE L
<pre>CD 340 REM *** CLEAR SCREEN **</pre>		OCATE 18,1:PRINT STRING\$(50.32):GOTO 290
 * CC 35Ø IF A\$<>"C" THEN 38Ø HH 36Ø LOCATE 17,1:PRINT"ARE YOU SURE (Y/N)":DEF SEG:POK E 106,0 DD 37Ø A\$=INKEY\$:IF A\$="" THEN 3 7Ø ELSE IF A\$="" THEN CL S:GOTO 19Ø ELSE LOCATE 17 ,1:PRINT STRING\$(66,32):G OTO 290 PM 38Ø IF A\$="S" THEN 87Ø ELSE I F A\$="L" THEN 990 OD 39Ø IF A\$="D" THEN 280Ø ELSE IF A\$="L" THEN 280Ø ELSE IF A\$="I" THEN 236Ø PM 40Ø GOTO 29Ø DF 410 IF FAST=Ø THEN BEEP:GOTO 29Ø ELSE FAST=FAST-1:LOCA TE 1,68:PRINT FAST;:GOTO 29Ø JL 42Ø IF FAST=15Ø THEN BEEP: GO TO 29Ø JL 42Ø IF FAST=15Ø THEN BEEP:GO F 43Ø ON VAL(A\$) GOTO 520,1080, 470,500,480,450,410,420,3 040 FH 44Ø REM \$\$\$ SET SPEED \$\$\$ P=SP+1:LOCATE 1,46:PRINT SP I1 46Ø GOTO 29Ø DA 70 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 29Ø PP 48Ø IF SP=-15 THEN BEEP ELSE 	CD 34Ø	REM *** CLEAR SCREEN **
 HW 360 LOCATE 17,1:PRINT"ARE YOU SURE (Y/N)":DEF SEG:POK E 106,0 DD 370 A*=INKEY*:IF A*="" THEN 3 70 ELSE IF A*="Y" THEN CL S:GOTO 190 ELSE LOCATE 17 ,1:PRINT STRING*(66,32):G OTO 290 PM 380 IF A*="S" THEN 870 ELSE I F A*="L" THEN 970 ELSE I F A*="D" THEN 2800 ELSE I IF A*="D" THEN 2800 ELSE IF A*="I" THEN 2360 HM 400 GOTO 290 DF 410 IF FAST=0 THEN BEEP:GOTO 290 ELSE FAST=FAST-1:LOCA TE 1,68:PRINT FAST;:GOTO 290 JL 420 IF FAST=150 THEN BEEP: GO TO 290 ELSE FAST=FAST+1:L OCATE 1,68:PRINT FAST;:GO TO 290 KP 430 ON VAL(A*) GOTO 520,1080, 470,500,480,450,410,420,3 040 FH 440 REM *** SET SPEED *** CI 450 IF SP=15 THEN BEEP ELSE S P=SP+1:LOCATE 1,46:PRINT SP 11 460 GOTO 290 DV 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PP 480 IF SP=-15 THEN BEEP ELSE 	CC 35Ø	IF A\$<>"C" THEN 380
 SURE (Y/N)"IDEF SEGIPUK E 106,0 D) 370 A\$=INKEY\$: IF A\$="" THEN 3 70 ELSE IF A\$="Y" THEN CL S:GOTO 190 ELSE LOCATE 17 ,1:PRINT STRING\$(66,32):0 OTO 290 PM 380 IF A\$="S" THEN 870 ELSE I F A\$="L" THEN 970 O0 390 IF A\$="D" THEN 2800 ELSE IF A\$="I" THEN 2800 ELSE IF A\$="I" THEN 2800 ELSE IF A\$="I" THEN 2800 ELSE IF A\$="I" THEN 2800 ELSE IF A\$="D" THEN 2800 ELSE IF A\$="I" THEN 2800 ELSE IF A\$="I" THEN 870 ELSE I F A\$="I" THEN 870 ELSE I F A\$="I" THEN 8800 ELSE IF A\$="I" THEN 8800 ELSE II 460 IF FAST=150 THEN 88EP ELSE S P=SP+1:LOCATE 1,46:PRINT SP II 460 GOTO 290 N 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PP 480 IF SP=-15 THEN 88EP ELSE 	HN 360	LOCATE 17, 1: PRINT"ARE YOU
 D 370 A*=INKEY*: IF A*="" THEN 3 70 ELSE IF A*="Y" THEN CL S:GOTO 190 ELSE LOCATE 17 ,1:PRINT STRING*(66,32):0 OTO 290 PM 380 IF A*="S" THEN 870 ELSE I F A*="L" THEN 990 O 390 IF A*="D" THEN 2800 ELSE IF A*="I" THEN 8800 ELSE IS 000 290 IL 420 IF FAST=150 THEN 8800 IF 440 REM *** SET SPEED *** CI 450 IF SP=15 THEN 8800 ELSE S P=SP+1:LOCATE 1,46:PRINT SP II 460 GOTO 290 IN 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PP 480 IF SP=-15 THEN 8800 ELSE 		E 106,0
No ELSE IP HP-1 THEN LL SIGOTO 190 ELSE LOCATE 17 11PRINT STRING\$(66,32):0 OTO 290 PM 380 IF A\$="S" THEN 870 ELSE I F A\$="L" THEN 990 O390 IF A\$="D" THEN 2800 ELSE I IF A\$="L" THEN 990 O390 IF A\$="D" THEN 2800 ELSE I F A\$="L" THEN 2800 ELSE I F A\$="D" THEN 2800 ELSE I IF A\$="D" THEN 2800 ELSE I IF A\$="T" THEN 2800 ELSE I IF A\$="D" THEN 2800 ELSE IS 290 JL 420 IF FAST=150 THEN BEEP: GO TO 290 ELSE FAST=FAST+1:L OCATE 1, 68:PRINT FAST;:GO TO 290 KP 430 ON VAL(A\$) GOTO 520,1080, 470,500,480,450,410,420,3 Ø40 FH 440 REM \$\$\$\$ EST SPEED \$\$\$\$ P=SP+1:LOCATE 1,46:PRINT SP 11 460 GOTO 290 N 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 N 470 STA=SNUM:LOCATE 1,20:PRINT STA:GOTO 290 P 480 IF SP=-15 THEN BEEP ELSE	DD 37Ø	AS=INKEYS: IF AS="" THEN 3
<pre>,1:PRINT STRING*(66,32):9 OTO 290 PM 380 IF A\$="S" THEN 870 ELSE I F A\$="L" THEN 990 OD 390 IF A\$="D" THEN 2800 ELSE IF A\$="D" THEN 2800 ELSE IF A\$="I" THEN 2360 HM 400 GOTO 290 DF 410 IF FAST=0 THEN BEEP:GOTO 290 ELSE FAST=FAST-1:LOCA TE 1,68:PRINT FAST;:GOTO 290 JL 420 IF FAST=150 THEN BEEP: GO TO 290 ELSE FAST=FAST+1:L OCATE 1,68:PRINT FAST;:GO TO 290 KP 430 ON VAL(A\$) GOTO 520,1080, 470,500,480,450,410,420,3 0440 FH 440 REM \$** SET SPEED \$** CI 450 IF SP=15 THEN BEEP ELSE S P=SP+1:LOCATE 1,46:PRINT SP II 460 GOTO 290 DN 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PP 480 IF SP=-15 THEN BEEP ELSE</pre>		SIGOTO 190 ELSE LOCATE 17
 DIG 270 PM 380 IF A\$="S" THEN 870 ELSE I F A\$="L" THEN 970 D370 IF A\$="D" THEN 2800 ELSE IF A\$="I" THEN 2360 HM 400 GOTO 270 DF 410 IF FAST=0 THEN BEEP:GOTO 270 ELSE FAST=FAST-1:LOCA TE 1,68:PRINT FAST;:GOTO 270 JL 420 IF FAST=150 THEN BEEP: GO TO 270 ELSE FAST=FAST+1:L DCATE 1,68:PRINT FAST;:GO TO 270 KP 430 ON VAL(A\$) GOTO 520,1080, 470,500,480,450,410,420,3 040 FH 440 REM *** SET SPEED *** CI 450 IF SP=15 THEN BEEP ELSE S P=SP+1:LOCATE 1,46:PRINT SP 11 460 GOTO 270 D 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 270 PP 480 IF SP=-15 THEN BEEP ELSE 		,1:PRINT STRING\$ (66, 32):0
F A\$="L" THEN 990 00 390 IF A\$="D" THEN 2800 ELSE IF A\$="D" THEN 2800 ELSE IF A\$="I" THEN 2360 0F 410 IF FAST=0 THEN BEEP:GOTO 290 ELSE FAST=FAST-1:LOCA TE 1,68:PRINT FAST;:GOTO 290 JL 420 IF FAST=150 THEN BEEP: GO TO 290 ELSE FAST=FAST+1:L OCATE 1,68:PRINT FAST;:GO TO 290 KP 430 ON VAL(A\$) GOTO 520,1080, 470,500,480,450,410,420,3 0440 FH 440 REM \$\$\$ SET SPEED \$\$ P=SP+1:LOCATE 1,46:PRINT SP 11 460 GOTO 290 DN 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PP 480 IF SP=-15 THEN BEEP ELSE	PH 38Ø	IF AS="S" THEN 870 ELSE I
 IF A%="I" THEN 2360 HM 400 GOTO 290 F 410 IF FAST=0 THEN BEEP:GOTO 290 ELSE FAST=FAST-1:LOCA TE 1,68:PRINT FAST;:GOTO 290 JL 420 IF FAST=150 THEN BEEP: GO TO 290 ELSE FAST=FAST+1:L OCATE 1,68:PRINT FAST;:GO TO 290 KP 430 ON VAL(A%) GOTO 520,1080, 470,500,480,450,410,420,3 040 FH 440 REM *** SET SPEED *** CI 450 IF SP=15 THEN BEEP ELSE S P=SP+1:LOCATE 1,46:PRINT SP II 460 GOTO 290 N 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PP 480 IF SP=-15 THEN BEEP ELSE 	00 390	F AS="L" THEN 990
<pre>HM 400 GOTD 290 DF 410 IF FAST=0 THEN BEEP:GOTD 290 ELSE FAST=FAST-1:LOCA TE 1,68:PRINT FAST;:GOTD 290 JL 420 IF FAST=150 THEN BEEP: GO TO 290 ELSE FAST=FAST+1:L OCATE 1,68:PRINT FAST;:GO TO 290 KP 430 ON VAL(A*) GOTD 520,1080, 470,500,480,450,410,420,3 040 FH 440 REM *** SET SPEED *** CI 450 IF SP=15 THEN BEEP ELSE S P=SP+1:LOCATE 1,46:PRINT SP II 460 GOTD 290 DN 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTD 290 PP 480 IF SP=-15 THEN BEEP ELSE</pre>		IF As="I" THEN 2360
290 ELSE FAST=FAST-1:LOCA TE 1,68:PRINT FAST;:GOTO 290 JL 420 IF FAST=150 THEN BEEP: GO TO 290 ELSE FAST=FAST+1:L DCATE 1,68:PRINT FAST;:GO TO 290 KP 430 ON VAL(A\$) GOTO 520,1080, 470,500,480,450,410,420,3 040 FH 440 REM *** SET SPEED *** CI 450 IF SP=15 THEN BEEP ELSE S P=SP+1:LOCATE 1,46:PRINT SP II 460 GOTO 290 DN 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PP 480 IF SP=-15 THEN BEEP ELSE	HM 400	GOTO 290 IF FAST=0 THEN BEEP: GOTO
IL 1,681PRINT FAST;160T0 290 290 JL 420 IF FAST=150 THEN BEEP: GO TO 290 ELSE FAST=FAST+1:L DCATE 1,68:PRINT FAST;:GO TO 290 KP 430 ON VAL(A\$) GOTO 500,480,450,410,420,3 040 FH 440 REM \$*** SET SPEED \$*** CI 450 IF SP=15 THEN BEEP ELSE S P=SP+1:LOCATE 1,46:PRINT SP 11 460 GOTO 290 N 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PP 480 IF SP=-15		290 ELSE FAST=FAST-1:LOCA
JL 420 IF FAST=150 THEN BEEP: GO TO 290 ELSE FAST=FAST+1:L OCATE 1,68:PRINT FAST;:GO TO 290 KP 430 ON VAL(A\$) GOTO 520,1080, 470,500,480,450,410,420,3 040 FH 440 REM *** SET SPEED *** CI 450 IF SP=15 THEN BEEP ELSE S P=SP+1:LOCATE 1,46:PRINT SP II 460 GOTO 290 N 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PP 480 IF SP=-15 THEN BEEP ELSE		29Ø
ID 290 ELSE PAST=PAST=IL OCATE 1,68:PRINT FAST;:GO TO 290 KP 430 ON VAL(A\$) GOTO 520,1080, 470,500,480,450,410,420,3 040 FH 440 REM \$*** SET SPEED \$*** CI 450 IF SP=15 THEN BEEP ELSE S P=SP+1:LOCATE 1,46:PRINT SP II 460 GOTO 290 N 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PP 480 IF SP=-15 THEN BEEP ELSE	JL 42Ø	IF FAST=150 THEN BEEP: GO
TO 290 KP 430 ON VAL(A\$) GDTO 520,1080, 470,500,480,450,410,420,3 040 FH 440 REM \$\$\$ SET SPEED \$\$ P=SP+1:LOCATE 1,46:PRINT SP 11 460 GOTO 290 N 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PP 480 IF SP=-15 THEN BEEP ELSE		OCATE 1,68:PRINT FAST;:GO
A70,500,480,450,410,420,3 040 FH 440 REM \$*** SET SPEED \$*** CI 450 IF SP=15 THEN BEEP ELSE S P=SP+1:LOCATE 1,46:PRINT SP II 460 GOTO 290 N 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PP 480 IF SP=-15 THEN BEEP ELSE		
040 FH 440 REM *** SET SPEED *** CI 450 IF SP=15 THEN BEEP ELSE S P=SP+1:LOCATE 1,46:PRINT SP II 460 GOTO 290 N 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PP 480 IF SP=-15 THEN BEEP ELSE	KF 4310	470, 500, 480, 450, 410, 420, 3
CI 450 IF SP=15 THEN BEEP ELSE S P=SP+1:LOCATE 1,46:PRINT SP 11 460 GOTO 290 N 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PP 480 IF SP=-15 THEN BEEP ELSE		040
P=SP+1:LOCATE 1,46:PRINT SP II 460 GOTO 290 N 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PP 480 IF SP=-15 THEN BEEP ELSE	CI 450	IF SP=15 THEN BEEP ELSE S
II 460 GOTO 290 N 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PP 480 IF SP=-15 THEN BEEP ELSE		P=SP+1:LOCATE 1,46:PRINT
N 470 STA=NUM:LOCATE 1,20:PRINT STA:GOTO 290 PP 480 IF SP=-15 THEN BEEP ELSE	11 460	GOTO 29Ø
PP 480 IF SP=-15 THEN BEEP ELSE	DJ 47Ø	STA=NUM:LOCATE 1,20:PRINT
	PP 480	IF SP=-15 THEN BEEP ELSE



"Animator for IBM PC/PCjr" takes advantage of extended BASIC graphics features such as GET and PUT.

		CD-CD 1.1 DOATE 1 44. DOANT	
10	100	SP=SP-1:LUCATE 1,46:PRINT	
HP	500	EN=NUM:LOCATE 1,31:PRINT	
		EN: GOTO 290	
LJ	210	REM ### ANIMATE PICTURES	
BL	52Ø	LOCATE 17,1: PRINT"PRESS S	
		TIL OCATE 18, 1, PRINT USE	
		ARROW KEYS FOR SPEED": IF	
		STA>EN THEN QQ=-1 ELSE QQ	
	ETA	=1	
C1	540	PL1=PL: IF PL+SP<1 THEN PL	
	0.0	=57Ø ELSE IF PL+SP>58Ø TH	
		EN PL=1	
ON	550	PL=PL+SP	
UN	200	OTO 630,640,650,660,670,6	
		80,690,700,710,720,730,74	
		0,750,760,770,780,790,800	
CN	570	FOR N=Ø TO FAST\$4:NEXT:A\$	
-		=INKEYS: IF AS=" " THEN 23	
		40 ELSE IF A*<>"" AND LEN	
		(A\$) <>2 THEN LOCATE 1,8:P	
		T STRING\$ (150, 32): GOTO 29	
		Ø	
DG	580	IF LEN(A\$)<>2 THEN 620	
FA	246	77 THEN SPESSE1 FLSE IF C	
		=75 THEN SP=SP-1	
EN	600	IF SP=-16 THEN SP=-15 ELS	
FI	610	E IF SP=16 THEN SP=15	
EJ	620	NEXT: GOTO 530	
MO	630	PUT (PL1, 52), U%, PSET: PUT (P	
05	1.10	L, 52), A%160T0 570	
UE	040	L.52) . B%: GOTO 570	
BK	65Ø	PUT (PL1, 52) , U%, PSET: PUT (P	
		L, 52), C%: GOTO 570	
UA	6610	L. 52), DX: GOTO 570	
FB	670	PUT (PL1, 52), U%, PSET: PUT (P	
		L, 52), E%: GOTO 570	
IR	680	PUT (PL1, 52), U%, PSET: PUT (P	
KC	690	PUT (PL1, 52), U%, PSET: PUT (P	1
		L, 52), 6%: 60TO 57Ø	
LF	700	PUT (PL1, 52), U%, PSET: PUT (P	
OL	710	PUT (PL1, 52), U%, PSET: PUT (P	
		L,52),1%:GOTO 570	
AB	720	PUT (PL1, 52), U%, PSET: PUT (P	
CH	730	L, 52), J%: GUTU 570	
	130	L, 52), K%: GOTO 57Ø	
FN	74Ø	PUT (PL1, 52), U%, PSET: PUT (P	
un	750	L, 52), L%: GOTO 570	
μŅ	1.210	L.52).M%;GOTO 570	
KJ	760	PUT (PL1, 52) , U%, PSET: PUT (P	

MP	77ø	PUT (PL1, 52), U%, PSET: PUT (P
OF	78Ø	L, 52), 0%: GOTO 570 PUT (PL1, 52), U%, PSET: PUT (P
BL	790	L, 52), P%: 60T0 570
0	Daa	L,52),Q%:GOTO 570
	800	L,52),R%1GOTO 57Ø
EE	81Ø	PUT (PL1,52),U%,PSET:PUT (P L,52),S%:GOTO 57Ø
HK	82Ø	PUT (PL1, 52), U%, PSET: PUT (P
JH	830	C=ASC(RIGHT\$(A\$,1)):IF C= 77 THEN NUM=NUM+1 ELSE IF
=	044	C=75 THEN NUM=NUM-1
ru	649	IF NUM=21 THEN NUM=1
IR	850	LOCATE 1,8:PRINT NUM:GOTO
PC	86Ø	REM ### SAVE PICTURE ##
LO	870	CLS: ON ERROR GOTO 25010
nr	860	S A-ABORT SAVE AN
pu	004	Y OTHER KEY TO CONTINUE"
DI	670	90 ELSE IF AS="F" THEN FI
		LES"*. ANI" ELSE IF AS="A"
C.1	Daa	THEN GOSUB 2310: GUIU 190
	100	AME OF FILE TO SAVE"; A\$: I
		F A\$="" THEN GOSUB 2310:G
	-	
JU	9110	CLS:LOCATE 9.10:PRINT"NO
		EXTENSION PLEASE ": GOTO
		880
11	920	ATE 9 16 PRINT"NO MORE TH
		AN 8 CHARACTERS PLEASE":G
_	-	OTO 88Ø
CD	930	IF VAL (RIGHT\$(A\$,1)) >0 DR RIGHT\$(A\$,1)="0" THEN CL
		SILOCATE 9, 10: PRINT THE F
		IRST CHARACTER CAN'T BE A
RF	944	NUMBER": GUTU 889
BL	950	A\$=A\$+".ANI"
81	960	DEF SEG=&HB8ØØ:BSAVE A\$,Ø
		, &H4000: PRINT"IT HAS BEEN
		TO CONTINUE":PRINT:PRINT
		PRINT
81	97Ø	A\$=INKEYS: IF A\$="" THEN 9
		TO 190
AG	98Ø	REM ### LOAD PICTURE ##
13	904	CI STON ERROR COTO 25444
ID	1000	LOCATE 10, 10: PRINT"F-FIL
		ES A-ABORT LOAD
		ANY OTHER KEY TO CONTINU
CD	1010	AS=INKEYS: IF AS="" THEN
		1010 ELSE IF AS="F" THEN
		FILES"*. ANI" ELSE IF A\$
		0 190
PI	1020	PRINT: PRINT: PRINT: INPUT"
		NAME OF FILE TO LOAD"; A\$
		Ø:GOTO 190
II	1030	IF INSTR(A\$,".")<>Ø THEN
		CLSILOCATE 9, 10: PRINT"N
		TO 1000
GD	1040	IF LEN (A\$) >8 THEN CLS:LD
		CATE 9, 10: PRINT NO MORE
		": GOTO 1000
PK	1050	IF VAL (RIGHT\$ (A\$, 1)) >0 0
		R RIGHT\$ (A\$, 1) ="Ø" THEN
		LESILUCATE 9, 10: PRINT "TH

		E FIDET CHARACTER CAN'T
		PE A NUMBER ", GOTO 1000
KF	1040	AS=AS+" ANI ": DEF SEG=&HB
-	1000	800: BLOAD AS, 0: ON ERROR
		GOTO Ø:GOTO 19Ø
LG	1070	REM ### EDIT A PICTURE

10	1080	LOCATE 16,1:PRINT"TYPE I
		N 21 TO ABORT": PRINT"NUM
		BER SET AT THE TUP UP TH
		E SUREEN IS PIL. IU READ
		DCATE 18 1: INPLIT "EDIT PI
		CTURE NUMBER" : B: IF B(Ø 0
		R B>21 THEN BEEP: GOTO 10
		80
JC	1090	IF B=21 THEN CLS: GOSUB 2
		310:GOTO 190
IA	1100	IF B=0 THEN B=NUM
EU	1110	FDIT ON SCREEN ###
PB	1120	CLS:LOCATE 1.24:PRINT"WA
		IT ": ON NUM GOTO 1130,
		1140,1150,1160,1170,1180
		,1190,1200,1210,1220,123
		0,1240,1250,1260,1270,12
		80,1290,1300,1310,1320
NG D1	1130	PUT (1,50), A7: GUTU 1340
DM	1150	PUT (1,50), 5%: 6010 1340
BP	1160	PUT (1.50). DX: GOTO 1340
23	1170	PUT(1.50).E%:GOTO 1340
DF	1180	PUT (1, 50), F%: GOTO 1340
FI	1190	PUT(1,50),6%:60TO 1340
EP	1200	PUT(1,50),H%:GOTO 1340
FC	1210	PUT(1,50), 1%: GOTO 1340
6F	1220	PUT (1,50), J%: GOTO 1340
11	1230	PUT (1,50), K7: GUTU 1340
KO	1250	PUT (1 50) MY GOTO 1340
LB	1260	PUT (1, 50) . N% GOTO 1340
ME	1270	PUT (1, 50), 0%: GOTO 1340
NH	128Ø	PUT(1,50), P%: GOTO 1340
PK	1290	PUT(1,50),Q%1GOTO 1340
OB	1300	PUT(1,50), R%: GOTO 1340
PE	1310	PUT (1,50),5%: GUTU 1340
PO	1330	REM 11 GET ON-DEE POIN
	1000	TS \$\$\$
JO	1340	FOR I=1 TO 20: FOR X=1 TO
		54:A(I,X)=POINT(X, I+49)
PL	1350	NEXT: NEXT
KB	1360	REM ### DRAW EDITING SC
TR	1370	FOR INI TO 201 OCATE 3+1
10	13/10	.14:PRINT "
		"; 1 FOR
		J=1 TO 54: IF A(I, J)=1 TH
		EN LOCATE 3+1, 13+J1PRINT
PF	1704	NEXT-NEXT
CP.	1300	LOCATE 1. 30 PRINT (D) UTT
ur	1370	(D) RAW (M) DVE (E)
		RASE (C) LEAR (S) AVE
		(I)NVERSE"
PL	1400	GOTO 1550
GF	1410	REM ### PLACE CURSOR #
		**
KO	1420	BLINKZ=(BLINKZ+1) MOD 20
		FISE 1440
P.1	1430	REM ### CURSOR OFF ###
GH	1440	IF A (ROW, COLUMN) =Ø THEN
		CHS="." ELSE IF A (ROW, CO
		LUMN)=1 THEN CH\$="#"
BF	1450	GOTO 148Ø
6M	1460	REM *** CURSOR ON ***
LO	147Ø	IF CURS=-1 THEN CHS="-"
		THE ELGE TE CHOCHT THEN
		CHS="+"
EI	1480	LOCATE 3+ROW, 13+COLUMN:P
-		RINT CH\$;:RETURN

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DE 1490 REM ### REMOVE CURSOR *** IF A (ROW, COLUMN) =0 THEN SN 1500 CHS="." ELSE IF A(ROW, CO LUMN) =1 THEN CH\$="#" CF 1510 LOCATE 3+ROW, 13+COLUMN: P RINT CH\$; : RETURN P 1520 LOCATE 24, 18: PRINT "wait ": FOR I=1 TO 20:LOCATE 3+1,14:PRINT STRING\$ (54, 46); EN 1530 NEXT: ERASE A: DIM A (20, 54):LOCATE 24, 18: PRINT" "; : PUT (1, 50), U%, PSET: RE TURN CD 1540 REM *** SET CURSOR *** IJ 1550 ROW=1: COLUMN=1: CURS=0 NF 1560 REM ### MAIN LOOP *** EH 1570 BLINK%=0: IF CURS=-1 THEN A (ROW, COLUMN) =Ø: PSET (CO LUMN, ROW+49) , Ø ELSE IF C URS=+1 THEN A (ROW, COLUMN)=1:PSET(COLUMN, ROW+49), IL 1580 GOSUB 1420 P8 1590 AS=INKEYS:DEF SEG:POKE 1 06, 0: IF LEN (A\$)=0 THEN 1 580 ELSE IF LEN(A\$)=1 TH EN 1600 ELSE IF LEN(A\$)= 2 THEN 1720 OH 1600 CODE1=ASC(A\$) AND &HSF FC 1610 REM ### READ KEYS *** IF CODE1=ASC("E") THEN 2 DF 1620 040 PH 1630 IF CODE1=ASC("M") THEN 2 050 OF 1640 IF CODE1=ASC("D") THEN 2 060 JC 1650 IF CODE1=ASC("C") THEN 2 ØBØ AL 1660 IF CODE1=ASC("S") THEN 2 100 60 1670 IF CODE1=ASC("Q") THEN G OSUB 2310:GOTO 190 PP 1680 IF CODE1=ASC("I") THEN 1 710 DB 1690 GOTO 1580 INVERSE A PICTU K6 1700 REM *** RE III LF 1710 GET(1, 50) - (54, 70), U%. PUT (1, 50), U%, PRESET: GET (1, 7 5)-(54,95),U%:GOTO 1340 EL 1720 IF ASC(A\$) <>Ø THEN 157Ø ELSE CODE2=ASC (RIGHT\$ (A\$.1)):GOSUB 1500 HB 1730 REM ### READ ARROW KEYS IC 1740 IF CODE2=71 THEN 1840 PA 1750 IF CODE2=73 THEN 1870 MM 1760 IF CODE2=79 THEN 1900 KJ 1770 IF CODE2=81 THEN 1930 PI 1780 IF CODE2=72 THEN 1960 FN 1790 IF CODE2=75 THEN 1980 NL 1800 IF CODE2=77 THEN 2000 KP 1810 IF CODE2=80 THEN 2020 CA 1820 GOTO 1580 OK 1830 REM ### MOVE THE CURSOR *** EJ 1840 IF ROW=1 THEN ROW=21 FH 185Ø IF COLUMN=1 THEN COLUMN= 55 LE 1860 ROW=ROW-1: COLUMN=COLUMN-1:GOTO 157Ø EC 1870 IF ROW=1 THEN ROW=21 IN 1880 IF COLUMN=54 THEN COLUMN =0 10 1890 ROW=ROW-1:COLUMN=COLUMN+ 1:GOTO 157Ø IF ROW=20 THEN ROW=0 LH 1900 FN 1910 IF COLUMN=1 THEN COLUMN= 55 JA 1920 ROW=ROW+1: COLUMN=COLUMN-1:GOTO 157Ø MA 1930 IF ROW=20 THEN ROW=0

LD 1940 IF COLUMN=54 THEN COLUMN =Ø 6P 1950 ROW=ROW+1:COLUMN=COLUMN+ 1:GOTO 157Ø EB 1960 IF ROW=1 THEN ROW=21 KN 1970 ROW=ROW-1:GOTO 1570 6C 198Ø IF COLUMN=1 THEN COLUMN= 55 ON 1990 COLUMN=COLUMN-1: GOTO 157 JE 2000 IF COLUMN=54 THEN COLUMN =Ø J0 2010 COLUMN=COLUMN+1: GOTO 157 ø LA 2020 IF ROW=20 THEN ROW=0 6F 2030 ROW=ROW+1:GOTO 1570 DJ 2040 CURS=-1:GOTO 1570 KB 2050 CURS=0:GOTO 1570 CJ 2060 CURS=+1:GOTO 1570 NG 2070 REM ### CLEAR THE PICTU RE BN 2080 GOSUB 1520: GOTO 1550 HE 2090 REM ### SAVE THE PICTUR E ### PD 2100 LOCATE 1,24: PRINT "WAIT. .": ON B GOTO 2110,2120,2 130, 2140, 2150, 2160, 2170, 2180,2190,2200,2210,2220 2230, 2240, 2250, 2260, 227 0,2280,2290,2300 JB 2110 GET (1, 50) - (54, 70) , A%: GOS UB 2310:GOTO 190 LM 2120 GET (1, 50) - (54, 70), B%: GOS UB 2310:GOTO 190 HH 2130 GET (1, 50) - (54, 70), C%: GOS UB 2310:GOTO 190 0C 214Ø GET(1,50)-(54,70), D%: GOS UB 2310:GOTO 190 9 2150 GET (1, 50) - (54, 70), EX: GOS UB 2310:GOTO 190 GET (1, 50) - (54, 70), F%: GOS CI 216Ø UB 2310:GOTO 190 DD 2170 GET (1, 50) - (54, 70), G%: GOS UB 2310:GOTO 190 F0 2180 GET(1,50)-(54,70), H%: GOS UB 2310:GOTO 190 HJ 2190 GET (1, 50) - (54, 70), I%: GOS UB 2310:GOTO 190 HI 2200 GET (1, 50) - (54, 70), J%: GOS UB 2310:GOTO 190 10 2210 GET (1, 50) - (54, 70), K%: GOS UB 2310:GOTO 190 K0 2220 GET(1,50)-(54,70),L%:GOS UB 2310:GOTO 190 N 2230 GET (1, 50) - (54, 70), M%: GOS UB 2310:GOTO 190 NE 2240 GET (1, 50) - (54, 70) , N%: 605 UB 2310:GOTO 190 PP 2250 GET (1, 50) - (54, 70), 0%: GOS UB 2310:GOTO 190 BK 2260 GET (1, 50) - (54, 70), P%: GOS UB 2310:GOTO 190 CF 227Ø GET(1,50)-(54,70),Q%:GOS UB 2310:GOTO 190 EA 2280 GET(1,50)-(54,70), R%: GOS UB 2310:GOTO 190 6L 2290 GET(1,50)-(54,70), S%: GOS UB 2310:GOTO 190 6K 2300 GET(1,50)-(54,70), T%: GOS UB 2310:GOTO 190 6K 2310 CLS: PUT (1, 10) , A% PUT (61 10), B%: PUT (121, 10), C%: PU T(181,10), D%: PUT(241,10) , E% PUT (301, 10) , F% PUT (3 61, 10), G%: PUT (421, 10), H% PUT (481, 10), 1%: PUT (541, 1Ø), J% CA 2320 PUT (1,81), K%: PUT (61,81), L%: PUT (121, 81), M%: PUT (18 1,81), N%: PUT (241,81),0%: PUT (301,81), P%: PUT (361,8 1), Q%: PUT (421, 81), R%: PUT (481,81), S%: PUT (541,81), T%. PSET

JL 233Ø 01 234Ø	RETURN IF INKEYS="" THEN 2340 E	-
PL 2350	LSE 620 REM ### INSERT A BLANK	EF 281Ø
18 2360	PICTURE ###	
1. 2000	U SURE? THIS WILL MOVE	NH 282Ø
HC 237Ø	AS=INKEYS: IF AS="" THEN	
	2370 ELSE IF A\$<>"Y" THE N LOCATE 18,1:PRINT STRI	
A STATISTICS	NG\$ (50, 32): GOTO 190	JL 283Ø
EF 238Ø	ON NUM GOTO 2390,2400,24	DB 284Ø
1	460,2470,2480,2490,2450,2	NI 2860
	2510, 2520, 2530, 2540, 2550	IH 287Ø
	,2560,2570,2820	LK 288Ø
HH 2390	GET (1, 10) - (54, 30), B%	CO 289Ø
F6 2410	GET (121, 10) - (174, 30), DZ	KJ 2910
IJ 242Ø	GET(181,10)-(234,30),E%	LB 292Ø
PN 243Ø	GET (241, 10) - (294, 30), F%	DL 293Ø
LH 2440	GET (301, 10) - (354, 30), GZ	BD 2940
ED 2460	GET (421, 10) - (474, 30), 1%	LH 2960
66 2470	GET (481, 10) - (534, 30), J%	HH 297Ø
OK 248Ø	GET (541, 1Ø) - (594, 3Ø), K%	JA 2980
FA 2500	GET (41 B1) - (114 101) ,LZ	AF 2990
EK 2510	GET (121.81) - (174, 101) .N%	HP 3010
60 2520	GET(181,81)-(234,101),0%	IP 3020
ND 253Ø	GET (241, 81) - (294, 101), P%	
11 2550	GET (361, 81) - (414, 101), 8%	FI SUSU
DH 256Ø	GET (421, 81) - (474, 1Ø1), 5%	IN 3040
FA 257Ø	GET (481,81) - (534,1Ø1), T%	
AB 258Ø	CLS: ON NUM GOTO 2590,260	
1	50,2660,2670,2680,2690,2	
	700,2710,2720,2730,2740,	
10.0504	2750,2760,2770,2780	
18 2390	UB 2310: GOTO 190	
LA 2600	GET (1, 50) - (54, 70), B%: GOS	
	UB 2310:GOTO 190	HH 3050
NL 2610	GET (1,50) - (54,70), CZ: GUS	
06 2620	GET (1, 50) - (54, 70), D%: 605	
	UB 2310:GOTO 190	
AB 2630	GET (1, 50) - (54, 70), E%: GOS	
CH 2640	GET (1, 50) - (54, 70) - FX: 605	
	UB 2310:GOTO 190	
DH 2650	GET(1,50)-(54,70),6%:605	E6 3060
55 3440	UB 2310:GOTO 190	IF 3070
10 2000	UB 2310:GOTO 190	BN 3080
HN 267Ø	GET (1, 50) - (54, 70), 1%: GOS	
	UB 23101GOTO 190	
11 2680	UB 2310:00TO 190	P.1 3090
KD 269Ø	GET (1, 50) - (54, 70) , K%: GOS	
	UB 2310:GOTO 190	
KC 2700	UB 2310, 60TO 190	
NN 271Ø	GET (1, 50) - (54, 70) , M%: GOS	NN 3100
	UB 2310:GOTO 190	
0I 272Ø	GET (1, 50) - (54, 70), N%: GOS	PL 3110
PD 2730	GET (1, 50) - (54, 70) . 0%: 60S	
	UB 2310:GOTO 190	JL 3120
B0 274Ø	GET (1, 50) - (54, 70), P%: GOS	
DJ 2750	GET (1, 50) - (54, 70) 07+606	EP 3130
	UB 2310: GOTO 190	
EE 276Ø	GET (1, 50) - (54, 70), R%: 605	KE 314Ø
69 3770	UB 2310:GOTO 190	
or 2//10	UB 2310:GOTO 190	
IK 278Ø	GET (1, 50) - (54, 70), T%: 605	
EN 0704	UB 2310:GOTO 190	BN 315Ø
EN 2790	E ### DELETE A PICTUR	CH 3146
BN 2800	LOCATE 18, 1: PRINT ARE YO	
	Analog Saure Contraction of the	

	U SURE YOU WANT TO DELET
281Ø	AS=INKEYS: IF AS="" THEN
	2810 ELSE IF A\$<>"Y" THE
	NES (50.32) : GOTO 190
282Ø	ON NUM GOTO 2830, 2840, 28
	50,2860,2870,2880,2890,2
	2950, 2910, 2920, 2930, 2940, 2950, 2960, 2970, 2980, 2990
	,3000,3010,3020
2830	GET (61, 10) - (114, 30), A%
2850	GET (121, 10) - (1/4, 30), 8%
286Ø	GET (241, 10) - (294, 30), D%
2870	GET (301, 10) - (354, 30), E%
2890	GET (421, 10) - (474, 30), 6%
2900	GET (481, 10) - (534, 30), H%
2910	GET (541, 10) - (594, 30), 1%
2930	GET (61,81) - (114,101), 5%
2940	GET(121,81)-(174,1Ø1),L%
2950	GET(181,81)-(234,101),M%
2970	GET(241, B1) - (294, 101), NZ GET(301, B1) - (354, 101), NZ
2980	GET (361, 81) - (414, 101), P%
2990	GET (421, 81) - (474, 101), Q%
3000	GET (541, 81) - (534, 101), R%
3020	CLS: GET (1, 10) - (54, 30), T%
	: GOSUB 2310: GOTO 190
2020	PICTURES 111
3Ø4Ø	CLS: PUT (1, 10), A%, PRESET:
	PUT (61, 10), 8%, PRESET: PUT
	(121,10), CZ, PRESET: PUT (1 81,10), DZ, PRESET: PUT (241
	,10), E%, PRESET: PUT (301,1
	Ø), F%, PRESET: PUT (361, 10)
	, GZ, PRESET: PUT (421, 10), H
	PRESET: PUT (541, 10), JZ, PR
7050	ESET
DEDE	61, 81), LZ, PRESET: PUT (121
	,81),M%,PRESET:PUT(181,8
	1), N%, PRESET: PUT (241, 81)
	, UZ, PRESET: PUT (361, 81), P
	PRESET: PUT (421, 81), R%, PR
	ESET: PUT (481, 81), 5%, PRES
3060	GOTO 190
3070	REM *** MAKE A PROGRAM
7000	STATE 10 1- PRINT PAPE VO
2020	U SURE YOU WANT TO MAKE
	THIS SET-UP INTO A PROGR
7000	AM?"
96490	3090 ELSE IF AS="Y" THEN
	3100 ELSE LOCATE 18,1:P
	RINT STRING\$ (66, 32): GOTO
3100	G=30:0PEN "0",#1, "PRG.BA
	S"
3110	PRINT #1, "10 CLS:KEY OFF
	"IPL=1"
312Ø	IF STA>EN THEN QQ=-1 ELS
7170	
3130	O EN STEP QQ: IF ISSTA T
	HEN A\$=A\$+","
314Ø	ON I GOTO 3150,3160,3170
	0,3230,3240,3250,3260,32
	70, 3280, 3290, 3300, 3310, 3
3150	320,3330,3340
3130	Ø
3160	A\$=A\$+"B%(144)":GOTO 335
	Ø

M	317Ø	A\$=A\$+"C%(144)":GOTO 335
M	318Ø	A\$=A\$+"D%(144)":GOTD 335
H	319Ø	A\$=A\$+"E%(144)":GOTO 335
A	3200	A\$=A\$+"F%(144)":GOTO 335
A	321Ø	A\$=A\$+"G%(144)":GOTO 335
GA	322Ø	A\$=A\$+"H%(144)":GOTO 335
IA	323ø	A\$=A\$+"I%(144)":GOTO 335
A	3240	A\$=A\$+"J%(144)":GOTO 335
A	325ø	A\$=A\$+"K%(144)":GOTO 335
A	326Ø	A\$=A\$+"L%(144)":GOTO 335
A.	327Ø	A\$=A\$+"M%(144)":GOTO 335
IA	328ø	A\$=A\$+"N%(144)":GOTO 335
IA	329ø	A\$=A\$+"0%(144)":GOTO 335
Æ	3300	A\$=A\$+"P%(144)":GOTD 335
E	331ø	Ø A\$=A\$+"Q%(144)":GOTO 335
DE	332Ø	Ø A\$=A\$+"R%(144)":GOTO 335
E	333Ø	A\$=A\$+"5%(144)":GOTO 335
E	334ø	Ø A\$=A\$+"T%(144)":GOTO 335
D	335Ø	Ø NEXT
II	3360	A\$=A\$+",U%(144)":PRINT # 1,A\$:PRINT #1,"30 GET(1,
0	337Ø	1)-(54,20),U%" IF STA>EN THEN QQ=-1 ELS
	7704	E QQ=1
E	3390	CLS: ON P GOTO 3400, 3410, 3420, 3430, 3440, 3450, 3460
		0,3520,3530,3540,3550,35
I	3400	69,3579,3589,3599 PUT (1.50) A7:6010 3699
HL.	3410	PUT (1, 50), 8%: GOTO 3600
0	and have been a second	
-	3420	PUT (1, 50), C%: GOTO 3600
E	342Ø 343Ø 344Ø	PUT(1,50),C%:GOTO 3600 PUT(1,50),D%:GOTO 3600 PUT(1,50),E%:GOTO 3600
EH	342Ø 343Ø 344Ø 345Ø	PUT(1,50),C%:GOTO 3600 PUT(1,50),D%:GOTO 3600 PUT(1,50),E%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600
N H H H	342Ø 343Ø 344Ø 345Ø 346Ø 346Ø	PUT(1,50),C%:GOTO 3600 PUT(1,50),D%:GOTO 3600 PUT(1,50),E%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),G%:GOTO 3600 PUT(1,50),H%:GOTO 3600
EHKINA	3420 3430 3440 3450 3460 3470 3480	PUT(1,50),C%:GOTO 3600 PUT(1,50),D%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),H%:GOTO 3600 PUT(1,50),I%:GOTO 3600
BEHKIN ADK	3420 3430 3440 3450 3450 3460 3470 3480 3490 3500	PUT(1,50),C%:GOTO 3600 PUT(1,50),D%:GOTO 3600 PUT(1,50),E%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),H%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),J%:GOTO 3600
HE H KIN AD KN	3420 3430 3450 3460 3460 3470 3480 3490 3500 3510	PUT(1,50),C%:GOTO 3600 PUT(1,50),D%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),H%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),L%:GOTO 3600
HEH KIN ADK NA	3420 3430 3440 3450 3460 3470 3480 3470 3480 3500 3510 3520 3520	PUT(1,50),C%:GOTO 3600 PUT(1,50),D%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),H%:GOTO 3600 PUT(1,50),1%:GOTO 3600 PUT(1,50),X%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),L%:GOTO 3600 PUT(1,50),M%:GOTO 3600 PUT(1,50),M%:GOTO 3600 PUT(1,50),M%:GOTO 3600
SEHKINADK NADIG	3420 3430 3440 3450 3460 3470 3480 3470 3500 3510 3520 3530 3530 3540	PUT(1,50),C%:GOTO 3600 PUT(1,50),D%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),H%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),N%:GOTO 3600 PUT(1,50),N%:GOTO 3600 PUT(1,50),N%:GOTO 3600 PUT(1,50),N%:GOTO 3600
HEHKIN ADKIN ADIGJ	3420 3430 3440 3450 3460 3470 3480 3500 3500 3510 3520 3530 3540 3550	PUT(1,50),C%:GOTO 3600 PUT(1,50),D%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),H%:GOTO 3600 PUT(1,50),1%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),M%:GOTO 3600 PUT(1,50),N%:GOTO 3600 PUT(1,50),0%:GOTO 3600 PUT(1,50),0%:GOTO 3600 PUT(1,50),P%:GOTO 3600
HE HKINADKINADIGJIM	3420 3430 3450 3450 3450 3470 3480 3590 3590 3520 3530 3550 3550 3550	PUT(1,50),C%:GOTO 3600 PUT(1,50),D%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),H%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),M%:GOTO 3600 PUT(1,50),N%:GOTO 3600 PUT(1,50),0%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),Q%:GOTO 3600 PUT(1,50),Q%:GOTO 3600 PUT(1,50),Q%:GOTO 3600 PUT(1,50),Q%:GOTO 3600 PUT(1,50),Q%:GOTO 3600
HEHKINADKNADIGJ MPC	3420 3430 3450 3450 3470 3480 3590 3590 3520 3530 3550 3550 3550 3550 3550 3580	PUT(1,50),C%:GOTO 3600 PUT(1,50),D%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),H%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),N%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),R%:GOTO 3600 PUT(1,50),R%:GOTO 3600 PUT(1,50),R%:GOTO 3600 PUT(1,50),R%:GOTO 3600 PUT(1,50),R%:GOTO 3600
HEHKINADKINADIBJ MPCF	3420 3440 3450 3450 3470 3470 3500 3510 3520 3530 3550 3550 3550 3550 3550 355	PUT(1,50),C%:GOTO 3600 PUT(1,50),D%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),H%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),N%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),R%:GOTO 3600 PUT(1,50),S%:GOTO 3600 PUT(1,50),S%:GOTO 3600 PUT(1,50),S%:GOTO 3600 PUT(1,50),7%:GOTO 3600 PUT(1,50),7%:GOTO 3600
SEHKINADKNADIGJ MPCFIN	3420 3430 3450 3450 3450 3470 3500 3510 3500 3510 3520 3530 3550 3550 3550 3550 3550 355	PUT(1,50),C%:GOTO 3600 PUT(1,50),D%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),H%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,
BEHKINADKINADIBJ MPCFIN	3420 3430 3450 3450 3450 3470 3500 3510 3520 3520 3520 3520 3550 3550 3550 355	PUT(1,50),C%:GOTO 3600 PUT(1,50),D%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),H%:GOTO 3600 PUT(1,50),1%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),N%:GOTO 3600 PUT(1,50),0%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),R%:GOTO 3600 PUT(1,50),7%:GOTO 3600 PUT(1,
SEHKINADKINADIBJ MPCFIN	3420 3430 3450 3450 3450 3470 3500 3510 3520 3530 3550 3550 3550 3550 3550 355	PUT(1,50),C%:GOTO 3600 PUT(1,50),D%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),H%:GOTO 3600 PUT(1,50),1%:GOTO 3600 PUT(1,50),1%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),M%:GOTO 3600 PUT(1,50),M%:GOTO 3600 PUT(1,50),0%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),2%:GOTO 3600 PUT(1,50),7%:GOTO 3600 PUT(1,
SEHKINADKINADIBJ MPCFIN	3420 3430 3450 3450 3450 3460 3470 3500 3510 3520 3520 3550 3550 3550 3550 3550 3590 3600	PUT(1,50),C%:GOTO 3600 PUT(1,50),D%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),H%:GOTO 3600 PUT(1,50),1%:GOTO 3600 PUT(1,50),1%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),M%:GOTO 3600 PUT(1,50),M%:GOTO 3600 PUT(1,50),0%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),7%:GOTO 3600 PUT(1,
SEHKINADKNADIBJ MPCFIN	3420 3430 3450 3450 3450 3470 3480 3510 3520 3520 3520 3520 3550 3550 3550 3570 3570 3570 3590 3590 3600	PUT(1,50),C%:GOTO 3600 PUT(1,50),D%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),H%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),X%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),M%:GOTO 3600 PUT(1,50),M%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),R%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),7%:GOTO 3600 PUT(1,
SEHKINADKNADIBJ MPCFIN	3420 3430 3450 3450 3450 3470 3510 3510 3520 3520 3520 3550 3550 3550 3550 355	PUT(1,50),C%:GOTO 3600 PUT(1,50),D%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),C%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),R%:GOTO 3600 PUT(1,50),R%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,
SEHKINADKNADBJMPCFIN	3420 3430 3450 3450 3450 3460 3470 3480 3590 3590 3550 3550 3550 3550 3550 355	PUT(1,50),C%:GOTO 3600 PUT(1,50),C%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),C%:GOTO 3600 PUT(1,50),C%:GOTO 3600 PUT(1,50),C%:GOTO 3600 PUT(1,50),C%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,
H H H H H H H H H H H H H H H H H H H	3420 3430 3450 3450 3450 3470 3590 3590 3590 3550 3550 3550 3550 355	PUT(1,50),C%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,
H H H H H H H H H H H H H H H H H H H	3420 3430 3450 3450 3450 3470 3500 3500 3500 3550 3550 3550 3550 35	PUT(1,50),C%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,
H H H H H H H H H H H H H H H H H H H	3420 3430 3450 3450 3450 3500 3510 3550 3550 3550 3550 3550 35	PUT(1,50),C%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,
H ADKNADBUN ADBUN PCCFN	3420 3430 3450 3450 3450 3500 3510 3550 3550 3550 3550 3550 35	PUT(1,50),C%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),J%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),K%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),P%:GOTO 3600 PUT(1,50),F%:GOTO 3600 PUT(1,

BD	3630	G=G+10:A=STR(G):A=RIG			TO 3960, 3970, 3980, 3990, 4 000 4010 4020 4030, 4040.
		OTO 3640, 3650, 3660, 3670,			4050,4060,4070,4080,4090
		3680, 3690, 3700, 3710, 3720			,4100,4110,4120,4130,414
		, 3730, 3740, 3750, 3760, 377			0,4150
		0,3780,3790,3800,3810,38	IE	3960	A\$=A\$+" PUT (PL1, 52), U%, P
-	71 40	20, 3830			SET: PUT (PL, 52), HA: 16010
-un	3640).AZ":GOTO 3840	IF	3970	As=As+" PUT (PL1, 52), U%, P
CP	3650	A\$=A\$+" GET(1,50)-(54,70		5110	SET: PUT (PL, 52), 8%: ": GOTO
	00000), B%": GOTO 384Ø			4160
EC	3660	A\$=A\$+" GET(1,50)-(54,70	OE	3980	A\$=A\$+"-PUT (PL1, 52), UZ, P
),C%":GOTO 384Ø			SET: PUT (PL, 52), C%: ": GOTO
GF	3670	A\$=A\$+" GET(1,50)-(54,70			4160
11	3490	04=04+" GET (1.50) - (54.70	BF	3990	A\$=A\$+" PUT(PL1, 527, 0%, P
	3000).E%":GOTO 384Ø			4160
LL	3690	A\$=A\$+" GET(1,50)-(54,70	BF	4000	A\$=A\$+" PUT (PL1, 52), U%, P
),F%":GOTO 384Ø			SET: PUT (PL, 52) , E%: ": GOTO
LC	3700	A\$=A\$+" GET(1,50)-(54,70			4160
NC	7710	04-04+" CET(1 50)-(54 70	EF	4010	A\$=A\$+" PUT (PL1,52),U%,P
AF	3/10) HZ": GOTO 3840			SET: PUT (PL, 52), FZ: ":GUIU
QI	3720	A\$=A\$+" GET(1,50)-(54,70	UE	1000	4169 At-At+" PUT (PL 1 57) 117 P
), 1%": GOTO 384Ø	nr	4020	SET: PUT (PL . 52) . 6%: ": GOTO
CL	373Ø	A\$=A\$+" GET(1,50)-(54,70			4160
),J%":GOTO 384Ø	KF	4030	A\$=A\$+" PUT (PL1, 52), U%, P
EO	3740	As=As+" GET(1,50)-(54,70			SET: PUT (PL, 52) , H%: ": GOTO
	7750	Ac-Ac+" (CET (1 50) - (54 70			4160
00	3730).LZ":GOTO 384Ø	NF	4040	A\$=A\$+" PUT (PL1, 52), UZ, P
IE	3760	A\$=A\$+" GET(1,50)-(54,70			A146
1.00	distant.),M%":GOTO 384Ø	AF	4050	AS=AS+" PUT (PL1.52), U%, P
KH	377Ø	A\$=A\$+" GET(1,50)-(54,70			SET: PUT (PL, 52) , J%: ": GOTO
),N%":GOTO 384Ø			416Ø
NK	378Ø	A\$=A\$+" GET(1,50)-(54,70	DF	4060	A\$=A\$+" PUT (PL1, 52), U%, P
DW	3700	At=At+" GET (1 50) - (54 70			SET: PUT (PL, 52) , K%: ": GUTU
	3/10).P%"1GOTO 384Ø	CE	4070	4160 At-At- PUT (PI 1 57) 117 P
PE	3800	A\$=A\$+" GET(1,50)-(54,70	OF	40/0	SET: PUT (PL. 52) . L%: ": GOTO
),Q%":GOTO 384Ø			4160
BH	381Ø	A\$=A\$+" GET(1,50)-(54,70	JE	4090	A\$=0\$+" PUT (PL 1, 52) .11% P
),R%":GOTO 3840		1000	SET: PUT (PL, 52) , M%: ": GOTO
EK	3820	AS=AS+" GET (1, 50) - (54, 70			4160
GN	3830	As=As+" GET (1.50) - (54.70	MF	4090	A\$=A\$+" PUT (PL1, 52), U%, P
	0002), T%": GOTO 384Ø			SET: PUT (PL, 52), N%: ": GOTO
PN	384Ø	A\$=A\$+":CLS":PRINT #1,A\$	0.1	41.00	4160
	-	:NEXT	00	4100	SET: PUT (PL . 52) . 0%; ": 60T0
KG	385Ø	IF STA=EN THEN STN=1:EA=			4160
NY	3940	IF STAVEN THEN STN=STA-F	BJ	4110	A\$=A\$+" PUT (PL1, 52), U%, P
in s	5000	NIEA=1 ELSE EA=EN-STAIST			SET: PUT (PL, 52) , P%: ": GOTO
		N=1			416Ø
ED	387Ø	IF EA+QQ=Ø THEN EA=EA-QQ	EJ	4120	A\$=A\$+" PUT (PL1, 52), U%, P
OF	3880	G=G+1Ø:R=G:A\$=RIGHT\$(STR			A140
		\$ (G), LEN (STR\$ (G)) -1) +" F	HJ	4130	As=As+" PUT (PL1, 52), U%, P
		UR 1="+RIGHI\$(SIR\$(SIN), IEN(CTD\$(CTN))-1)+" TO"+			SET: PUT (PL, 52) , R%: ": GOTO
		STRS (EA+QQ) +" STEP"+STRS			4160
		(QQ) : PRINT #1, A\$: G=G+10	KJ	4140	A\$=A\$+" PUT(PL1,52),U%,P
QM	389Ø	A\$=RIGHT\$ (STR\$ (G) , LEN (ST			SET: PUT (PL, 52), 5%: ": GOTO
		R\$(G))-1)+" FOR P=1 TO":	NJ	4150	4100 0\$=0\$+" PUT (PL1 57) 117 P
		A\$=A\$+STR\$ (INT (FAS1\$4.2)	1	4150	SET: PUT (PL. 52) . T%: ": GOTO
		1 THEN DI =570 ELCE TE P			4160
		L+SP>580 THEN PL=1"	DO	4160	A\$=A\$+"GOTO"+STR\$(X+1Ø):
MJ	3900	G=G+10:PRINT #1.A\$			PRINT #1, A\$:NEXT:G=X+10
FG	3910	A\$=RIGHT\$ (STR\$ (G) , LEN (ST	LH	417Ø	A\$=RIGHT\$(STR\$(G),LEN(ST
		R\$(G))-1)+" PL=PL+SP":PR			R\$(G))-1):A\$=A\$+" NEXT:G
-		INT #1, A\$:G=G+1Ø	NA	4100	CLOCE #1.CLC. DDINT"DECOD
CK	3920	A\$=RIGHT\$(STR\$(G), LEN(ST	1	4100	E YOU DO ANYTHING FLSE I
		=G+10:0\$=0\$+STR\$(X):FOR			DAD THE PROGRAM <prg> AN</prg>
		I=STA TO EN+(QQ#-1) STEP			D THEN SAVE IT UNDER THE
		QQ: X=X+10: A\$=A\$+", "+RIG	-		NAME YOU WANT" END
		HT\$ (STR\$ (X), LEN (STR\$ (X))	6D	2500	Ø GOSUB 25020: RESUME 990
		-1):NEXT:PRINT#1,A\$	D1	2501	G PRINT PRINT "
KL	3930	IF STAZEN THEN Q=STA:W=E	113	2302	DIG
		EN:W=STA			K ERROR #"ERR
DL	3940	FOR P=W TO Q	QP	2503	Ø PRINT:PRINT "
00	3050	G=G+10:A\$=RIGHT\$(STR\$(G)			HIT SPACE
1 44	3730				

		SET: PUT (PL, 52), 6%: ": GOTO	1
F	4030	4169 A\$=A\$+" PUT (PL1, 52), U%, P	
w.	4030	SET: PUT (PL, 52) , H%: ": GOTO	
		4160	2
NF	4040	As=As+" PUT (PL1, 52), U%, P	1
		A160	
AF	4050	A\$=A\$+" PUT (PL1, 52), U%, P	1
		SET: PUT (PL, 52), J%: ": GOTO	
		416Ø	4
DF	4060	A\$=A\$+" PUT (PL1, 52), 04, P	
		4160	
GF	4070	A\$=A\$+" PUT (PL1, 52), U%, P	
		SET: PUT (PL, 52), L%: ": GOTO	
		4160	1
JF	4080	A\$=A\$+" PUT (PL1, 52), U%, P	
		4160	
MF	4090	A\$=A\$+" PUT (PL1, 52), U%, P	
		SET: PUT (PL, 52) , N%: ": GOTO	
		4160	
UJ	4100	A\$=A\$+" PUT (PL1, 52), 0%, P	
		4160	1
BJ	4110	A\$=A\$+" PUT (PL1, 52), U%, P	
		SET: PUT (PL, 52), P%: ": GOTO	
F.I	4170	4160 As=As+" PUT (PL 1 52) 117 P	
	4120	SET: PUT (PL. 52) . 0%: ": GOTO	
		4160	
HJ	4130	A\$=A\$+" PUT (PL1, 52), U%, P	1
		A140	
KJ	4140	A\$=A\$+" PUT (PL1, 52), U%, P	
		SET: PUT (PL, 52) , 5%: ": GOTO	
		4160	
NJ	4150	A\$=A\$+" PUI (PL1, 52), UZ, P	
		4160	
00	4160	A\$=A\$+"GOTO"+STR\$(X+1Ø):	
		PRINT #1, A\$:NEXT: G=X+1Ø	3
LM	417Ø	A\$=RIGHT\$(STR\$(G),LEN(ST	
		R\$ (G))-1):A\$=A\$+" NEXT:G	1
NA	4180	CLOSE #1:CLS:PRINT"BEFOR	3
		E YOU DO ANYTHING ELSE L	
		DAD THE PROGRAM <prg> AN</prg>	
		D THEN SAVE IT UNDER THE	
cn	25000	NAME YOU WANT"IEND	
BH	25010	GOSUB 25020: RESUME 870	
PJ	25020	PRINT:PRINT "	
		DIS	
OP	2547	K ERROR #"ERR	
er.	23036	HIT SPACE	
		BAR TO CONTINUE"	

TO 3960,3970,3980,3990,4

CH 25040 A\$=INKEY\$: IF EN 25040 ELSE 1

Program 2: 64 Animator

Version by Kevin Mykytyn, Editorial Programmer

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

49152	:032,238,203,032,142,203,082
49158	:160.127.185.123,206,153,192
49164	.064.003.136.016.247.076.042
40170	. 046 192 000 001 001 015 017
49170	
49176	:001,012,008,000,000,000,045
49182	:000,000,000,000,000,000,000,030
49188	:006,000,000,000,000,000,042
49194	:000,000,000,000,032,077,151
49200	:192.169.000.141.028.192.002
19206	.032 070 193 032 044 193 106
49200	and and 104 and 215 103 and
49212	:032,070,194,032,215,195,020
49218	:032,033,197,162,255,032,009
49224	:205,194,076,060,192,120,151
49230	:169,127,141,013,220,169,149
49236	:105,141,020,003,169,192,202
49242	.141 021 003.169.129.141.182
19218	.026 208 169 027 141 017.172
49240	200 000 006 160 001 141 037
49254	:208,088,090,109,001,141,097
49260	:025,208,173,044,192,208,190
49266	:069,173,018,208,201,010,025
49272	:176,011,162,225,160,059,145
49278	:169.083.141.018,208,208,185
49284	.029 201 085 176 011 162 028
10200	.232 160 099 169 130 141 045
49290	232,100,099,109,150,141,019
49296	:018,208,208,014,102,239,223
49302	:160,139,169,000,141,018,009
493Ø8	:208,240,003,140,018,208,205
49314	:152,160,012,153,001,208,080
49320	:136.136.016.249,160,000,097
49326	+138,153,248,007,200,232,128
19332	192 007 208 246 173 013 251
10330	220 041 001 240 081 164 165
49330	220,041,001,240,001,104,105
49344	:203,204,043,192,240,030,100
49350	:140,043,192,185,129,235,098
49356	:201,088,208,008,1/3,029,143
49362	:208,073,128,141,029,208,229
49368	:201,089,208,008,173,023,150
49374	:208,073,128,141,023,208,235
49380	:201.049.144.022.201.057,134
49386	:176,018,056,174,141,002,033
49392	.224 004 208 010 233 049 200
40200	160 007 152 020 200 126 101
49390	100,007,155,059,200,150,101
49404	:010,250,201,133,208,011,047
49410	:1/3,045,192,240,000,032,178
49416	:019,193,032,238,203,076,001
49422	:049,234,076,188,254,173,220
49428	:136,002,073,012,141,136,008
49434	:002,173,024,208,073,048,042
49440	:141,024,208,173,021,208,039
49446	:073.127.141.021.208.096.192
49452	169 127 141 021 208 169 111
19159	· @64 141 @16 2@9 16@ @@6 133
49450	162 012 105 047 200 157 055
49404	:102,012,103,047,204,137,033
49470	:000,208,202,202,136,016,058
49476	:245,096,169,147,032,210,199
49482	:255,169,015,141,033,208,127
49488	:162,001,160,002,024,032,205
49494	:240,255,032,197,193,162,141
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49512	160 002 024 032 240 255 049
49518	·032 197 193 162 004 160 090
49524	· 002 024 032 240 255 160 070
10520	- ADE 164 204 032 030 171 036
49530	:003,100,204,032,030,171,030
49536	:162,009,160,002,024,032,005
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49548	:032,030,171,162,014,160,197
49554	:002,024,032,240,255,169,100
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49572	:096,162,019,160.001.024.114
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49584	:204.032.030.171 096 162 102
49590	:022,160,001,024,022,240,140
49596	255 169 116 160 205 022 101
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49002	.030,1/1,090,109,00/,141,040
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49014	:032,030,1/1,206,020,192,089
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49620	:208,244,096,162,019,160,077

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49638 :194, 162, 019, 160, 038, 024, 059	
49644 :032,240,255 169 000 174 082	
49650 :024,192,032,061 194 162 139	1 2 3 4 3 6 7
49656 :020,160,018,024,032,240,220	
49662 .255 169 000 174 022 192 042	, , , , , , , , , , , , , , , , , , ,
49668 .032 061 194 032 164 196 171	
49674 162 021 160 019 024 022 171	
49680 .240 255 169 000 174 022 100	
49686 192 202 032 061 104 162 007	
49692 :021,160,038,024,032,240,021	7
49698 :255,169,000 174,032,240,031	STARTING PICTURE 1 HUDBUR BOOULS 18
49704 :224,016,144 002 162 015 001	SHITCHING SPEED 14 MOTE DURATION 8
49710 :142,038,192,032,061,104,102	HOLD HOND ISOUL ALLOS ALL
49716 1173,038 192,032,001,194,193	SCATALOG INSERT CELETE CULT
49722 .012 212 006 022 205 100 026	A CONTRACTOR OF A CONTRACTOR O
49728 169 032 032 210 255 000 000	"64 Animator" uses raster interrupt
49734 .174 029 102 173 000 200 000	techniques to dientau un to 22 envites at
49740 :074 176 014 032 150 104 012	rechniques to utsping up to 22 sprites ut
49746 .202 016 002 162 006 022 246	once.
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49758 176 016 022 150 104 222 125	50178 -016 209 209 069 173 016 179
49764 .224 007 144 002 162 001 100	50184 +208 041 127 141 016 200 227
49770 .032 159 104 077 154 104 128	50104 :200,041,127,141,010,208,237
49776 :032,139,194,076,154,194,147	50196 173 031 102 034 100 035 070
49792 .201 001 240 002 002 008	50202 ,102 141 031 102 172 014 001
49702 1201,001,240,003,222,020,037	50202 :192,141,031,192,1/3,014,001
49788 :192,0/6,154,194,074,176,222	50208 :208,105,000,141,014,208,196
49/94 :013,189,020,192,201,021,254	50214 :208,010,1/3,016,208,009,150
49800 :240,003,254,020,192,076,153	50220 :128,141,010,208,208,024,001
49806 :154,194,074,176,007,138,117	50220 :201,085,208,020,1/3,016,241
49812 :072,032,225,194,104,170,177	50232 :208,041,128,240,013,169,087
49818 :142,028,192,096,096,072,012	50238 :010,141,014,208,173,016,112
49824 :138,072,010,170,189,051,022	50244 :208,041,127,141,016,208,041
49830 :205,133,251,189,052,205,177	50250 :234,173,000,220,074,074,081
49836 :133,252,160,015,177,251,136	50256 :0/4,1/6,016,1/3,025,192,224
49842 :073,128,145,251,136,016,159	50262 :240,054,206,027,192,208,245
49848 :247,104,170,104,096,169,050	50268 :049,206,025,192,076,142,014
49854 :001,141,028,192,169,000,209	50274 :196,074,176,018,173,025,248
49860 :160,004,153,021,192,136,094	50280 :192,201,021,240,033,238,005
49866 :016,250,096,160,100,136,192	50286 :027,192,208,028,238,025,060
49872 :208,253,202,208,248,096,143	50292 :192,076,142,196,074,176,204
49878 :032,205,194,173,000,220,014	50298 :019,169,000,141,045,192,176
49884 :041,016,240,246,096,032,123	50304 :173,136,002,201,004,240,116
49890 :214,194,169,255,141,045,220	50310 :003,032,019,193,032,214,115
49896 :192,141,021,208,169,000,195	50316 :194,096,032,164,196,032,086
49902 :141,029,192,169,180,141,066	50322 :235,196,173,022,192,168,108
49908 :015,208.173.036.192.141.241	50328 :024,105,224,141,255,007,140
49914 :046,208,173,024,192,205,074	50334 :141,255,011,076,040,195,108
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49938 .169 021 056 237 023 192 204	50358 :016,014,169,045,141,069,124
49944 -141 032 192 201 021 208 051	50364 :007,104,073,255,024,105,244
49950 .003 238 037 192 173 025 196	50370 :001,076,204,196,169,032,104
49956 :192,141,034,192,173,032,032	50376 :141,069,007,104,201,010,220
49962 192,240,020,173,037,192,128	50382 :144,016,072,169,049,141,029
49968 :208,113,206,033,192,208,240	50388 :070,007,104,056,233,010,180
49974 :108,169,100,141,033,192,029	50394 :009,048,141,071,007,096,078
49980 206,032,192,208,098,169,197	50400 :009,048,141,070,007,169,156
49986 .021.056 237.023 192 141 224	50406 :032,141,071,007,096,173,238
49992 :032,192,173,021 192,205 119	50412 :022,192,201,020,144,016,063
49998 :024,192,240,041,173,022,002	50418 :072,169,050,141,050,007,219
50004 192,205,024 192,208,008 145	50424 :104,056,233,020,009,048,206
50010 :173,021,192,141,022,192,063	50430 :141,051,007,096,201,010,248
50016 :208,025,173,029,192,240,195	50436 :144,016,072,169,049,141,083
50022 :011,173,022,192,056,233,021	50442 :050,007,104,056,233,010,214
50028 :001.141.022.192.208.009.169	50448 :009,048,141,051,007,096,112
50034 173,022 192 024 105 001 119	50454 :009,048,141,050.007.169.190
50040 +141,022,192,168,185,220,024	50460 :032,141,051,007,096,032,131
50046 :055 240 010 169 128 141 101	50466 :228,255,201.069.208.003.230
50052 .004 212 169 129 141 004 022	50472 :076,184,199,201,067,208,207
50052 :004,212,105,125,141,004,023	50478 :038,032,002,204,176,033,010
50064 +141 008 212 185 024 056 002	50484 :169.064.133.251 169.056.126
50070 .141 007 212 160 032 141 004	50490 :133.252.032 126 203 199 224
50076 011 212 160 032 141 011 221	50496 +252,032 126 203 160 021 000
50002 .212 169 000 141 020 102 120	50502 +169 000 153 220 0EE 152 0E2
50088 .173 034 103 340 005 306 350	50502 :105,000,153,220,055,153,052 50508 .250 055 153 024 056 126 220
50000 :1/3,034,192,240,005,200,250	50514 016 244 006 201 072 200 152
50100 .102 056 222 011 016 000 104	50514 :010,244,090,201,0/3,208,152 50520 :006 160 120 120 120 251 160 120
50100 :152,050,255,011,010,008,184	50520 :050,109,120,133,251,109,010 5
50110 :236,030,192,073,255,024,230	50520 :001,133,252,109,064,133,138 5
50112 :105,001,141,034,192,173,070	50532 1253,109,001,133,254,169,115
50110 :034,192,170,240,007,024,097	50538 :022,056,237,022,192,170,037 5
50124 :109,034,192,202,208,249,174	50544 :240,0/1,160,063,177,253,052 5
50130 :141,035,192,173,030,192,205	50550 :145,251,136,016,249,165,056 5
50136 :240,058,173,031,192,056,198	50556 :251,056,233,064,133,251,088 5
50142 :237,035,192,141,031,192,026	50562 :165,252,233,000,133,252,141 5
50148 :1/3,014,208,233,000,141,229	50568 :165,253,056,233,064,133,016 5
50154 :014,208,201,255,208,090,186	50574 :253,165,254,233,000,133,156 5
50160 :1/3,016,208,041,128,208,246	50580 :254,202,208,218,162,020,188 5
50166 :015,169,085,141,014,208,110	50586 :189,250,055,072,189,024,165 5
1 501/2 :1/3,016,208,009,128,141,159	50592 :056,072,189,220,055,232,216 5

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0178	:010	5,208	208	,068	,173	,016,	179
Ø19Ø	:208	5,041	,208	,076	,010	,196,	020
Ø196 Ø2Ø2	:17:	3,031	,192	,024	,109	,035,	Ø72 ØØ1
Ø2Ø8 Ø214	:208	3,105	,000	,141	,014	,208,	196
0220	:128	3,141	,016	,208	,208	,024,	001
Ø226 Ø232	:201	8,041	, 208	,020	,013	,169,	Ø87
Ø238 Ø244	:010	ð,141 8,041	,014	,208	,173	,016,	112 Ø41
0250	:234	4,173	,000	,220	,074	,074,	081
0256	:240	0,054	,206	,027	,192	,208,	245
0268	:049	9,206	,025	,192	,076	,142,	Ø14 248
0280	:192	2,201	,021	,240	,033	,238,	005
Ø286 Ø292	:02	2,076	,208	,028	,238	,025,	204
0298	:019	9,169	,000	,141	,045	,192,	176
0310	:00	3,032	,019	,193	,032	,214,	115
Ø316 Ø322	:194	4,096	,032	,164	,196	,032,	Ø86 1Ø8
0328	:024	4,105	,224	,141	,255	,007,	140
0340	:169	9,000	,141	,069	,219	,141,	135
Ø346 Ø352	:070	5,192	,141	,071	,219	,173,	Ø39 253
0358	:010	5,014	,169	,045	,141	,069,	124
0370	:001	1,076	,204	,196	,169	,032,	104
Ø376 Ø382	:141	4,016	,007	,104	,201	,010,	22Ø Ø29
0388	:070	3,007	,104	,056	,233	,010,	180
0400	:009	9,048	,141	,070	,007	,169,	156
Ø4Ø6 Ø412	:032	2,141	,071	,007	,096	,173,	238 Ø63
0418	:072	2,169	,050	,141	,050	,007,	219
0430	:141	1,051	,007	,096	,201	,010,	248
Ø436 Ø442	:144	4,016	,072	,169	,049	,141,	Ø83 214
0448	:009	9,048	,141	,051	,007	,096,	112
Ø454 Ø46Ø	:0032	2,141	,051	,0007	,007	,032,	131
Ø466 Ø472	:228	3,255	,201	,069	,208	,003,	230
0478	:038	3,032	.002	,204	,176	,033,	Ø19
Ø49Ø	:133	3,252	,032	,126	,203	,198,	234
Ø496 Ø5Ø2	:252	2,032	,126	,203	,160	,021,	Ø9Ø Ø52
0508	:256	0,055	,153	,024	,056	,136,	238
Ø514 Ø52Ø	:016	5,244	,096	,201	,073	,208,	152 Ø1Ø
Ø526 Ø532	:061	1,133	252	,169	,064	,133,	138
0538	:022	2,056	,237	,022	,192	,170,	037
Ø55Ø	:240	5,251	160	,063	,177	,253,	Ø52 Ø56
Ø556	:251	,056	233	,064	,133	,251,	088
0568	:165	,253	056	,233	,064	,133,	Ø16
Ø58Ø	:253	, 202	208	,233	,000	,020,	156 188
Ø586	:189	.250	Ø55	,072	,189	.024.	165

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50598	:157.220.055.104.157.024.115
50604	:056.104.157.250.055.202.228
50610	:202.236.022.192.176.226.208
50616	:096.201.068.208.100.173.006
50622	·022.192.032.165.199.165.197
50628	-251, 024, 105, 064, 133, 253, 002
50634	165 252 105 000 133 254 087
50640	169 022 056 237 022 192 138
50040	179 249 072 169 062 177 072
50640	11/0,240,0/2,100,003,1/7,0/2
50652	1253,145,251,136,016,249,246
50658	:165,251,024,105,064,133,200
50664	:251,165,252,105,000,133,114
50670	:252,165,253,024,105,064,077
50676	:133,253,165,254,105,000,130
50682	:133,254,202,016,218,174,223
50688	:022,192,232,189,250,055,172
50694	:072,189,024,056,072,189,096
50700	:220,055,202,157,220,055.153
50706	:104,157,024,056,104,157,108
50712	:250,055,232,232,224,021,014
50718	:144,227,096,201,083,208,221
50724	:044,032,146,199,032,063,040
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50736	:055,133,254,173,024,192,111
50742	:032,165,199,165,251,024,122
50748	:105,064,170,165,252,105,153
50754	:000,168,169,253,032,216,136
50760	:255,032,233,198,104,104,230
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50784	:032,233,198,104,104,076,075
50790	:046,192,201,036,208,099,116
50796	:032,146,199,169,001,162,049
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50808	:169.008.162.059.160.206.116
50814	:032.189.255.032.192.255.057
50820	:032.233.198.162.001.032.022
50826	:198.255.032.207.255.032.093
50832	207.255.169.013.032.210.006
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50844	:255.032.233.198.176.032.058
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5Ø862	:032,210,255,032,207,255,141
5Ø868	:240,220,032,210,255,165,022
5Ø874	:203,201,064,208,250,076,164
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50892	:076,046,192,201,081,208,240
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50922	:038,192,024,165,144,240,013
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50946	:218,198,104,104,076,202,136
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50958	:032,186,255,169,000,032,176
50904	1189,255,032,192,255,162,081
50970	1013,032,198,255,169,013,196
50970	1032,210,255,032,207,255,255
50902	10/2,032,210,255,104,201,144
509004	:013,208,244,109,015,032,213
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51000	1218,198,056,173,038,192,163
51006	:096,169,210,160,205,032,166
51012	:030,171,032,249,171,173,126
51018	:000,002,208,005,104,104,241
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51060	160 205 022 020 020 121 020 218
51066	228 255 261 664 260 664 750
51072	162 001 200 004,208,004,078
51070	208 241 162 000,201,068,006
1094	166 661 632 106 255 606 156
1004	· 632 691 255 632 120 255 102
1006	169 024 141 034 200 100
51102	251 160 205 022 020 171
1100	196 024 105 224 122 251 229
51114	169,000,133,252,162,006,124
1120	:006,251,038,252,202,200,124
51126	1249,096,169,001 141 044 114
1132	192,169,055 141 011 200 100
1138	141,013,208,169,025,141,122

51144	:012,208,169,255,141,010,227	51690	:162,003,032,061,203,202,129	52236	:032,228,255,201,089,024,073
5115Ø	:208,169,224,141,021,208,153	51696	:208,250,076,092,200,201,243	52242	:240,005,201,078,208,244,226
51156	:169,195,141,016,208,169,086	51702	:017,208,011,162,003,032,167	52248	:056,008,032,038,204,169,019
51162	:020,141,014,208,169,085,087	517Ø8	:091,203,202,208,250,076,002	52254	:083,160,206,032,030,171,200
51168	:141,015,208,169,084,133,206	51714	:092.200.201.029.208.027.247	52260	:040.096,162,015,160.014.011
51174	:247.169.004.133.248.169.176	51720	:160.002.177.139.106.136.216	52266	:024.032.240.255.096.048.225
51180	:020.141.000.208.141.002.236	51726	+136,162 003 177 139 106 225	52272	:088.128.168.208.248.033.153
51100	200 160 165 141 001 208 110	51732	145,139,200 202 208 247 137	52278	144.182.163.163.163.181.026
51180	160 100 141 002 200 160 104	51738	200,200,192 066 144 234 039	52284	1017.157.157.157.157.157.157.094
51192	:169,190,141,003,208,109,104	51744	.200,200,192,000,144,234,038	52204	192 032 032 032 191 017 030
51198	:013,141,248,007,169,014,078	51754	10/0,092,200,201,157,208,198	52290	167 167 167 167 167 107 102 016
51204	:141,249,007,032,170,202,037	51750	1029,100,000,177,139,042,073	52290	137,137,137,137,137,137,162,013
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51216	:240,020,173,021,208,009,175	51/62	:042,145,139,136,202,208,154	52308	:000,144,032,032,049,032,117
51222	:001,141,021,208,169,128,178	51768	:247,200,200,200,200,192,015	52314	:032,032,032,050,032,032,044
51228	:141,004,212,169,129,141,056	51774	:064,144,232,076,092,200,102	52320	:032,032,051,032,032,032,051
51234	:004,212,208,008,173,021,148	51780	:201,068,208,014,172,022,241	52326	:032,052,032,032,032,032,058
51240	:208,041,254,141,021,208,145	51786	:192,185,220,055,073,001,032	52332	:053,032,032,032,032,054,087
51246	:172,022,192,185,250,055,154	51792	:153,220,055,076,010,200,026	52338	:032,032,032,032,055,000,041
51252	:240,030,141,008,212,185,100	51798	:173,141,002,201,004,240,079	52344	:032,032,056,032,032,032,080
51258	:024.056.141.007.212.169.155	518Ø4	:062,164,203,185,129,235,046	5235Ø	:032,057,032,032,032,032,087
51264	.032 141 011 212 169 033 150	51810	:205,060,003,240,052,141,031	52356	:049,048,032,032,032,049,118
51270	141 011 212 173 021 208 068	51816	:060.003.201.049.144.045.094	52362	:049,032,032,032,049,050,126
51270	ago ago 141 gol 200 g76 gol	51822	1201.058.176.041.174.022.014	52368	:032,032,032,049,051,032,116
51270	1009,002,141,021,200,010,021	51828	192,056,233,049 168 185 231	52374	:032,032,049,052,000,032,091
51282	1092,200,173,021,200,041,049	51834	1050 206 157 250 055 105 001	52380	:049.053.032.032.032.032.130
51288	:253,141,021,208,032,194,109	51840	·041 206 157 024 056 172 017	52386	:049.054.032.032.032.049.154
51294	:202,032,118,203,169,084,134	51946	141 002 240 014 100 024 222	52392	1055 032 032 032 049 056 168
51300	:133,253,133,141,169,216,121	51050	AFC 010 157 004,185,024,232	52398	· 032 032 032 049 057 032 152
51306	:133,254,133,142,1/3,022,195	51652	1050,010,157,024,056,189,120	52404	.032 032 050 049 032 032 150
51312	:192,024,105,224,141,255,029	51858	:250,055,042,157,250,055,187	52404	- a22 a5a a40 aaa 144 a19 223
51318	:007,056,233,001,141,253,041	51864	:070,010,200,201,092,208,171	52410	- 002,000,045,000,144,010,225
51324	:007,024,105,002,141,254,145	51870	:003,076,010,200,032,225,192	52416	:083,084,065,082,084,073,151
51330	:007,173,022,192,032,165,209	51876	:202,160,000,076,216,200,250	52422	:0/8,0/1,032,080,0/3,06/,08/
51336	:199,165,251,133,139,165,164	51882	:169,065,160,205,032,030,063	52428	:084,085,082,069,146,144,046
51342	:252,133,140,169,000,141,209	51888	:171,169,021,141,020,192,122	52434	:032,032,032,032,069,078,229
51348	:038,192,169,003,141,039,218	51894	:169,068,160,205,032,030,078	52440	:068.073.078.071.032.080.106
51354	:192,172,038,192,177,251,152	51900	:171,206,020,192,208,244,205	52446	:073.067.084.085.082.069.170
51360	:140.038.192.160.000.162.084	51906	:162.012.160.033.024.032.105	52452	·032.032.013.029.080.073.231
51366	·008.010.144.006.072.169.063	51912	240,255 169 000 174 022 036	52452	.067 084 085 082 069 032 141
51372	·001 145 253 104 230 253 134	51918	192 032 205 199 169 022 030	52450	A70 005 077 066 069 082 185
51270	208 002 230 254 202 208 002	51924	·032 210 255 006 160 000 107	52404	
51204	230 230 038 102 173 038 077	51030	177 139 441 137 145 130 310	52470	ATO AP6 A69 A92 A65 A76 197
51304	100 201 064 240 021 206 090	51930	11/1,139,041,127,145,139,218	52470	arc arr arr arr arr arr arr arr arr arr
51390	192,201,004,240,021,200,050	51930	140,100,141,133,103,105,003	52482	· · · · · · · · · · · · · · · · · · ·
51 396	1039,192,208,211,105,255,240	51942	:142,133,164,169,000,141,211	52488	:068,032,032,032,013,029,214
51402	:024,105,016,133,253,165,130	51948	:038,192,169,003,141,039,050	52494	:083,087,073,084,067,072,224
51408	:254,105,000,133,254,076,006	51954	:192,160,007,169,000,141,143	52500	:073,078,071,032,083,080,181
51414	:150,200,165,247,133,249,078	51960	:042,192,024,177,163,041,119	52506	:069,069,068,032,032,032,072
51420	:165,248,133,250,160,000,152	51966	:015,240,001,056,110,042,206	52512	:032,032,078,079,084,069,150
51426	:177,247,073,128,145,247,219	51972	:192,136,016,242,172,038,032	52518	:032,068,085,082,065,084,198
51432	:162,128,032,205,194,073,002	51978	:192,173,042,192,145,139,125	52524	:073,079,078,032,032,032,114
51438	:128,145,247,173,000,220,127	51984	:165,163,024,105,008,133,102	5253Ø	:000,249,006,249,006,033,081
51444	:074,176,015,072,165,247,225	51990	:163,165,164,105,000,133,240	52536	:007,073,007,013,007,053,216
51450	:056,233,040,133,247,165,100	51996	:164,238,038,192,173,038,103	52542	:007,093,007,147,017,000,077
51456	:248,233,000,133,248,104,198	52002	:192,201,064,208,001,096,028	52548	:013,146,144,029,029,029,202
51462	:074,176,015,072,165,247,243	52008	:206,039,192,208,198,165,024	52554	:029,033,033,033,033,033,033,012
51468	:024,105,040,133,247,165,214	52014	:163.024.105.016.133.163.138	52560	:033.033.033.033.033.033.033.022
51474	:248,105,000,133,248,104,088	52020	:165,164,105,000,133,164,015	52566	:033,033,033,033,033,033,033,028
51480	:074,176,015,072,165,247,005	52026	:076.238.202.160.000.177.143	52572	:033.033.033.033.033.033.033.034
51486	:056,233,001,133,247,165,097	52032	+139,141,038,192,136,200,142	52578	:033.000.000.126.126.126.253
51492	1248.233.000.133.248.104.234	52038	-200 192 064 208 008 173 147	52584	126.126.126.000.255.129.098
51498	:074.176.015.072.165.247.023	52044	1038,192,136,136,145,139,094	52590	:129.129.129.129.129.255.242
51504	:024.105.001.133.247.165.211	52050	· Ø96 . 177 . 139 . 136 . 145 . 139 . 146	52596	:017.028.018.069.146.068.206
51510	:248.105.000.133.248.104.124	52056	·076 069 203 160 062 177 067	52602	:073.084.032.032.032.032.151
51516	:074.176.038.165.249.024.018	52062	139 141 038 192 200 136 172	52608	:032.032.018.076.146.079.255
51522	:105,000,133,078,165,250,029	52060	136 016 007 173 039 192 150	52614	:065,068,032,032,032,032,139
51528	:105,212,133,079,173.041.047	52074	200.145.139.096.177.139.234	52620	:032,032,018,083,146,065,004
51534	192.208.012.169.001.141.033	52000	200 145 130 076 000 202 206	52626	:086.069.032.032.032.032.173
	(41 100 177 070 073 001 104	52000	160 000 133 251 160 216 032	52632	:032.032.018.067.146.076.011
51540	:041,192,177,078,073,001,134	52080	122 252 162 004 160 000 052	52638	· 069 065 082 032 065 076 035
51546	1141,040,192,1/3,040,192,100	52092	153,252,102,004,100,000,067	52644	:076.032.018.036.146.067.027
51552	:145,078,076,106,201,169,103	52098	1152,145,251,136,208,251,249	52650	· 065 084 065 076 079 071 098
51558	:000,141,041,192,177,247,132	52104	1230,252,202,208,243,096,087	52656	·032 032 019 073 146 070 043
51564	:201,032,208,008,165,249,203	52110	:120,165,001,041,251,133,085	52050	- A02 A60 A02 A04 A22 A22 A52
51570	:133,247,165,250,133,248,010	52116	:001,169,000,133,251,169,103	52669	-032 032 018 068 146 069 041
51576	:032,228,255,201,082,208,102	52122	:032,133,252,169,000,133,105	52674	A76 660 601 660 632 632 644
51582	:013,169,000,141,044,192,173	52128	1253,109,208,133,254,162,059	52600	·032 032 019 001 146 005 002
51588	:169,129,141,026,208,076,113	52134	:008,160,000,177,253,145,141	52080	1032,032,010,001,140,000,082
51594	:049,192,201,147,208,003,170	52140	:251,136,208,249,230,252,218	52080	10/3,004,144,000,01/,01/,029
51600	:032,170,202,201,043,208,232	52146	:230,254,202,208,240,165,197	52692	1023,003,078,084,009,082,111
51606	:013,173,022,192,201,021,004	52152	:001,009,004,133,001,088,164	52698	1032,070,073,076,069,078,104
51612	:240,006,238,022,192,076,162	52158	:160,007,185,100,205,153,232	52704	1005,077,069,013,000,017,209
51618	:010,200,201,045,208,013,071	52164	:008,033,185,108,205,153,120	52710	:017,032,018,084,146,065,080
51624	:173,022,192,201,001,240,229	52170	:008,037,136,016,241,169,041	52716	:080,069,032,079,082,032,098
51630	1006.206.022.192.076.010.174	52176	:024,141,024,208,160,023,020	52722	:018,068,146,073,083,075,193
51636	:200.201.073.208.014.160.012	52182	:169,000,153,000,212,136,116	52728	:013,013,000,147,005,017,187
51642	1063.177.139.073.255.145.014	52188	:016,250,169,015,141,024,067	52734	:017,000,013,017,032,072,149
51640	139 136 016 247 076 092 130	52194	:212,169,050,141,001,212,243	5274Ø	:073,084,032,082,069,084,172
51654	200,201,136,208,010,160,090	52200	:169,019,141,005,212,096,106	52746	:085,082,078,032,084,079,194
51664	·063 177 139 153 122 206 040	52206	:169,032,160,000,153,000,240	52752	:032,067,079,078,084,073,173
51666	136 016 249 201 140 209 135	52212	:008,153,000,009,153,000,055	52758	:078,085,069,000,068,082,148
51670	133 160 063 195 122 206 197	52218	:010,153,000,011,136,208,000	52764	:085,077,000,078,079,084,175
51670	145 139 136 016 249 076 214	52224	:241,096,032,038,204,169,012	5277Ø	:069,000,032,032,032,032,231
- IN /8	1143,133,130,010,240,010,214	50000	ACT 160 206 032 030 171 160	52776	:000.097.104.143.048.143.063
51684	1092.200.201.145.208.011.061	52230	:007,100,200,032,030,171,100		1000100112011210101012101000

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$\begin{array}{llllllllllllllllllllllllllllllllllll$
Program 3: Atari Animator,
Part 1
Version by Kevin Mykytyn, Editorial Programmer
Please refer to "COMPUTEI's Guide to Typing
18 Ø GRAPHICS Ø:POKE 752.1:P
RINT "(CLEAR)(5 DOWN) (12 SPACES)PLEASE WAIT":
PRINT "(DOWN)
LL BLANK "
661READ B:POKE A, B:CH=C
H+BINEXT ALIF CH<>43015 Then Print "Error in D
ATA" : END
E0 4 DATA 169,3,141,242,6,16
9,8,141,243,8 0 5 DATA 165,88,133,205,165
,89,133,206,169,0 DP 6 DATA 141,241,6,169,0,14
1,240,6,160,7
240,1,24,110,240
HN B DATA 6,136,16,242,173,2 40,6,174,241,6
IF 9 DATA 157, 8, 96, 32, 190, 11
WF 10 DATA 105, 8, 141, 241, 6, 2
HI 11 DATA 242,6,208,39,169,
3,141,242,6,32 DH 12 DATA 198.113,32.198.11
3,173,241,6,56,233
243,6,208,14,169
41,6,24,105,16
P 15 DATA 141,241,6,24,144, 163,104.96.165.205
A 16 DATA 24, 105, 8, 133, 205,
HK 17 DATA 206,96,165,20,197
. 28. 248. 252. 184. 169

	i Avimetor'' lets you create car-
toons	in 128 different colors.
KA 19	DATA 154,141,71,114,10 4,104,10,170,189,139
PI 20	DATA 114,133,203,232,1 B9,139,114,133,204,104
KA 21	DATA 141,242,6,48,20,1 04,24,109,244,6
NL 22	DATA 141,244,6,173,246 ,6,109,242,6,141
HD 23	DATA 246,6,24,144,31,7 3,255,24,105,1
NH 24	DATA 141,242,6,104,141 ,245,6,173,244,6
LI 25	DATA 56,237,245,6,141, 244,6,173,246,6
HK 26	DATA 237,242,6,141,246 ,6,162,3,160,7
HN 27	DATA 177,203,153,170,9 4,136,16,248,160,15
FJ 28	DATA 177,203,153,42,95 136,192,8,176,246
HN 29	DATA 160,23,177,203,15 3,170,95,136,192,16
10 20	DATA 176,246,165,203,2 4,105,24,133,203,145
CN 31	DATA 204,105,0,133,204
NP 32	DATA 8,141,49,114,173,
NL 33	DATA 59,114,173,71,114
DI 34	DATA 114,202,208,180,1
60 35	DATA 24,105,8,141,2,20
P8 36	8,24,105,8,141 DATA 3,208,96,8,72,8,7
IF 37	2,80,72,152 DATA 72,224,72,40,73,1
KK 38	12,73,184,73,8 DATA 80,80,80,152,80,2
KB 39	24,80,40,81,112 DATA 81,184,81,8,88,80
NO 4 0	,88,152,88,224 DATA 88,40,89,112,89,1
	84,89
Prog	gram 4: Atari Animator, 2
PJ 10	POKE 559,0,008UB 1000,
	APHICS Ø:POKE 752,1:60
KJ 20	SUB 280:A=USR(1535) GOSUB 680:GOSUB 460:GO
JK 3Ø	TO 20 R=0:TRAP 120:GOSUB 165
CH 4Ø	Ø:OPEN #1,6,Ø,"D:*.*" INPUT #1,BOX\$:PRINT BO
P6 5Ø	X\$:GOTO 40 TRAP 120:X=NUMBER(1):G
	OSUB 160: FA=SA: X=NUMBE R(4)+1: GOSUB 160
DP 60	FAH=INT (FA/256) + FAL=FA
	6) : SAL=SA-SAH#256

KJ JK CM PG

DATA 170,141,49,114,16 EC 70 GOSUB 170:IF FN\$="" TH 9,34,141,59,114,169 EN 110

F 75	F DEVS="C:" THEN PRIN
	AND PLAY ON TAPE"
	PEN #1,8,0,FN\$:PUT #1
	SALIPUT #1.SAH
1 9Ø F	OR A=FA TO SA
P 100	PUT #1, PEEK (A) INEXT A
* 1 1 4	CLOSE #1
120	TRAP 327671 IF PEEK (19
0.22	5) <>136 THEN PRINT "
	(3 DOWN) SYSTEM ERROR
130	PRINT "(DOWN)HIT ANY
	KEY TO CONTINUE" POKE
	764,255
1140	IF PEEK(764)=255 THEN
C 150	BOSUB 1670: CLOSE #1:R
	ETURN
160	Y=X-1: BA=(X-(INT(Y/7)
	\$7))\$72+(INT(Y/7))\$20
6 170	DN\$=""IFN\$=""IGOSUB 1
	650 PRINT "(4 DOWN)EN
	TER FILENAME"
E 18Ø	INPUT DN\$1 IF DN\$="" T
K 190	PRINT "(3 DOWN)TAPE O
	R DISK": POKE 764,255
8 200	IF PEEK (764) =45 THEN
	DEVS="C1":GOTO 230
90 X 1 80	DEV\$="D:":GOTO 230
P 220	GOTO 200
8230	FN\$ (3, LEN (DN\$) +3) = DN\$
8 744	RETURN
6 250	TRAP 1201BOSUB 1701 IF
	FN\$="" THEN 110
0 255	IF DEVS="C:" THEN PRI
	NI "(DOWN)PRESS PLAY
P 260	OPEN #1.4.0.FN#: BET #
	1, FALIGET #1, FAHIGET
	#1, SAL: GET #1, SAH: FA=
	FAL+256#FAHIBA=BAL+25
F 27Ø	FOR A=FA TO SA+641GET
	#1, B: POKE A, B: NEXT A
	1608UB 16701CLOSE #11
1 204	RETURN BOXSE" (3 N3 (DOWN)
200	(4 LEFT) (B)
	(3 SPACES) (V) (DOWN)
	(5 LEFT) (B)
	(5 LEET)(B)
	(3 SPACES) (V) (DOWN)
	(4 LEFT) (3 M) (4 UP)
	(RIGHT)"
0 300	FOR A=0 TO 12 STEP 4.
	POSITION 2.A
P 310	FOR B=1 TO 7: PRINT BO
	XSIINEXT B
330	POSITION 4.5. PRINT "1
	(4 SPACES)2
	(4 SPACES)3
	(4 SPACES)4
	(4 SPACES)6
	(4 SPACES)7"
J 34Ø	POSITION 4,11:PRINT "
	B(4 SPACES)9
	(4 SPACES)10
	(3 SPACES)12
	(3 SPACES)13
	(3 SPACES)14"
and the second second second second	POSITION 4.17 PRINT "
N 350	IELT ODADEDLAS

	(3 SPACES)17 (3 SPACES)18
	(3 SPACES)19
	(3 SPACES)20 (3 SPACES)21"
CN 360	E=-9:FOR B=0 TO 30 ST
KE 370	EP 5:E=E+9 FOR A=1 TO 13 STEP 6:
	CHAR=33
00 288	3+B, A+D
FI 39Ø	FOR C=Ø TO 2:PRINT CH R\$(CHAR+C+F):
0E 4 Ø Ø	NEXT CIPRINT " (DOWN)
	3 LEF 1) " I CHAR=CHAR+
IN 410	NEXT DINEXT AINEXT B
	START PICTURE
	(7 SPACES)END PICTURE
EB 43Ø	POSITION 1, 20: PRINT "
	(6 SPACES) OVERALL SPE
-	ED"
10	SWITCHING SPEED "
HJ 450	RETURN JOY=STICK(Ø)
BK 47Ø	ON JOY-4 GOTO 560,560
	,480,520,560,560,560,500, 560,520,540,560
EJ 48Ø	IF NUMBER (ARRPOS) =21
C6 4 9 Ø	NUMBER (ARRPOS) =NUMBER
EE 500	(ARRPOS)+1;GOTO 560 IF NUMBER(ARRPOS)=1 T
	HEN NUMBER (ARRPOS) =22
18 51 19	(ARRPOS)-1:GOTO 560
DI 52Ø	GOSUB 660: IF ARRPOS=5
ON 530	ARRPOS=ARRPOS+1: GOTO
DH 540	GOSUB 660: IF ARRPOS=1
	THEN ARRPOS=6
DF 560	POSITION COORD (ARRPOS
KL 570	,1),COORD(ARRPOS,2) PRINT ">"
BH 58Ø	IF STRIG(0)=0 THEN GO
KN 59Ø	KEY=PEEK(764):POKE 76
00 4 33	4,255
	1100
MI 6110	SØ
ND 620	IF KEY=Ø THEN GOSUB 2
HN 630	IF KEY=58 THEN GOSUB
PD 640	30 IF KEY=18 THEN FOR A=
and the second	Ø TO 511: POKE A+CHAR1
	E A+CHAR3, Ø:NEXT A
HL 650	RETURN POSITION COORD (ARRPOS
	,1),COORD(ARRPOS,2)
11 67Ø	FOR A=1 TO 4
MH 690	POSITION COORD (A, 1) +1
P0 7 9 9	PRINT NUMBER (A) ; "
ON 710	NEXT A: POSITION 36,20 PRINT NUMBER(A)-10:"
	"
0B 73Ø	RESTORE 760:A=1535
L0 74Ø	READ B: IF B=256 THEN A=USR (1535): RETURN
NN 75Ø	POKE A, B: A=A+1: GOTO 7
	40

01	7	6	ø	D	A	T	A		1	Ø	4	,	1	7	3	,	4	8	,	2		1	4	1	1
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н	1	8	9	,	2	0	3		1	6	8	9	2	8	,	1	6	9	,	2	,	1	4	2	
D	7	9	ø	9	A	1	A 6	2	1	3	6	,	1	9	2	,	5	,	2	ø	8	,	2	4	
BM	8	ø	ø	D	A	T	A		5	,	1	8	9	,	1	ø	2	,	6	,	1	6	8	,	
L	8	1	ø	D	A	T	A	-	2	ø	3	,	9	,	1	2	B	,	1	4	5	,	2	ø	
BA	8	2	ø	D	A	T	A	4	1	6	,	2	4	3	,	1	6	9	,	6	4	,	1	4	
JC	8	3	ø	1	Å	Ø	A		2	,	1	6	9	,	6	,	1	4	1	,	1	,	2		
10	8	4	ø	D 6	A	T 1	AZ	3	1	6	9	•	2	5	5	,	1	4	1	•	1	ø	8	,	
PI	8	5	ø	D	A	Ť	A		1	1	,	2	1	2	,	2	ø	8	,	2	5	1	,	1	
11	8	6	ø	D	A	Ť	A	7	1	4	1	,	1	4	,	2	1	2	,	9	6	,	7	2	
10	8	7	ø	'n	1 A	3 T	BA		7	2	,	2	3	8	,	1	ø	8	,	6	,	1	7	3	
AE	8	8		'n	1	Ø	BA		6		2		1		6		2	ø	8		5		1	4	
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	8	7	0	1	8	19	H		0	,	1	4	1	,	1	Ø	8		0	,	1	'	10	,	
F6	9	ø	ø	1	4	1	A		9	6	,	6	,	1	4	1	9	1	ø	,	2	1	2	,	
IK	9	1	ø	D	A	T	A		9	,	2	1	2	,	1	ø	4	,	1	7	ø	,	1	ø	
JK	9	2	ø	4	Å	6 T	4 A		7	2	,	2	2	4	,	8	ø	,	2	2	4	,	8	8	
FH	9	3	ø	'n	2	2	4		3		8		1	1		1	4		1	7		2	ø		
				2	5	6				,				7					-	u	^			_	
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EC	9	5	ø	F	0	R	2	A	5	20	R	1 I	G	H	AN	A	L	-	T	4	2	0	R	I	
GH	9	6	ø	G	1	NA	A	L	+ R	1 I	Ø	2	4 N	A	L	1	v	-	P	E	E	ĸ	(A	
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no	7	'		H	A	R	2	+	D	,	v	1	P	0	K	'E	•	ċ	н	A	R	3	+	D	
				Ť		A	P	0	ĸ	E		C	н	A	R	Ø	+	D	,	v	2	N	E	X	
DO	9	8	ø	R 6	E 4	S	T	0	R	E 2	4	96	98	Ø 7	2	FR	OE	RA	D	A	B	2	4 P	6	
FA	0	0	a	K	E	т	A	,	BA	1	N	EA	X	Т	4	A	1	R 2	E	T	U	R 2	N	5	
		1	~		4	8	,	4	8	,	4	8	-	ø		1	2	6	,	1	20	6	,	1	
				1	2	9	1	1	2	3	1,	1	2	9	8	1	2	\$,	1	2	9	,	1	
11	1	ø	ø	2	9 D	, I	2	5	5 B	0	x	\$	(5	ø	,		D	I	M		N	U	м	
					B	E	R	(5)	1	D	I	M	4	B)	\$	(5)	8	DF	IN	M	
					(1	5)	1	D	i	M		D	E	v	\$	(2)	1	D	I	M	
					,	2)	3	(1	'	,	1	D	1	m		C	U	U	ĸ	D	"	2	
FP	1	ø	16	8	PØ	0	K	E	F	70	5 R	2	Å	1	: 1	R	E	S	Т	05	R	EN	u	1 M	
					87	E	R	(A)	-	1	8	F	D	R		B	-	1		т	0		
NI	1	ø	26	8	R	E	A	D		C		C		0	R	D	1	A	,	B)	-	C	1	
LJ	1	ø	36	8	D	A	T	A		ø	;	1	9	,	ø	,	2	ø	,	ø	,	2	1	,	
KE	1	ø	46	8	A	R	R	1 P	9	;s	2	Ø 1	-	2 R	ØE	s	т	o	R	E		1	ø	6	
					Ø	B	F	0	R		A	-	1		Т	0		6	4	1	R	E	A	D	
CH	1	ø	56	8	B	I	N	A	R	Y	-	(A	, T	A	>	-	C	н	R	\$	(B	*	
BB	1	ø	66	8	D	A	T	A	1	1	,	1	,	1	,	1	,	1		1	9	1	,	ø	
						1		1	,	1		1		1		1	,	1		0	9	1		1	
						1	,	0		Ø		0	,	ØØ		1		1	,	1		ø		1	
HK	1	ø	76	8	D	A	T	A		000	,	ø	,	1	,	1	,	ø	,	ø		1	,	ø	
PJ	1	ø	8	8	'n		ï	2	P	E	ż	K	•	5	6	00	;	+	2	9 5	6		P	E	
					E +	K	()	5	6	1 D)	-	P	DE	E	= K	P (ED	E	KI	(+	D 5	L)	I	
						100	-	-	-	-	- *		-	-	-			-	-	-	1	-	1		

ĸ	11	ø	70	RETURN
L	1	1 1	00	GOSUB 1110:GOTO 1200
D	1	1	1Ø	NU=NUMBER(2)-1:POKE
				756,96
(H	1	1:	29	SA= (NUMBER (2) - (INT (N
				U/7) \$7)) \$72+(INT(NU/
				7))\$2048+18368
88	1	1	30	GOSUB 1650
J	1	1 .	4Ø	R=0:5=0:NR=8:FOR A=8
			-	A TO SA+71:P=PEEK(A)
LE	1	1	5Ø	HB=INT(P/16)+1:LB=P-
			-	16\$(HB-1)+1
DB	1	1	60	POSITION 8#8, R: PRINT
				BINARY\$ (HB\$4-3, HB\$4
) BINARYS(LB#4-3, LB#
				4)
EN	1	1	10	RER+1: IF RENK THEN R
				-NK-818=8+111F 5=3 1
				HEN RERTBINKENRTBISE
			-	NEXT A
	1	-		DETUDN
NL.	÷	-	70	PORTION 71 1/ PRINT
	*	~	00	NUMPER (2)
AN.		2	10	FOR A=4 TO 2. FOR R-4
W	*	4	× 10	TO 2
J	1	2	20	POSITION TALE 11+0-P
	-	-	- 10	RINT CHR&(TT+B+AtT)
AR	1	2	30	NEXT BINEYT A
CF	1	2	40	A=USR (29000) . TE EL =0
	-	-		THEN LOCATE DY . DY . 7
IJ	1	2	50	OX=DX: OY=DY: POSITION
	-	-		DX. DY PRINT "+"
FI	1	2	60	JOY=STICK(Ø)-4
06	1	2	70	ON JOY GOTO 1280.129
				0.1300.1360.1310.132
				0,1330,1360,1340,135
				0,1360
06	1	2	8Ø	DX=DX+1:DY=DY+1:GOTO
				1360
DJ	1	2	90	DX=DX+1:DY=DY-1:GOTO
				1360
NC	1	3	ØØ	DX=DX+1:GOTO 136Ø
OC	1	3	10	DX=DX-1:DY=DY+1:GOTO
				1360
OF	1	3	2Ø	DX=DX-1:DY=DY-1:GOTO
				1360
NH	1	3	3Ø	DX=DX-1:GOTO 136Ø
NI	1	3	4ø	DY=DY+1:GOTO 1360
NL	1	3	5Ø	DY=DY-1:GOTO 136Ø
NA	1	3	60	IF DX>23 THEN DX=Ø
ND	1	3	7Ø	IF DY>23 THEN DY=Ø
NA	1	3	8Ø	IF DX<Ø THEN DX=23
ND	1	3	90	IF DY<Ø THEN DY=23
NL	1	4	øø	IF STRIG(Ø)=Ø AND FL
				=Ø THEN FL=1:Z=(Z=44
) #1+44
DH	1	4	1Ø	IF STRIG(Ø) <>Ø THEN
F	1	4	20	PUSITION OX, OY: PRINT
			-	
NH	1	4	50	KEY=PEEK(/64) PUKE 7
				64,200
٥L	1	4	40	TE RETEIN THEN FUR A
				-D IU ZSIFUK BED IU
				T CUDA (AS) - NEVT D.N
				EXT A
NI.	1	4	50	TE KEVMAD THEN ISIA
11	1	A	60	TE KEVEL AND NUMBER
	-	-	20	2) (21 THEN GOOLD 152
				Ø NUMBER (2) = NUMBER (2)
)+1:60T0 1100
IN	1	4	70	IF KEY=14 AND NUMBER
- 11	-	*		(2) >1 THEN BOSUB 152
				ØINUMBER(2)=NUMBER(2
)-1:GOTO 1100
IN	1	4	80	IF KEY=61 THEN SHP=N
1	-	-	-	UMBER (2)
BC	1	4	90	IF KEY=10 THEN TEMP=
-	-	-		NUMBER (2) : TEMP2=SA: N
				UMBER (2) = SHP : GOSUB 1
				110 NUMPER (2) -TEMP-C

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			A=1	E	M	P	2	1	G	O	Т	O		1	2	Ø	Ø	Į.		
MG	150	ø	GOT	0		1	2	4	Ø											
LB	151	ø	605	SU	B		1	6	7	ø	8	G	O	5	U	B		1	5	2
			ØIF	RE	т	U	R	N												
KA	152	ø	FOF	\$	A	-	ø		Т	O		7	1	2	P	0	K	E		8
			A+A	١,	P	Е	E	ĸ	(2	4	5	8	4	+	A)	1	N	E
			XT	A																
KJ	153	ø	RE1	Ľ	R	N														
MJ	154	ø	IF	8	т	R	I	G	(ø)	-	ø		т	н	E	N		1
			546	5																
DD	155	ø	GOS	BU	B		1	6	5	ø	1	P	D	ĸ	Ε		5	5	9	,
			46:	P	O	ĸ	Е		6	2	3	,	1	1	P	D	K	E		7
			Ø5,	8		P	0	K	E		7	Ø	6	,	в	1	P	O	ĸ	E
			70	57	,	8		P	0	ĸ	E		5	3	2	7	7	,	3	1
			POM	E		5	4	2	7	9		9	2					-		
KF	156	ø	SP=	N	U	M	в	E	R	(1)		E	P	-	N	U	M	B
			ER	4)	1	D	I	R	-	8	G	N	(E	P	-	8	P)
			195	3=	N	U	M	B	E	R	(3)	1	D	8	-	N	U	M
			BEF	2 (5)	_	1	ø											
OB	157	ø	S=A	B	8	(O	8)	1	3	2	2	5	6		I	F		
-	2.24	-	SKR	,	т	H	E	N		Q	-	2	5	5	2	T	N	т	(9
			/2:	56)		R	-	s	_	(2	5	5	_	ō	3		2	-
			615	-	D	*	2	5	-	+	R	-	-				1	-	_	
AA	158	Ø	08-	.8	-	-	-	-	-											
IH	159	ø	FOR	2	P	N	-	8	P		т	O		E	P		S	T	E	P
			DI	R																
CJ	160	ø	A=L	18	R	(2	9	1	3	2		P	N		n	8	:)		
PF	161	ø	TD	T	D	_	1	í	ī	F	7	Ť	D	<	a	-	T	H	F	N
-		-	TI) =	2	2	1	å	ŝ		N	Ē	x	T	-	P	N		R	r
			TO	1	5	9	a	Ĩ	~										-	
FH	167	a	KEY	/-	P	É	F	ĸ	1	7	4	4)		P	0	ĸ	F		7
			05	K	F	v	7	P	'n	K	F		7	a	4	-	K	F	v	
			POL	E	-	7	a	7	-	K	E	v		~	-				1	1
٥n	143	a	TE	B	т	P	7	'n	2	a	1	1	>	a		т	ч		N	
	100	~	140	10		~	1	-	`	~	1	1	1	~		1				
10	140	a	EOR	5	~	_	-	-	2				-	-	ι.	-		-	-	1
Vr	104			ì	2		~	3	5	2	0			E		7		-		ĉ
			Del		E		2	-	4	ć	10	-	-		ĥ			-		-
-	14=		DOL			ŝ	2	5	0	1	"	2		-	6			-		
nu	10.	10				20	7	É	-	0	2	, "	7				2		in	-
			-,-	-	7	-	-	6		-	7	2	-		5		5	5	-	5
			100		T	-	9	D	•	٢	-		E		Ľ	-	1	-		,
		-	T		-	~	,		~				-			-			~	
nn	100	90	1=1		E	R	-	1	R)	-	,,	-		-	K	5		1	2	-
			, 11	04	1	۲	R	1	N		_	-	H	H	Ŀ		1	1	2	1)
			IPO	JK	E		1	0	6		1		H			-	16			
11	167	ø	A=I	15	R	•	1	2	3	2)	-	P	"	IK	E		E		-
			+4	, 0	D	L	2	P	0	IK	E		D)F	. 1	+		5,	0	I
			HI	20	IK	E		8	8	,	C	DE		. 2	P	0	Jk	E		6
			9,0	וכ)H	1	R	E	T	U	IF	11	1							
D	-		-	E		1		_	-											
۲	100	Jre	am	9		-	4	ρ	P	1	e									
A	NIN	AA	TO	22	2	N	1		k	e	r									
17			1 7			T						r								
1 /	ana.	344	1211				14	10	A 10	1.00		4 - C	A 4	1.4	n		~ '			

Version by Tim Victor, Editorial Programmer

Please refer to "COMPUTEI's Guide to Typing In Programs" before entering these listings.

- 26 80 FOR I = 126 # 256 TO I + 1 455: READ A: POKE I, A: NEX
- F5 90 PRINT CHR\$ (4); "BSAVE ANIM ATOR2, A\$7EØØ, L\$5BØ": END
- 17 100 DATA 0,0,0,0,0,0,0,0,0,0,0,0,
- 82 110 DATA 0,0,0,0,0,216,120,13 3,69,134,70
- 78 120 DATA 132,71,166,7,10,10,1 76,4,16,62,48
- 13 130 DATA 4,16,1,232,232,10,13 4,27,24,101,6 55 14Ø DATA 133, 26, 144, 2, 23Ø, 27,
- 165, 40, 133, 8, 165 63 150 DATA 41,41,3,5,230,133,9,
- 162,8,160,0
- 78 160 DATA 177,26,36,50,48,2,73 ,127,164,36,145
- 90 170 DATA 8,230,26,208,2,230,2 7,165,9,24,105
- 16 180 DATA 4,133,9,202,208,226, 165,69,166,70,164
- 88 190 DATA 71,88,76,240,253,128 ,128,128,128,190,128

55	200	DATA 128, 128, 128, 128, 128, 128,	
		190, 128, 190, 128, 128, 128	
11	210	DATA 188,230,176,152,128,	
63	220	DATA 238, 230, 188, 128, 128	
-		152, 156, 152, 152, 152, 188	
E8	23Ø	DATA 128, 128, 188, 230, 176,	
75	240	140,230,254,128,128,188 DATA 230,176,224,230,188	
1	240	128, 128, 176, 184, 180, 254	
EC	25Ø	DATA 176, 176, 128, 128, 254,	
		134,190,224,230,188,128	
BR	260	230, 188, 128, 128, 134, 199, 239,	
B1	27Ø	DATA 176,152,140,140,128,	
	-	128, 188, 230, 188, 230, 230	
F3	28Ø	DATA 188, 128, 128, 188, 230,	1
98	290	DATA 152, 176, 254, 254, 176,	1
		152, 128, 128, 190, 190, 190	
21	300	DATA 190,190,190,128,0,0,	2
18	310		
10	510	0	1
10	32Ø	DATA 0,0,0,0,0,0,0,0,0,0,0,	
47	770	0	6
H/	330	B. 188, 152, 128, 128	18
64	34Ø	DATA 128,252,230,230,254,	1
	_	230, 230, 128, 128, 190, 230	
AZ	35Ø	DATA 230, 190, 230, 254, 128,	2
F1	360	DATA 190.128.128.190.230.	
		230, 230, 230, 190, 128, 128	
AD	37Ø	DATA 254, 134, 134, 190, 134,	0
FA	300	254, 128, 128, 254, 134, 134	
17	369	188,230,134,246,230,190	2
BA	390	DATA 128, 128, 230, 230, 230,	2
70		254,230,230,128,128,152	
36	400	128, 128, 224, 224, 224, 224	
87	41Ø	DATA 230, 188, 128, 128, 230,	
		230, 182, 158, 230, 230, 128	
2B	42Ø	DATA 128, 134, 134, 134, 134, 134, 134, 134	1
97	430	DATA 230, 230, 230, 230, 128,	
		128, 190, 230, 230, 230, 230	1
69	44Ø	DATA 230, 128, 128, 188, 230,	2
88	450	230,230,230,188,128,128 DATA 190 230 230 190 134	-
	130	134, 128, 128, 188, 230, 230	
8A	46Ø	DATA 230, 182, 236, 128, 128,	
47	470	190,230,230,190,230,230	
02	479	176, 230, 190, 128, 128, 128, 230, 140,	
50	48Ø	DATA 152, 152, 152, 152, 152, 152,	
		128, 128, 230, 230, 230, 230	
50	49Ø	DATA 230, 190, 128, 128, 230,	
30	500	DATA 128,230,230.230.230.	
		254,230,128,128,230,230	
27	51Ø	DATA 230, 188, 230, 230, 128,	
54	520	128,230,230,230,188,152	
14	320	152, 140, 134, 254, 128, 0	
94	53Ø	DATA Ø,Ø,Ø,Ø,Ø,Ø,Ø,160,Ø,	
07	-	162,7	
0/	340	132, 133, 255, 177, 254, 73	
44	55Ø	DATA 127, 145, 254, 200, 208.	1
S		247, 230, 255, 202, 208, 242	
3B	560	DATA 96,0,0,0,0,0,76,21,1	
85	570	DATA 128, 76, 130, 128, 76, 23	6
		9,128,76,6,130,76	
14	58ø	DATA 148, 129, 76, 210, 129, 1	1
82	590	67, 2, 141, 180, 131, 169 DATA 24 141, 181 131 32 31	
~*	5.0	,130,176,48,32,71	
3B	600	DATA 131, 176, 43, 32, 156, 13	- 1
10	110	1,176,38,173,178,131	
11	010	UMIM 100, 202, 1/0, 1/7, 101,	1

133, 253, 32, 223, 130, 32

D	62Ø	DATA 95,130,32,168,130,23 8,184,131,165,252,24
B	630	DATA 105, 3, 133, 252, 144, 2, 230, 253, 206, 181, 131
4	64Ø	DATA 208,228,96,169,2,141
8	65Ø	DATA 181,131,32,71,131,17
E	660	DATA 24,160,3,169,0,153,1
D	67Ø	DATA 32,223,130,32,168,13
2	68ø	DATA 131,208,242,96,165,5
E	69Ø	DATA 4,192,128,240,14,141
C	7ØØ	DATA 169,186,133,56,160,1
3	71Ø	DATA 169, Ø, 141, 194, 131, 32
2	72Ø	DATA 178,131,141,197,128,
C	73Ø	DATA 96,32,6,130,0,145,40
6	74Ø	,169,48,141,Ø DATA 2,141,1,2,173,255,25
A	75Ø	5,201,100,144,7 DATA 233,100,238,0,2,208,
E	760	245,201,10,144,7 DATA 233,10,238,1,2,208,2
c	77Ø	45,105,48,141,2 DATA 2,162,3,169,141,238,
7	78Ø	197,128,208,3,238 DATA 198,128,96,32,121,12
7	790	9,169,255,141,194,131 DATA 32,31,130,176,23,173
C	800	,178,131,141,84,129 DATA 173,179,131,141,85,1
8	810	27,167,196,141,110,127 DATA 169,131,141,111,129
	976	96,32,6,130,0,44
7	074	253, 201, 176, 144, 4
-	030	Ø, 195, 131, 56, 173, 11Ø
	849	41,182,131,169,Ø,168
2	850	DATA 201, 26, 176, 214, 10, 14 1,68, 129, 10, 10, 105
4	869	DATA 255, 176, 204, 121, 196, 131, 56, 233, 176, 200, 204
8	870	DATA 182,131,208,230,141, 255,255,238,84,129,208
1	88Ø	DATA 3,238,85,129,169,196 ,141,110,129,169,131
D	89Ø	DATA 141,111,129,172,195, 131,104,96,141,255,255
D	900	DATA 238,110,129,208,3,23 8,111,129,96,165,54
F	910	DATA 164,55,201,23,208,4, 192,129,240,14,141
C	92Ø	DATA 192,131,140,193,131, 169,23,133,54,160,129
4	93Ø	DATA 132,55,96,32,31,130, 176,56,173,178,131
3	94Ø	DATA 141, 198, 129, 208, 3, 20 6, 179, 131, 206, 198, 129
E	95Ø	DATA 173, 179, 131, 141, 204, 129, 169, 227, 133, 252, 169
2	96Ø	DATA 142, 133, 253, 160, 0, 17 7, 252, 160, 72, 145, 252
7	97Ø	DATA 165,252,208,2,198,25
3	98Ø	DATA 252,208,234,169,255, 197,253,208,228,94,32
9	99Ø	DATA 31,130,176,46,173,17 8 131 133 252 173 179
C	1000	DATA 131,133,253,169,228
9	1Ø19	DATA Ø, 130, 160, 72, 177, 25
7	1020	DATA 252, 208, 2, 230, 253, 1
D	1030	DATA 169,255,197,253,208
		,230,96,173,190,131,172

FC	1Ø49	0 DATA 191,131,240,4,133,5
49	105	6,132,57,173,192,131 Ø DATA 172,193,131,240,4,1
CØ	106	33,54,132,55,96,169 DATA 196,141,178,131,169
98	1079	,132,141,179,131,32,165 DATA 131,201,21,144,1,96
86	1089	,141,176,131,169,0 DATA 141,177,131,160,3,3
AB	1079	2,64,130,160,3,173 DATA 176,131,10,46,177,1
E6	1100	DATA 131,24,109,178,131,
44	1116	DATA 109,177,131,141,179
C4	1120	DATA 200,140,182,131,169
2E	1130	DATA 252, 153, 196, 131, 136
76	1140	DATA 127, 141, 183, 131, 172 187, 131, 240, 21, 162, 0
72	1150	DATA 14,196,131,189,196, 131,10,62,197,131,232
88	1160	DATA 236, 182, 131, 208, 243
C9	1170	DATA 185, 196, 131, 9, 128, 4 5, 183, 131, 153, 196, 131
50	1180	DATA 136,16,242,96,172,1 87,131,185,209,130,172
77	1190	DATA 182,131,49,254,25,1 96,131,145,254,136,185
BE	1200	DATA 196,131,145,254,136 ,208,248,172,187,131,185
4D	1210	DATA 216,130,160,0,49,25 4,13,196,131,145,254
ØD	1220	DATA 96,127,126,124,120, 112,96,64,0,1,3
60	1230	DATA 7,15,31,63,173,184, 131,41,63,168,185
FA	1240	DATA 7,131,5,230,133,255 ,173,184,131,41,8
9A	1250	DATA 240,2,169,128,24,44 ,184,131,112,4,16
BF	1260	DATA 4,105,40,105,40,109 ,186,131,133,254,96
78	1270	DATA Ø,4,8,12,16,20,24,2 8,0,4,8
69	1280	DATA 12,16,20,24,28,1,5, 9,13,17,21
26	1290	DATA 25,29,1,5,9,13,17,2 1,25,29,2
BØ	1300	DATA 6,10,14,18,22,26,30 ,2,6,10,14
70	1310	DATA 18,22,26,30,3,7,11, 15,19,23,27
49	1320	27,31,169,Ø
18	1330	,131,32,165,131,141,185
19	1342	Ø,1,96,201,24,144
EY	1350	,131,169,4,141,187
F2	1308	31,169,224,141,189,131 0 DATA 173,185,131 205,199
R7	1390	,131,144,4,237,189,131 DATA 56,46,188,131 78 19
6F	1390	9,131,144,239,24,109 DATA 187,131,141,187,131
AC	1400	,24,173,188,131,109,186 DATA 131,141,186,131,24
Fé	1410	96, 32, 165, 131, 141, 184 DATA 131, 201, 192, 96, 32, 1
86	1420	77, Ø, 32, 5, 225, 165 DATA 161, 164, 160, 96
P	rog	ram 6: Apple Animator
FD	100	DIM E%(2,23),M\$(8),CM\$(7) ,MM\$(14):D\$ = CHR\$(4): P

+28 SPEED 2 PRUSE 18 12 12 12 1 ADIHATE FASTER SPEED SLOHER SPEED LESS PRUSE HODE PRUSE In this demonstration of "Apple Animator," a motorcyclist performs a daring wheelstand. AF 110 FOR I = 0 TO 8: READ M\$(I): NEXT : FOR I = Ø TO 7: READ CM\$(I): NEXT : FOR I = Ø TO 14: READ MM\$(I): NEXT 46 12Ø GOSUB 53Ø 06 130 A\$ = "": FOR I = 1 TO 72: A\$ = A\$ + "Ø ":A = FRE (Ø): NEXT 16 140 GOSUB 650: GOSUB 590 16 150 F = 1:AB = 1:AE = 20:AS = Ø: AP = 10 85 16Ø ONERR GOTO 139Ø 6C 17Ø GOSUB 710: IF MQ = 1 THEN HOME : TEXT : END 44 180 C = PEEK (49152): IF C < 128 THEN 18Ø 45 190 POKE 49168, 0: IF C = 136 THEN F = F - 1 + 20 \$ (F = 1): GOTO 17Ø CF 200 IF C = 149 THEN F = F + 1 - 20 * (F = 20): GOTO 17 Ø 69 210 C = C - 175: IF C < 1 OR C > 22 THEN 180 CB 220 IF C < 11 THEN 250 75 23Ø IF C < 18 THEN 18Ø 98 24Ø C = C - 7 6A 250 MQ = 0: ON C GOSUB 260,11 20, 1210, 1500, 1510, 1520, 16 60, 1670, 1680, 1690, 1370, 12 50,1470,1460,1440:T = FRE (Ø): GOTO 17Ø 12 260 GOSUB 560: GOSUB 700: VTA B 19: HTAB 14: PRINT "EDI TING BOX ";A 51 270 PRINT "PRESS ESC TO CANCE L": HTAB 7: PRINT "RETURN FOR SAME": PRINT : PRINT "STORE RESULT IN BOX ";: R\$ = "" 98 280 XC = 21 + LEN (R\$): VTAB 23: HTAB XC: PRINT ";"; 77 290 C = PEEK (49152): IF C < 128 THEN 29Ø 25 300 POKE 49168,0: IF C = 141 OR C = 155 THEN VTAB 23: HTAB XC: PRINT " ";: GOTO 360 3A 31Ø IF C < > 136 AND C < > 25 5 THEN 340 AE 320 VTAB 23: HTAB XC: PRINT " ";: IF LEN (R\$) < 2 THEN R\$ = "": GOTO 280 46 330 R\$ = LEFT\$ (R\$, LEN (R\$) - 1): GOTO 28Ø AD 34Ø IF C < 176 OR C > 185 THE N 29Ø 93 350 VTAB 23: HTAB XC: PRINT C HR\$ (C - 12B);:R\$ = R\$ + CHR\$ (C - 12B):Q = FRE (Ø): GOTO 28Ø 4E 36Ø IF C = 155 THEN GOSUB 660 : RETURN

RINT D\$; "BLOAD ANIMATOR2" | F6 370 IF R\$ = "" THEN AA = A: G

OTO 390 \$6 380 AA = VAL (R\$): IF AA > 20 THEN GOSUB 660: RETURN 94 390 HGR2 : HOME : GOSUB 1070 F2 400 XP = 184:YP = 44:DX = 65: DY = 80: GOSUB 980 3A 41Ø VTAB 7: FOR Q = Ø TO 8: H TAB 28: INVERSE : PRINT M ID\$ ("123456789",Q + 1,1) ;: NORMAL : PRINT " ";M\$(Q): NEXT BC 420 CALL 32768, A, 206, 12: XC = Ø:YC = Ø:QF = Ø: GOSUB 87 44 430 IF QF THEN GOSUB 590: RET URN 32 440 SC = INT (YC / 8):SA = 10 24 + YC # 128 - SC # 984 + XC:CC\$ = " " 84 450 OC\$ = CC\$:CC\$ = CHR\$ (PE EK (SA) - 128): HTAB XC + 1: VTAB YC + 1: PRINT OC \$; C4 460 C = PEEK (49152): IF C < 128 THEN T = FRE (Ø): GOT 0 450 2E 47Ø POKE 49168, Ø: IF OC\$ = " " THEN HTAB XC + 1: VTAB YC + 1: PRINT CC\$: 91 480 FOR Q = 1 TO 13: IF C < > ASC (MID\$ ("JLIK1234567 89",Q,1)) + 128 THEN NEXT 84 490 ON Q GOSUB 750,760,770,78 0,840,850,870,880,890,990 ,1020,1050,1060: GOTO 430 BB 500 I = A # 28 - 24 - 280 # (A > 10): J = 26 + 80 \$ (A > 10): CALL 32768, A, I, J EB 51Ø X = FRE (Ø): RETURN AD 520 FOR A = 1 TO 20: GOSUB 50 Ø: NEXT : RETURN 17 530 POKE 6,0: POKE 7,126: IF PEEK (48640) = 76 THEN 55 os 6 540 POKE 54, 16: POKE 55, 126: CALL 1002: RETURN JE 550 PRINT : PRINT CHR\$ (4);"P R#A\$7E1Ø": RETURN 68 560 A = F: RETURN EJ 57Ø GOSUB 580: HTAB 1: INPUT "WHICH BOX?"; A: A = INT (A): IF A < 1 OR A > 20 THE N 57Ø 2F 58Ø VTAB 22: HTAB 1: PRINT SP C(39): RETURN of 590 HOME : HGR2 : HCOLOR= 3 8A 600 FOR J = 25 TO 105 STEP 80 : FOR I = 3 TO I + 9 # 28 STEP 28: FOR P = Ø TO 1 90 610 HPLOT I - P,J - P TO I + 22 + P,J - P TO I + 22 + P,J + 25 + P TO I - P,J + 25 + P TO I - P, J - P FB 620 NEXT : NEXT : NEXT 18 630 FOR J = 0 TO 1: FOR I = 1 TO 10: HTAB I # 4 - 2: V TAB J # 10 + 3: PRINT I + J # 10: NEXT : NEXT 90 64Ø GOSUB 52Ø: GOTO 66Ø 87 650 POKE 242, 0: CALL 32777, 0: FOR I = Ø TO 20: PRINT A \$: NEXT : CALL 32780: RET URN 3A 66Ø GOSUB 7ØØ: XP = 2: YP = 14Ø :DX = 275:DY = 48: GOSUB 980 AA 670 VTAB 19: FOR I = 0 TO 4: HTAB 2: INVERSE : PRINT I : NORMAL : PRINT " "; MM\$ (I);: HTAB 17: INVERSE : PRINT I + 5; DE 680 NORMAL : PRINT " "; MM\$ (I + 5) ; : HTAB 32: INVERSE :

RMAL : PRINT " "; MM\$(I + 10): NEXT 28 69Ø RETURN #3 700 HTAB 1: VTAB 18: FOR Q = 1 TO 7: PRINT SPC(40): N EXT : RETURN #7 71Ø VTAB 1: HTAB 1: PRINT "FR AME ":F:" ": 76 720 HTAB 10: PRINT "RANGE ";A B;" ";: HTAB 18: PRINT ": ";AE;" "; FD 730 HTAB 22: PRINT "SPEED ";A S;" ";: HTAB 32: PRINT " PAUSE "; AP; " "; IF 74Ø RETURN 18 75Ø XC = XC - (XC > Ø): GOTO 790 47 76Ø XC = XC + (XC < 20): GOTO 790 68 77Ø YC = YC - (YC > Ø): GOTO 790 58 78Ø YC = YC + (YC < 23): GOTO 790 DI 790 XB = INT (XC / 7):PM = 2 ^ (XC - 7 # XB):T = INT (E%(XB,YC) / PM): ON DF GO TO 800,820: RETURN BB 800 IF T = 2 # INT (T / 2) TH EN EX(XB, YC) = EX(XB, YC)+ PM: HTAB XC + 1: VTAB Y C + 1: PRINT ";"; 1A 81Ø RETURN 58 82Ø IF T < > 2 # INT (T / 2) THEN E% (XB, YC) = E% (XB, YC) - PM: HTAB XC + 1: VTAB YC + 1: PRINT "."; IE 83Ø RETURN C8 84Ø QF = 1: RETURN 58 850 DF = 1: GOSUB 860: HTAB 2 9: VTAB 8: PRINT "@";: GO TO 79Ø 85 860 VTAB 8: FOR I = 1 TO 3: H TAB 29: PRINT " ": NEXT : RETURN 78 87Ø DF = Ø: GOSUB 860: HTAB 2 9: VTAB 9: PRINT "@";: RE TURN CD 880 DF = 2: GOSUB 860: HTAB 2 9: VTAB 10: PRINT "@";: G **OTO 79Ø** D3 890 XP = 149: YP = 140: DX = 128:DY = 40: GOSUB 980 48 900 FOR I = 0 TO 3: VTAB 19 + I: FOR J = Ø TO 1: HTAB 23 + 9 # J: INVERSE : PRI NT I + J \$ 4;: NORMAL : P RINT " ";CM\$(I + J \$ 4);: NEXT : NEXT DD 910 C = PEEK (49152): IF C < 128 THEN 910 19 920 VTAB 18: FOR I = 0 TO 5: HTAB 22: PRINT SPC(19): NEXT : POKE 49168, Ø:C = C - 176 EI 93Ø IF C < Ø OR C > 7 THEN RE TURN 22 940 T = C - 4 * INT (C / 4):P Ø = 42 # T + (T > 1):P1 = PØ: IF PØ = 42 OR PØ = 8 5 THEN P1 = 127 - PØ # 950 IF C > 3 THEN PØ = PØ + 1 28:P1 = P1 + 12828 960 T = T + (T > 2): FOR I = Ø TO 23: VTAB I + 1: HTAB 1:E%(Ø,I) = PØ:E%(1,I) = P1:E%(2,I) = PØ 52 970 FOR J = 1 TO 10: PRINT MI D\$ ("..;.;;",T + 1,2);: N EXT : PRINT MID\$ (".;",(T > 1) + 1,1);: NEXT : RET URN 44 980 FOR P = Ø TO 1: HPLOT XP + P, YP + P TO XP + DX - P , YP + P TO XP + DX - P, YP 49 1420 PRINT : PRINT "PRESS ANY

+ DY - P TO XP + P, YP + DY - P TO XP + P, YP + P: NEXT : RETURN 70 990 QF = 1: GOSUB 1000: RETUR M 7F 1000 POKE 242,0: CALL 32777,A A 70 1010 FOR I = 0 TO 23: FOR J = Ø TO 2: PRINT E%(J,I): NEXT : NEXT : CALL 32780 : RETURN F9 1020 HOME : FOR I = 0 TO 23: FOR J = Ø TO 2:0 = 127 -E%(J,I): IF D < Ø THEN 0 = 0 + 256 9 1130 GOSUB 700: IF A < 20 THE N CALL 32783, A 86 1140 POKE 242, 0: CALL 32777, A : PRINT AS: CALL 32780: FOR A = A TO 20: GOSUB 5 ØØ: NEXT FØ 1150 GOSUB 660: RETURN ED 1160 PRINT "-REALLY/"; AB 1170 C = PEEK (49152): IF C < 128 THEN 1170 IF 1180 POKE 49168, 0: IF C = 206 THEN PRINT "NO": RETURN 82 1190 IF C = 217 THEN PRINT "Y ES": RETURN 6C 1200 GOTO 1170 70 1210 GOSUB 560: GOSUB 700: VT AB 19: HTAB 10: PRINT "D ELETE BOX ";A;: GOSUB 11 60: IF C = 206 THEN 1240 IE 1220 GOSUB 700: IF A < 20 THE N CALL 32786, A AF 1230 POKE 242,0: CALL 32777,2 Ø: PRINT A\$: CALL 32780: FOR A = A TO 20: GOSUB 500: NEXT EE 124Ø GOSUB 66Ø: RETURN 98 1250 F\$ = "SAVE": GOSUB 1270: IF LEN (N\$) < > Ø THEN PRINT : PRINT D\$; "BSAVE ";N\$;",A\$84C4,L\$5E8" F6 1260 GOTO 590 52 1270 HOME : TEXT : VTAB 2: PR INT "ESC TO CANCEL, RETU RN FOR CATALOG" AI 1280 PRINT : PRINT F\$;" FILEN AME: ";:N\$ = "" 48 1290 GOSUB 1320: IF C\$ = CHR\$ (27) THEN N\$ = "": RETU RN CE 1300 IF N\$ = "" THEN PRINT : PRINT D\$: "CATALOG": GOTO 1280 DB 1310 RETURN AC 1320 T = FRE (0): GET C\$: IF C\$ = CHR\$ (13) OR C\$ = C HR\$ (27) THEN RETURN BA 1330 IF C\$ < > CHR\$ (127) AND C\$ < > CHR\$ (8) THEN N\$ = N\$ + C\$: PRINT C\$;: G OTO 132Ø CE 134Ø IF N\$ = "" THEN 1320 29 1350 HTAB LEN (N\$) + 14: PRIN T " ";: HTAB LEN (N\$) + 14: IF LEN (N\$) = 1 THEN N\$ = "": GOTO 1320 8A 136Ø N\$ = LEFT\$ (N\$, LEN (N\$) - 1): GOTO 1320 # 1370 F\$ = "LOAD": GOSUB 1270: IF LEN (N\$) < > Ø THEN PRINT : PRINT D\$; "BLOAD ":N\$:",A\$84C4" #1 138Ø GOTO 59Ø EA 1390 PRINT : PRINT "AN ERROR HAS OCCURRED" 5E 1400 PRINT "MAKE SURE THAT YO U HAVE A FORMATTED" F9 1410 PRINT " DISK IN THE DRIV E"

KEY TO CONTINUE" C2 143Ø GET W\$: GOSUB 59Ø: GOTO 170 E 1440 GOSUB 700: VTAB 19: HTAB 10: PRINT "QUIT ANIMATO R";: GOSUB 1160: IF C = 217 THEN MQ = 1: RETURN F6 145Ø GOSUB 66Ø: RETURN A7 1460 CALL 32736: GOTO 520 BD 147Ø GOSUB 7ØØ: VTAB 19: HTAB 9: PRINT "CLEAR ALL BOX ES";: GOSUB 1160: IF C = 206 THEN 1490 78 1480 GOSUB 700: GOSUB 650: GO SUB 520 #7 1490 GOSUB 660: RETURN 36 1500 AB = F: RETURN 9A 151Ø AE = F: RETURN 48 1520 A = AB:QF = 0:AR = 0:AX = 0 BD 1530 CALL 32771, AD, 60: CALL 3 2768, A, AX, 60: AD = AX: IF QF = 1 THEN RETURN # 154Ø C = PEEK (49152): IF C > 128 THEN POKE 49168, Ø: GOSUB 1600 E3 1550 FOR I = 0 TO AP * 5: NEX T : AR = AR + AS: IF AR > 259 THEN AR = Ø 50 1560 IF AR < Ø THEN AR = 259 BA 157Ø AX = 2 # INT (AR / 2): I F AE > AB THEN A = A + 1: IF A > AE THEN A = AB 38 1580 IF AE < AB THEN A = A -1: IF A < AE THEN A = AB 8E 1590 GOTO 1530 61 1600 IF C < > 160 THEN 1630 % 1610 IF PEEK (49152) < 128 TH EN 161Ø \$3 1620 POKE 49168, 0: RETURN 36 1630 IF C = 136 THEN GOSUB 16 70: GOTO 710 #8 164Ø IF C = 149 THEN GOSUB 16 60: GOTO 710 43 1650 QF = 1: RETURN 18 1660 AS = AS + (AS < 15): RET LIRN 02 1670 AS = AS - (AS > - 15): R ETURN 5A 168Ø AP = AP - (AP > Ø): RETU RN #1 169Ø AP = AP + (AP < 15Ø): RE TURN BC 1700 DATA QUIT, DRAW, MOVE, ERAS E, CLEAR, SAVE, INVERT, UPDA TE, REVERT 98 1710 DATA BLACK1, GREEN, PURPLE , WHITE1, BLACK2, ORANGE, BL UE, WHITE2 B# 1720 DATA EDIT FRAME, INSERT F RAME, DELETE FRAME, RANGE BOTTOM, RANGE TOP E6 1730 DATA ANIMATE, FASTER SPEE D, SLOWER SPEED, LESS PAUS E AN 1740 DATA MORE PAUSE, LOAD, SAV E, CLEAR, INVERT, QUIT Program 7: TI Animator Version by Patrick Parrish, Programming Supervisor 10 FORE=2 :: BACK=12 :: REM REQUIRES EXTENDED BASIC 20 CALL CLEAR :: GOSUB 480 :: F=1 :: L=1Ø :: N=1 :: BE=1 :: E=2Ø :: SP=Ø :: DL=Ø :: FOR I=104 TO 14 3 :: CALL CHAR(I, RPT\$("Ø ,16)):: NEXT I 30 CALL MAGNIFY(4) :: DIM B(

16,16),C\$(15),E\$(20),IFL

AG(20):: Q\$="DEVICE (DSK

1.FILE OR CS1)?" :: GOSU B 910 :: CALL SCREEN (BAC K):: GOSUB 97Ø 40 CALL KEY(0,K,S) :: IF S=0 THEN 40 50 IF K>48 AND K<57 THEN K= K-48 :: ON K GOTO 170,50 0,220,220,240,240,250,25 60 IF K=66 THEN GOSUB 260 70 IF K=70 THEN GOSUB 270 80 IF K=73 THEN GOSUB 280 90 IF K=69 THEN GOSUB 300 100 IF K=65 THEN GOSUB 330 110 IF K=76 THEN GOSUB 370 120 IF K=67 THEN GOSUB 390 130 IF K=81 THEN END 14Ø IF K=78 THEN GOSUB 41Ø 150 IF K=68 OR K=83 THEN N= N-((N < > 1) - (N = 1) * 19) * (K =B3)+((N<>2Ø)-(N=2Ø)*19) * (K=68) :: DISPLAY AT (4. 1):N; 16Ø GOTO 4Ø 170 CALL CLEAR :: GOSUB 480 :: FOR I=5 TO 8 :: CAL L COLOR(I, FORE, 1) :: NEX Т I :: FOR I=1 TO 20 :: CALL CHAR (60+1*4, E\$(1)):: NEXT I 180 GOSUB 490 :: CALL SPRIT E(#1,60+BE#4,FORE,100,1 ØØ) :: CALL MOTION (#1, Ø, SP\$6) 190 FOR I=BE TO E :: CALL P ATTERN(#1,60+I*4):: DIS PLAY AT(1,1): I :: FOR J =1 TO DL :: NEXT J :: N EXT I 200 CALL KEY (Ø,K,S) :: IF S= Ø THEN 19Ø ELSE CALL DE LSPRITE(#1):: CALL CHAR SET 210 FORE=FORE-1 :: GOSUB 27 Ø :: FOR I=5 TO 8 :: CA LL COLOR(I,2,1):: NEXT I :: LF=1 :: GOSUB 910 :: GOSUB 97Ø :: GOTO 4Ø 220 IF K=3 THEN BE=N ELSE E =N230 GOSUB 1060 :: GOTO 40 24Ø SP=SP-(SP<>-15)*(K=5)+(SP<>15) * (K=6) :: GOSUB 1 Ø6Ø :: GOTO 4Ø 25Ø DL=DL-(DL<>Ø) * (K=7)+(DL =Ø) * (K=7) *15Ø+(DL<>15Ø) * (K=B) - (DL=15Ø) * (K=B) *1 5Ø :: GOSUB 1060 :: GOT 0 40 26Ø BACK=BACK+1+(BACK=16) #1 4 :: CALL SCREEN(BACK): RETURN 270 FORE=FORE+1+(FORE=16) #1 5 :: FOR I=10 TO 14 :: CALL COLOR(I, FORE, 1):: NEXT I :: CALL COLOR(9, FORE, 16):: RETURN 280 GOSUB 320 :: IF A\$="N" THEN RETURN 290 FOR I=20 TO N+1 STEP -1 :: E\$(I)=E\$(I-1):: NEX T I :: E\$(N)=RPT\$("Ø".6 4):: GOSUB 450 :: GOSUB 440 :: RETURN 300 GOSUB 320 :: IF A\$="N" THEN RETURN 310 FOR I=N TO 19 :: E\$(I)= E\$(I+1):: NEXT I :: E\$(2Ø)=RPT\$("Ø",64):: GOSU B 450 :: GOSUB 440 :: R ETURN 320 DISPLAY AT(12,4):"ARE Y DU SURE (Y/N)?" :: ACCE PT AT(12,24) VALIDATE("Y 60 COMPUTEI August 1985

0	ANIMATOR	52
#	1 B= 1 E= 20 SP= 0 D=0	53
1	2 3 4 5 6 7 8 9 10	54
4 6	NIMATE 2 EDII 3 STARL PIC	56
7 -	SWITCH 8 +SUITCH	
2	NSEXT GROUP" (05011"	
"TI rede	Animator" makes extensive use of fined character graphics.	57
	N"):A\$:: IF A\$="Y" THE N RETURN ELSE GOSUB 440	
330	:: RETURN GOSUB 420 :: OPEN #1:D\$	58
	BØ :: PRINT #1:FORE ::	
	1 TO 20 :: PRINT #1:E\$(59
34Ø	PRINT #1:IFLAG(I):: NEX	
35Ø	CLOSE #1 :: FOR I=10 TO 14 :: CALL COLOR(I,FOR	
	E,1):: NEXT I :: CALL S CREEN(BACK)	60
36Ø	IF ASC(D\$)=67 THEN GOSU B 97Ø :: RETURN ELSE GO	
37Ø	GOSUB 440 :: RETURN GOSUB 420 :: OPEN #1:D\$	61
	BØ :: INPUT #1:FORE :: INPUT #1:BACK :: FOR I=	
	1 TO 2Ø :: INPUT #1:E\$(I)	62
38Ø	INPUT #1:IFLAG(I):: NEX T I :: GOSUB 450 :: GOT	
39Ø	0 350 GOSUB 320 :: IF A\$="N"	63
400	THEN RETURN FOR I=1 TO 20 :: E\$(I)=	64
	: GOSUB 450 :: GOSUB 44	65
41Ø	F=F-(F=1)*1Ø+(F=11)*1Ø :: L=F+9 :: GOSUB 45Ø :	66
420	: GOSUB 460 :: RETURN DISPLAY AT(12,1):Q\$::	67 68
	ACCEPT AT(13,1):D\$:: I F D\$="" THEN GOSUB 440	
43Ø 44Ø	RETURN CALL HCHAR(12,1,32,64):	69
45Ø	J=Ø :: FOR I=F TO L :: CALL CHAR(104+J\$4.E\$(I)	10
):: J=J+1 :: NEXT I :: RETURN	
46Ø	CALL HCHAR(9,2,32,2):: J=F+1 :: FOR I=2 TO 26	71
	STEP 3 :: DISPLAY AT(9, I):J :: J=J+1 :: NEXT I	
	Y AT(4,1):N;	73
479	FOR I=1 TO LEN(F\$):: CA LL HCHAR(9,1+I,ASC(SEG\$	74
480	RETURN DISPLAY AT(1.7): "PLEASE	75
490	WAIT" :: RETURN CALL HCHAR(1,9,32,14)::	
500	RETURN DISPLAY AT(12,1): "TYPE	76
	21 TO ABORT, A # 1-20, OR <enter> FOR CURRENT</enter>	77
51Ø	# :" ACCEPT AT(13,27):A\$:: TE A\$="" THEN DN-N D	70
	I HA- THEN PN-N II OT	, 9

Ø IF A\$<"1" OR A\$>"9" THE N 51Ø a J=VAL(A\$):: IF J=21 THE N GOSUB 440 :: GOTO 40 IF J>20 OR J<1 THEN 510 Ø IF J=N THEN PN=N ELSE P ø N = JØ IFLAG(PN)=IFLAG(N):: CA LL CLEAR :: DISPLAY AT(2,1):"1-MOVE 2-DRAW (4 SPACES) 3-ERASE" :: D ISPLAY AT(3,1): "4-CLEAR 5-INVERSE 6-DISPLAY" Ø DISPLAY AT(4,1): "7-SAVE 8-QUIT" :: DISPLAY AT (5,2):"(USE ARROW KEYS TO MOVE) " :: DISPLAY AT (24,7): "FRAME"; PN :: GF =1 :: GOSUB 920 Ø IF IFLAG(N)=1 THEN CALL CHAR(100,U\$,101,"")ELS E CALL CHAR(100,"",101, U\$) F\$=E\$(N):: FOR I=Ø TO 6 3 STEP 2 :: D=ASC(SEG\$(F\$, I+1, 1))-48 :: D=D+(D >9) \$7 :: D1=ASC(SEG\$(F\$, I+2, 1))-48 :: D1=D1+(D 1>9) \$7 Ø D=-15*(IFLAG(PN)=1)+D*(IFLAG(PN)=1)-(IFLAG(PN) =Ø) *D :: D1=-15*(IFLAG(PN) = 1) + D1 * (IFLAG(PN) = 1) $-(IFLAG(PN)=\emptyset) *D1$ Ø DISPLAY AT(7+1/2+(1>31) *16,3-(I>31)*8):C\$(D):: DISPLAY AT (7+1/2+(1>31) #16,7-(I>31) #8):C\$(D1) :: NEXT I CALL SPRITE(#28,96,14,4 ø 9,33):: KHAR=101 :: FLA G=1 :: R=1 :: C=1 CALL KEY(Ø,K,S) :: IF S= ø Ø THEN 63Ø ELSE CALL DE LSPRITE(#1) IF K=51 THEN KHAR=100 : ø FLAG=Ø :: GOTO 790 IF K=49 THEN FLAG=1 :: Ø GOTO 800 IF K=50 THEN KHAR=101 : Ø : FLAG=Ø :: GOTO 79Ø IF K<>52 THEN 69Ø Ø FOR R=1 TO 16 :: CALL H a CHAR(6+R, 5, 100, 16) :: NE XT R :: DFLAG=Ø :: GOTO 620 ø IF K<>53 THEN 720 DFLAG=Ø :: IFLAG(PN)=-(IFLAG(PN)=Ø):: IF IFLAG (PN) =Ø THEN CALL CHAR(1 00, "", 101, U\$) ELSE CALL CHAR(100,U\$,101,"") Ø GOTO 800 IF K=56 THEN CALL DELSP ø RITE(ALL):: LF=1 :: GOS UB 91Ø :: GOSUB 97Ø :: GOTO 4Ø Ø IF K=66 THEN GOSUB 260 :: DFLAG=1 IF K=7Ø THEN GOSUB 27Ø Ø :: DFLAG=1 IF K=54 OR K=55 THEN CA LL DELSPRITE (ALL) :: IF DFLAG=1 THEN 890 ELSE 8 10 C=C+(K=B3)+((C=1)*(K=B3) #16) - (K=68) - ((C=16) # (K =68) \$16) R=R+(K=69)+((R=1)*(K=69) \$16) - (K=88) - ((R=16) \$ (K =88) \$16) Ø CALL LOCATE (#28,8*R+41,

OTO 560

	B*C+25):: IF FLAG=1 THE	95Ø F	OR J=1 TO 4 :: T=VAL(S	Learn Computer
790	DELAGEN CALL HCHARIA	T	\$%CHR\$(T) NEXT .1	acam compater
	+R. 4+C. KHAR)		S(I)=DS := NEXT I	Programming
800	CALL SOUND (20 200 5)	960 F	OR I=1 TO 20 + F\$(I)=	The JOC Wass
	GOTO 630	5	PT\$ ("0" - 64) NEXT I .	I ne ICS way
810	GOSUB 480 :: FOR R=1 TO		RETURN	
	16 :: FOR C=1 TO 16 ::	970 0	ALL CLEAR :: DISPLAY A	Affordable,
	CALL GCHAR (A+R, 4+C, GC)	T	(1.10): "ANIMATOR" :: C	Enjoyable.
	11 GC = GC - 100 st B(B, C) =	e e	LL HCHAR (4.2.35) :: DIS	Challenging
	GC 11 NEXT C 11 NEXT R	F	LAY AT (4.5) : "B=	
820	F\$="" :: IF IFLAG(PN)=0	(4 SPACES E= (4 SPACES)S	
	THEN HEX\$="Ø123456789A	F	={4 SPACES}D="	
	BCDEF" ELSE HEX\$="FEDCB	98Ø G	OSUB 1060 :: CALL VCHA	
	A987654321Ø"	R	(6,1,38,2):: CALL VCHA	
830	FOR R=1 TO 16 :: LOW=B(R	(6,31,39,2):: FOR I=2	THAT WE U
	R,5)*8+B(R,6)*4+B(R,7)*	Т	0 29 STEP 3 :: CALL HC	
	2+B(R,8)+1	H	AR(5, I, 36, 2) :: CALL HC	T
84Ø	HIGH=B(R, 1) #8+B(R, 2) #4+	H	AR(8, 1, 37, 2)	rain at home in spare time! No previous experi-
	B(R,3)#2+B(R,4)+1	99Ø N	EXT I :: FOR I=4 TO 28	ence needed! Now you can learn it all! Computer
85Ø	F\$=F\$&SEG\$(HEX\$,HIGH,1)		STEP 3 :: CALL VCHAR (6	games everything you ever wanted to know about
	&SEG\$ (HEX\$,LOW,1):: NEX	,	I,33,2):: NEXT I :: GO	computer operation! Write your own computer pro-
	T R :: FOR R=1 TO 16	S	UB 46Ø :: GOSUB 45Ø ::	grams or use hundreds of programs already
860	LOW=B(R, 13) #8+B(R, 14) #4		$J = 1 \emptyset 4$	availablebudgeting, real estate, bookkeeping,
	+B(R,15) #2+B(R,16)+1	1000	FOR I=2 TO 29 STEP 3 :	lists vacation planning addresses phone numbers.
87Ø	HIGH=B(R,9) #8+B(R,1Ø) #4		: CALL HCHAR(6, I, J)::	routingeven foreign languages and graphics.
	+B(R,11) #2+B(R,12)+1		CALL HCHAR(6, I+1, J+2):	You'll know what really happens when you have a computer
880	F\$=F\$&SEG\$(HEX\$,HIGH,1)		: CALL HCHAR(7, I, J+1):	problem with a bank, store, loan company, oil company, util-
	&SEG\$(HEX\$,LOW,1):: NEX		: CALL HCHAR (7, I+1, J+3	ity or anyone else. You'll be able to talk their language
	T R :: IF K=54 THEN DFL):: J=J+4 :: NEXT I	take the offensive when you're the victim of a computer
	AG=1	1010	CALL HCHAR(15,1,49)::	error. Experts explain everything in easy-to-understand lan-
890	IF K=55 THEN E\$ (PN)=F\$		CALL HCHAR(16,1,52)::	your trainingplugs into your TV. SEND FOR FREE FACTS
	:: LF=1 :: GOSUB 91Ø ::	1075-3-32	CALL HCHAR(17, 1, 55)	
	GOSUB 97Ø :: GOTO 4Ø	1020	DISPLAY AT(15,1): "ANIM	COMPUTER TRAINING, Dept. DZ075
700	CALL MAGNIFY(4):: CALL		ATE 2 EDIT(3 SPACES)3	SINCE 1891 Scranton, Pennsylvania 18515
	CHAR (36, F\$):: GUSUB 490		START PIC" :: DISPLAY	Rush me free facts that tell how I can learn computer appli-
	:: CALL SPRITE (#1, 36, F		AT(16,1):"END PIC 5 -S	No cost. No obligation. No salesman will visit you!
	URE, 80, 1/5):: GUTU 620		PEED 6 +SPEED"	Nama
710	CALL CHAR(33, RPT\$("81",	1030	DISPLAY AT(17,1): "-SWI	Name Age
	8), 36, RP1\$("9", 14)&"FF"		TCH 8 +SWITCH"	Address
	, 37, "FF"&RP1\$("Ø", 14), 3	1040	DISPLAY AT(20,1):"(I)N	- City/State/Zin
	8, RP1\$("01", 8), 39, RP1\$(SERT PIC D(E)LETE PIC	
	SU, S) :: IF LF=1 THEN		" :: DISPLAY AT(21,1):	Phone No. ()
224	LF=0 II REIURN		SAVE (L)UAD (C)LE	
920	U\$=RP1\$("F",16):: CALL	1050	AR ALL"	
	CHAR(199, 191, 0\$, 76, "	1030	VT GROUP/4 GRACEGY (D)	
	F97979F & KP1\$("9", 3/)):		TT" PETIIDN	
	I CALL CULUR(9, FURE, 16)	1040	DISPLAY AT(A 7) . BE	
	THEN GET INEN GET I	1000	DISPLAY AT(A 13). E	
230	F\$="0000000100100011010		DISPLAY AT(A 20) CD	
100	0010101100111100010011010		DISPLAY AT (4 24) - CTD#	
			(DL)*CED#(#(7 CDACED)#	
240	FOR I=0 TO 15 74=856		1.3-LEN(STR\$(DL)))	

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Archive: Two-Drive Backup for Commodore 64

Philip I. Nelson, Assistant Editor

Now you can copy entire disks at machine language speed with this convenient backup program for the Commodore 64 with two 1541 disk drives. It also works on the new Commodore 128 in 64 mode.

Sooner or later it's bound to happen. You'll make an unconscious error, or lightning may strike while you're resaving a program, or the family dog will chew a few disks for dinner—and an important disk will be utterly destroyed. If you have a backup copy, of course, such accidents aren't fatal. You take a moment to pat yourself on the back, pull out the archive disk, and go back to work.

If you don't have a backup, it's like watching a gold ring slip off your finger and go clanking down the drain. In the long hours spent reconstructing what you've lost, you have plenty of time to reflect on the wisdom of archiving your work on a regular basis.

Archiving is one of those grim tasks that's easy to postpone. BASIC programs (like COPY/ALL on your 1541 Test/Demo disk) are slow, and may not copy machine language (ML) programs or sequential files. Even good single-drive backup programs keep you tied to the computer, tapping your fingers until it's time for the next disk swap.

Fast And Convenient

"Archive" offers a better way: It links two drives together to take the misery out of backing up important disks. To speed things up, it's written entirely in machine language and copies only those disk sectors which actually contain data. But because it loads and runs just like a BASIC program, it's easy for anyone to use, even beginners.

You may find this program valuable even if you don't own two disk drives. Put your drive together with a friend's and swap several disks during one session. Or bring it to a user group meeting to speed up the duplication of public domain library disks. Since 1541-format disks work with other Commodore computers, Archive running on a Commodore 64 can also copy disks that will be used with the Commodore 128, VIC-20, Plus/4, 16, and 4040-format PET/CBM. (Of course, a program written for one of these machines may not work on another. Also, Archive cannot copy Commodore 128 CP/M disks.)

Archive has been tested successfully on the Commodore 128 in 64 mode with two 1541 drives. If the new 1571 drives are truly 1541compatible, Archive will work with them as well, since it uses standard Commodore disk commands. However, the 1571 was not available for testing when this article was written.

Incidentally, Archive cannot duplicate commercially protected software. Protected disks invariably contain deliberate errors (which shut down the program) or data hidden in unused sectors (which Archive does not copy).

Getting Started

Enter and save Archive using the MLX machine language entry program published elsewhere in this issue. Here's the information you need:

Starting address: 49152 Ending address: 51185

After you save Archive, activate it like a BASIC program by typing LOAD"ARCHIVE",8 followed by RUN. (For this program, *do not* use ,8,1 after the LOAD; just use ,8.) If you're already comfortable using two drives, you needn't read any further, since Archive prompts you at each step. Just pop a disk in each drive as instructed, press the f7 special function key, and relax while Archive does its work. (If you've never used two drives before, see "Setting Up Your System" below.)

Archive displays your source disk's Block Availability Map (BAM) graphically on the screen, updating the display as copying proceeds. Thus, you can tell at a glance how much of the disk is used and how much has been copied. The number at the lower right of the screen shows the sector being copied; the graphic display shows which sectors have already been copied.

If you want to abort the copy for any reason, press the f1 special function key to return to BASIC. (When you abort the copy process, the archive disk is incomplete and may be garbled. You can reuse it immediately with Archive, but do not use it for anything else without reformatting it as explained below.) Once the copy is done, press the f3 function key to copy another disk, or press f1 to quit. Whenever you exit Archive, it clears the screen and reports the status of each drive.

Quick Formatting

Since Archive always makes a complete disk copy, it *formats* the archive disk with a NEW command. Formatting renames the disk and erases everything it contained Figure 1 shows how to daisy-chain two drives to your computer. Connect the first drive as usual, then plug the serial cable from the second drive into the extra serial port connector on the first drive.

When more than one disk drive is active, each drive must be given a different *device number* so the computer can tell them apart. The 1541 is factory-set as device 8, but it can also have device numbers OPEN 15,8,15 PRINT#15,"M-W"CHR\$(119) CHR\$(0)CHR\$(2)CHR\$(32+9) CHR\$(64+9) CLOSE15

2. It's a good idea to verify the device number change. Put a disk in the drive, then type LOAD"\$",9 and press RETURN to load its directory. After the blinking cursor returns, type LIST and press RE-TURN. If you see the directory, the



before. You'll notice that the archive disk is formatted in only a few seconds rather than the usual couple of minutes, and without the usual knocking sound. To save time and minimize wear on the drive, Archive uses a shortened NEW command: the equivalent of OPEN 15,8,15, ''N0:*filename*'' without a disk ID.

The abbreviated NEW command works only on a disk that has been previously formatted. To use a brand new disk, you must prepare it first with a full NEW command: OPEN 15,8,15,"N0:*filename*,*ID*". The filename can be up to 16 characters long. The ID can be any two letters or numbers and should be unique for each disk. The *1541 User's Manual* contains more information about formatting disks.

Setting Up Your System

Although the Commodore 64 has only one serial port connector, the 1541 disk drive has two, letting you hook up more than one drive at a time. Since the drives are chained together in a series, this arrangement is often called *daisy-chaining*.

9-15. Archive uses device numbers 8 and 9, reading from drive 8 and copying to drive 9. You must always put the source disk (the original) in the drive that's device 8 and the archive disk (the copy) in the drive that's device 9.

If both of your drives are device 8, don't despair. You can easily change one of them to device 9. The change is temporary; the drive reverts to device 8 when you turn off the power. Here's the procedure:

1. Turn on the drive that you want to change to device 9. *Make sure the other drive is turned off.* Now you can change the device number either by running the DISK ADDR CHANGE utility program on your 1541 Test/Demo disk, or by typing in direct statements.

To use DISK ADDR CHANGE, load the program from the 1541 Test/Demo disk and enter RUN. Follow the program's instructions, then skip to Step 2 below.

You can also change the device number by entering the following statements in direct mode (with no line numbers). Press RETURN after you type each line: change worked and you may proceed to step 3. If you get an error (probably ?DEVICE NOT PRE-SENT), turn off the drive and repeat step 1.

3. Turn on the other drive. This drive will remain device 8 (the source drive). Now load and run Archive, inserting the disks as explained in the instructions. The source (original) disk goes in device 8, and the archive (copy) disk goes in device 9. As an additional precaution, you may want to writeprotect the source disk by taping over the notch in the sleeve.

In theory you can daisy-chain several drives to a 64, but in fact the 1541 doesn't enjoy sharing the serial bus. The drives should always be turned on one at a time, not simultaneously (as would happen with a power strip). Printer interfaces that draw power from the 64's cassette port are notorious for causing disk errors, and other peripherals can affect system voltage levels even if they're not turned on. Depending on your system, you may need to unplug other peripherals before using Archive.

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Location

Initialization

Before it starts copying, Archive *initializes* each disk to test whether devices 8 and 9 are active and if each contains a formatted disk. The initialization command transfers information (disk name, ID, etc.) from the disk into the drive's memory to prepare it for handling the disk.

If this step fails, it means one of the drives is not ready to go. Archive displays the status of both drives and returns you to BASIC. (If you forget to change one of the drives to device 9, Archive can't read its status; press RUN/STOP -RESTORE and proceed as explained below). Enter these lines in direct mode (without a line number) to retry the initialization:

> OPEN 15,8,15,"10":CLOSE 15 OPEN 15,9,15,"10":CLOSE 15

When you enter each line, the drive motor should run and its red light should glow. After one or two seconds the red light should go off and stay off, and you should be able to run Archive. If one or both of the red lights blink continuously, turn off both drives and repeat the setup process. The drive makes a knocking sound if you forget to insert a disk or try to use an unformatted disk for the archive.

Is Your Drive Healthy?

In ordinary use your drive works intermittently. It may spend 30 seconds loading a game for you, then sit idle for 30 minutes while you play. Copying a full disk with Archive is far more demanding work, requiring several minutes of continuous running. If one of your drives is misaligned, tends to overheat, or has other mechanical problems, don't be surprised if you experience occasional errors. When an error occurs during the copy process, Archive stops copying, reports the status of both drives, and returns to BASIC.

Such errors are especially likely to crop up when the source disk is nearly full. For mechanical reasons it's harder for the drive to access the disk's outer area than the area near the middle. To make things easy on itself, the drive always starts storing programs in the middle of the disk, leaving the outer tracks empty until there's no room left elsewhere.

Archive's BAM display lets you observe this storage scheme. When the source disk contains only a few programs, they'll all be stored in middle tracks (near track 18). The outermost tracks (1 and 35) are usually the last to be used. If your drive consistently has trouble accessing outer tracks, it's probably misaligned. The same problem can result if the disk was formatted on a badly misaligned drive.

1541 ML Programming

To shorten and speed up the program, all of Archive's 21 variables and pointers are located in the zero page (lowest 256 bytes) of memory. Zero page machine language instructions run faster and use less memory than instructions that reference higher memory addresses. The computer can find what it needs by checking only one byte, rather than wading through a twobyte address in search of the same information. In time-critical programs like Archive, which execute certain routines many thousands of times a minute, the microseconds you save can add up to a significant difference in running time.

Many programmers have trouble learning to handle disk files in machine language. For those who are interested, here's an outline of Archive's main routines.

\$0852-0863	Initialize device 8
\$0864-0878	Initialize device 9
\$0879-0918	Error—report status
\$0919-0981	Read BAM from source disk
\$0982-0A32	Display BAM and disk name
\$0A33-0A7E	Short NEW destination disk
SOA7F-0A8F	OPEN 3.8,15 command channel
\$0A90-0AA0	OPEN 5,9,15 command channel
\$0AA1-0AB4	OPEN 4,8,4,"#" buffer channel
\$0AB5-0AC8	OPEN 6,9,6,"#" buffer channel
\$0B94-0C42	Subroutine-copy a block
\$0BCE-0C04	Read block from source disk
\$0C05-0C42	Write block to archive disk
\$0C43-0C5C	Subroutine-initialize disk
\$0C94-0CA4	Subroutine-check error channel
\$0CC0-0CCB	String-BAM Block Read (U1)
\$0CCC-0CDF	String buffer-short NEW
\$0CE0	String-"#" for buffer channel
\$0CE1-0CE2	String-"I0" to initialize
\$0F04-0F0F	String buffer-Block Read (U1)
\$0F10-0F1B	String-Block Write (U2)
\$0FF3	256-byte data buffer starts here

First the program maps the source disk's BAM on the screen to record which sectors contain data. Then it copies each used sector in turn, reading it from the source disk and writing it to the archive disk. Note that to read a disk sector, you should always use the U1 direct access command rather than B-R (Block Read). Likewise, the U2 command must be used in place of B-W (Block Write). Despite what your user's guide says, the B-R and B-W commands are defective and should never be used.

Archive: Two-Drive Backup

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

49132	:021,000,000,000,100,000,245
49158	:048,055,055,058,143,034,143
49164	:020.020.020.020.020.020.032.144
10170	· 065 082 067 072 073 086 207
49170	
491/6	:009,000,000,000,102,015,014
49182	:142,033,208,142,032,208,027
49188	:232,142,134,002,169,028,231
49194	:160.015.032.030.171.169.107
10200	124 122 176 122 179 169 192
49200	124,133,170,133,170,109,193
49206	:004,133,177,169,216,133,118
49212	:179,165,197,201,004,240,022
49218	:006.201.003.208.246.240.202
49224	.008 169 009 032 210 255 243
40224	
49230	:0/0,121,008,109,227,100,071
49236	:012,032,030,171,169,008,250
49242	:133,002,032,067,012,165,245
49248	:144.048.021.169.008.160.134
49254	. 013 032 030 171 169 009 014
49234	1013,032,030,171,103,003,014
49260	:133,002,032,007,012,105,007
49266	:144,048,003,076,025,009,163
49272	:169,003,032,195,255,169,175
49278	:004.032.195.255.169.005.018
49284	.032 195 255 169 006 032 053
40204	105 255 100 412 422 105 200
49290	:195,255,169,013,032,195,229
49296	:255,169,015,032,195,255,041
49302	:032,204,255,169,206,160,152
49308	:015.032.030.171.169.015.076
10214	160 162 000 032 106 255 205
49314	100,102,000,032,100,233,203
49320	:109,000,032,189,255,032,077
49326	:192,255,162,015,032,198,004
49332	:255,032,207,255,201,013,119
49338	:240.014.201.032.240.004.149
49344	201 065 144 241 032 210 061
10250	255 076 102 000 160 015 125
49350	255,076,182,008,169,015,155
49356	:032,195,255,032,204,255,153
49362	:032,231,255,169,224,160,001
49368	:015.032.030.171.169.015.136
49374	168,162,009,032,186,255,010
10200	160 000 000 000 000 000 000
49300	:109,000,032,189,255,032,13/
49386	:192,255,162,015,032,198,064
49392	:255,032,207,255,201,013,179
49398	:240,014,201,032,240,004,209
49494	201 065 144 241 032 210 121
40410	255 076 242 000 160 015 255
49410	1255,076,242,008,169,015,255
49416	:032,195,255,032,204,255,213
49422	:169,013,032,210,255,162,087
49428	:128,108,000,003,169,087,003
49434	:160.013.032.030.171.169.089
49440	·015 168 162 000 032 106 001
10116	· 255 160,102,000,052,100,091
49440	:255,109,000,052,109,255,170
49452	:032,192,255,169,013,168,105
49458	:162,008,032,186,255,169,094
49464	:001,162,224,160,012,032,135
49470	:189,255,032,192,255,162,123
49476	+015 032 201 255 162 000 221
10102	100 102 012 022 210 255 100
49402	1109,192,012,032,210,255,196
49488	:232,224,013,208,245,032,010
49494	:204,255,162,013,032,198,182
49500	:255,162,000,032,207,255,235
49506	:157.243.015.232.208.247.176
49512	·032 204 255 162 015 022 026
10510	140 010 165 162,015,052,036
49518	1140,012,105,107,240,003,077
49524	:070,121,008,169,013,032,023
49530	:195,255,169,015,032,195,215
49536	:255,169,123,160,013,032.112
49542	:030,171,169,018.032.210.252
49548	:255,162 144 189 242 GIE 124
ADEEA	(32) 210 255 222 224 101 124
493334	1032,210,255,232,224,164,239
49560	:208,245,169,013,032,210,005
49566	:255,169,146,160,013,032,165
49572	:030,171,160,000.132,006 151
49578	:169.004.133.165.165.176.214
49594	133 251 165 177 100,214
12204	.133,251,105,1/1,133,252,007

40500	-16E 170 122 002 16E 170 227	Fala4 .007 000 1	E4 007 160 000 101	FACED	. 022 022 049 013 093 032 210
49590	:105,178,133,003,105,179,237	50124 :007,032,2	54,237,162,003,131	50658	:032,032,040,013,003,032,210
49596	:133,004,032,165,012,162,184	50130 :032,201,2	255, 162, 000, 189, 025	50664	:032,049,013,069,032,032,203
49602	:008,169,001,133,005,165,163	50136 :004,015,0	32,210,255,232,196	50670	:050,013,067,032,032,051,227
496Ø8	:166,037,005,240,006,169,055	50142 :224,012,2	08,245,032,254,173	50676	:013,084,032,032,052,013,214
49614	:046.145.251.208.004.169.005	50148 :237,162.0	04.032.198.255.092	50682	:079.032.032.053.013.082.029
49620	·081,145,251 032 093 012 059	50154 .162.000.0	32, 173, 241, 157, 231	50688	·032 032 054 013 213 032 120
19626	.202 200 224 022 165 012 047	50160 .242 015	22,175,241,157,251	EACOA	. MOD MEE MID 201 MOD MOD 125
49020	:202,208,234,032,105,012,047	50100 :243,015,2	32,200,247,032,193	50094	:052,055,015,221,052,052,155
49032	:162,008,169,001,133,005,190	50166 :254,237,1	62,003,032,148,058	50700	:056,013,221,032,032,057,167
49638	:165,166,037,005,240,006,081	50172 :012,165,1	67,240,003,076,147	50706	:013,221,032,049,048,013,138
49644	:169,046,145,251,208,004,035	50178 :059.012.0	32,254,237,162,246	50712	:221.032.049.049.013.221.097
49650	169,081,145,251,032,093,245	50184 :006.032.2	01.255.162.001.153	50710	. 032 049 050 013 221 032 171
10656	-103,001,143,201,002,005,245	50100 1100 242	15 022 221 227 103	50710	1032,049,030,013,221,032,111
49030	:012,202,208,234,032,165,077	50190 1189,243,8	015,052,221,257,185	50724	:049,051,013,221,032,049,195
49662	:012,162,005,169,001,133,224	50196 :232,208,2	47,189,243,015,130	50730	:052,013,221,032,049,053,206
49668	:005,165,166,037,005,240,110	50202 :032,221,2	237,032,254,237,015	50736	:013,221,032,049,054,013,174
49674	:006,169,046,145,251,208,067	50208 :162,005,0	32,201,255,162,081	50742	:000.221.032.049.055.029.184
49680	:004.169.081.145.251.032.186	50214 .000 .189 .0	116.015.032.210.244	50748	·029 029 029 029 029 029 029 234
49696	. 493 412 242 249 224 224 223	50220 .255 222	24 012 200 245 106	EGTEA	· @20 @20 @20 @20 @20 @20 24@
49000	1055,012,202,208,234,230,233	50220 :235,232,2	24,012,208,245,196	50754	:029,029,029,029,029,029,240
49692	:165,230,176,230,178,230,213	50226 :032,204,2	255, 162, 005, 032, 228	50/60	:029,029,029,029,029,029,246
49698	:006,165,006,201,035,176,111	50232 :148,012,0	32,204,255,104,043	5Ø766	:029,029,029,029,029,029,029,252
49704	:002,144,131,169,056,160,190	50238 :170,104,1	168,096,169,015,016	50772	:029,029,029,029,029,029,213,186
4971Ø	:014.032.030.171.160.144.085	50244 :168,166.0	02.032.186.255.109	50778	+195,195,195,195,013,221,080
49716	162 000 195 242 015 157 04C	50250 .160 002	62 225 160 012 036	50704	- A22 AA0 AEC A20 A20 A20 ACA
40722	207 012 222 200 200 201 015,157,040	50256 .022 100	CE, 223, 100, 012, 030	50704	.032,049,030,029,029,029,004
49/22	:207,012,232,200,224,016,181	50250 :032,189,2	255,032,192,255,011	50/90	:029,029,029,029,029,029,029
49728	:208,244,032,204,255,169,152	50262 :169,015,6	32,195,255,096,080	50796	:029,029,029,029,029,029,029,026
49734	:015,168,162,009,032,186,130	50268 :169,000,1	145,003,024,165,086	50802	:029,029,029,029,029,029,029,032
49740	:255,169,000,032,189,255,208	50274 :251,105,6	40,133,251,165,019	50808	:029.029.029.213.195.195.042
49746	1032,192,255,162 015 032 002	50280 :252.105.0	00.133.252.024.102	50814	+195,195,195,203,032,032,210
49752	201,255 162 000 100 204 075	50000 100 000		50000	·032 032 013 221 022 040 255
40750	.201,233,102,000,189,204,075	50286 :165,003,	105,040,133,003,047	50020	1032,032,013,221,032,049,233
49/58	1012,032,210,255,232,224,035	50292 :165,004,	105,000,133,004,015	50826	1057,029,029,029,029,029,084
49764	:019,208,245,032,204,255,039	50298 :006,005,1	096,177,251,009,154	50832	:029,029,029,029,029,029,029,062
4977Ø	:162,015,032,148,012,165,128	50304 :128.145	251,230,250 024 132	50838	:029,029,029,029,029,029,029,068
49776	:167.240.003.076.121 008 215	50310 .165 351	AE 040 122 251 055	50844	:213,195,195,195,195,195,195,064
49792	160 015 022 105 255 022 040	50310 1105,251,	105,040,133,231,055	FROFA	
40700	109,019,032,199,259,032,048	50316 :165,252,1	105,000,133,252,023	50850	195,205,052,052,084,082,022
49788	:204,255,169,003,162,008,157	50322 :096,169,6	000,133,167,032,231	50856	:065,067,075,032,048,049,248
49794	:160,015,032,186,255,169,179	50328 :198,255,6	32,207,255,201,020	5Ø862	:013,221,032,050,048,029,055
49800	:000,032,189,255,032,192,068	50334 :050.144.9	02.230.167.096.079	5Ø868	:029,029,029,029,029,029,029,098
49806	:255.169.005.162.009.160.134	50340 .230 165 1	66 165 199 243 842	50874	:029.029.029.029.029.029.029.104
49812	:015.032.186.255 169 000 027	50346 -015 123		50880	.029 029 029 029 221 019 035
10010	.022 100 255 022 102 255 005	50340 :015,133,1	100,090,102,040,022	50006	ACE 002 067 072 072 006 121
49010	160 001 160 160 000 000	50352 :056,233,8	10,144,003,232,086	50000	1003,002,007,072,073,000,131
49024	109,004,108,162,008,032,191	50358 :176,249,1	105,058,134,169,049	50892	1009,140,032,083,009,007,158
49830	:186,255,169,001,162,224,139	50364 :133,170,0	96,085,049,058,011	50898	:084,079,082,032,048,048,071
49836	:160,012,032,189,255,032,084	50370 :049.051.0	32.048.032.049.199	50904	:013,202,195,195,195,195,195,187
		50376 .056 022 0	AQ 070 040 050 000	50910	:195.195.195.195.195.195.195.112
49842	:192,255,169,006,168,162,106	50370 1030,032,0	40,070,040,050,008	50916	105 105 105 105 105 105 105 110
49848	:009,032,186,255,169,001,068	50382 :032,032,0	32,032,032,032,142	50910	195,195,195,195,195,195,195,118
49854	:162.224.160.012.032.189.201	50388 :032,032,0	32,032,032,032,148	50922	1195,195,195,195,203,018,211
19960	255 032 102 255 160 000 066	50394 :032,032.0	32,032,032,035,157	50928	:080,072,073,076,032,078,139
49000	122 000 100 000 122 165 042	50400 :073.048.0	113,013,032 032 179	50934	:069,076,083,079,078,032,151
49866	:132,000,109,004,133,105,045	50406 .201 078 0	73 084 073 065 036	50940	:032.049.057.056 053 019 006
49872	:169,001,133,249,169,124,029	50412 .076 072 0		50046	.000 005 040 050 053 023 033
49878	:133,176,169,004,133,177,238	50412 10/0,0/3,0	90,013,018,011,185	50050	.000,003,045,038,032,032,022
49884	:169,000,133,250,165,176,089	50418 :032,083,0	79,085,082,067,158	50952	:048,032,048,049,032,048,009
49890	:133.251.165.177.133.252.057	50424 :069,032,0	68,073,083,075,136	50958	:048,085,050,058,054,032,085
49996	162 016 177 251 201 001 006	50430 :032,068,9	82,073,086,069,152	50964	:048,032,048,049,032,048,021
10000	200 017 165 107 201 004 006	50436 :046,013.0	00.013.032.032.140	50970	:048,147,008,014,032,032,051
49902	1208,017,105,197,201,004,000	50442 .201 078 0	73 084 073 065 072	50976	:018,042,032,193,210,195,210
49908	:208,002,240,091,032,148,197	50442 .201,070,0	00,072,073,003,072	50982	200 201 214 197 032 042 156
49914	:011,165,167,240,002,208,019	50448 10/0,0/3,0	90,013,018,011,221	50000	· 642 622 212 607 670 622 614
49920	:082,032,126,012,202,208,150	50454 :032,068,6	069,083,084,073,175	50500	1042,032,212,087,079,032,016
49926	:227.165.249.201.018.144.242	50460 :078,065,0	84,073,079,078,229	50994	1196,082,073,086,069,032,076
49932	1014 201 025 144 014 201 099	50466 :032,068,9	82,073,086,069,188	21000	:195,079,080,073,069,082,122
100 20	· @21 144 @14 2@1 @26 144 @76	50472 :046.013.0	00.147.080.082.152	51006	:032,042,013,013,032,032,226
49930	1031,144,014,201,030,144,070	50478 +069 083 0	183 032 070 051 179	51012	:208,085,084,032,083,079,127
49944	:014,240,056,162,005,208,197	50484 .022 004		51018	:085.082.067.069.032.068.221
49950	:010,162,003,208,006,162,069	50404 1032,084,1	19,032,007,079,169	51024	1073 083 075 032 073 070 020
49956	:002,208,002,162,001,177,076	50490 1080,089,1	032,065,078,079,225	51020	.073 060 003 073 006 060 240
49962	:251,201,081,208,017,165,197	50490 :084,072,0	09,082,044,032,191	51030	.032,000,002,073,080,009,240
49968	:197,201,004.208.002.240.132	50502 :070,049,9	32,084,079,032,160	51030	1032,009,0/3,0/1,072,084,237
49974	:028.032.148.011.165.167.002	50508 :081,085.0	73,084,046,046,235	51042	:044,013,032,032,070,079,112
49000	240 002 209 010 022 126 175	50514 :046.009.1	46.000.013.032 072	51048	:082,077,065,084,084,069,053
49980	240,002,200,019,032,120,175	50520 .032 210	60 065 060 072 002	51054	:068,032,068,073,083,075,253
49986	:012,202,208,227,230,176,097	50520 .052,210,0	09,000,000,000,073,093	51060	:032.073.078.032.068 082 225
49992	:230,249,165,249,201,036,178	50526 :078,071,0	32,194,193,205,099	51066	· 073 096 060 022 070 072 021
49998	:240,003,076,221,010,169,029	50532 :044.032.0	70.079.082.077.228	51072	.075,000,005,052,078,073,021
50004	:004,032,195,255,169,006,233	50538 .065 084 0	84 073 078 071 049	51072	1078,009,040,013,013,032,123
50010	:032,195,255,169,003,032,008	50544 .022 065 0	02 067 072 072 247	51078	1032,208,082,069,083,083,179
50016	195 255 169 005 022 105 170	50544 :032,065,6	82,001,012,013,241	51084	:032,018,070,055,146,032,237
50010	1155,255,105,005,052,195,179	50550 :086,069,2	46,000,147,142,096	51090	:070,085,078,067,084,073,091
50022	1255,032,204,255,165,167,156	50556 :008,213,1	95,195,195,201,107	51096	:079,078,032,075 069 000 062
50028	:208,031,169,008,133,002,147	50562 :084,082.0	65,067,075,213,204	51102	1932 984 979 932 966 969,002
50034	:032,067,012,169,009,133,024	50568 :195.195.1	95,195,195,195,026	51100	.052,004,079,052,000,009,008
50040	:002,032,067,012,169.044.190	50574 .195 195	100 221 022 022 040	51108	.0/1,0/3,0/8,044,013,032,219
50046	:160.013.032.030.171.165.195	50500 .022 022	22 022 022 022 022	51114	:032,018,070,049,146,032,005
50050	197 201 005 240 007 200	50500 1032,032,0	32,032,032,032,084	51120	:075,069,089,032,084,079,092
50052	197,201,005,240,007,201,215	50586 :032,032,0	32,032,049,032,107	51126	:032,065,066,079.082.084.078
50058	1004,208,246,076,121,008,033	50592 :032,032,0	32,032,032,032,096	51132	:032.078.079 087 032 070 062
50064	:0/6,029,008,152,072,138,107	50598 :032.032.0	50,032,032,032.120	511 20	·082 032 076 065 004 069 063
50070	:072,165,249,032,175,012,087	50604 :032.032 0	32,032,032,032 109	51144	.002,032,070,000,084,009,090
50076	:165,169,141,011,015,141.030	50610 .051 022 0	32 032 032 032 133	51144	.002,040,040,046,000,147,055
50082	:023,015,141,149,007,165,150	50616 .012 201	32,032,032,032,133	51150	:018,083,079,085,082,067,108
50088	177 141 141 141 141 141 141 141 141 141	50010 1013,221,0	32,032,032,049,051	51156	:069,032,068,082,073,086,110
50004	:1/0.141.012.015 141 024 150	50622 :050,051,0	52,053,054,055,249	51162	:069,032,013,013,000,013,102
	:1/0,141,012,015,141,024,159		40 040 0F0 0F1 0F1		
500074	:170,141,012,015,141,024,159 :015,141,150,007,165,250,134	50628 :056,057,0	48,049,050,051,251	51168	:013.018.065 092 067 072 000
50100	:1/0,141,012,015,141,024,159 :015,141,150,007,165,250,134 :032,175,012,165,169,141,106	50628 :056,057,0 50634 :052,053.0	54,055,056,057,017	51168	:013,018,065,082,067,072,029
50100 50106	:1/0,141,012,015,141,024,159 :015,141,150,007,165,250,134 :032,175,012,165,169,141,106 :014,015,141,026,015,141,026	50628 :056,057,0 50634 :052,053,0 50640 :048.049,0	48,049,050,051,251 54,055,056,057,017 50,051,052,053,255	51168 51174	:013,018,065,082,067,072,029 :073,086,069,032,068,082,128
50100 50106 50112	:1/0,141,012,015,141,024,159 :015,141,150,007,165,250,134 :032,175,012,165,169,141,106 :014,015,141,026,015,141,026 :189,007,165,170,141,015,111	50628 :056,057,0 50634 :052,053,0 50640 :048,049,0 50646 :054 055 0	48,049,050,051,251 54,055,056,057,017 50,051,052,053,255 56,057,048,049,021	51168 51174 5118Ø	:013,018,065,082,067,072,029 :073,086,069,032,068,082,128 :073,086,069,013,013,000,234
50100 50106 50112 50118	:1/0,141,012,015,141,024,159 :015,141,150,007,165,250,134 :032,175,012,165,169,141,106 :014,015,141,026,015,141,026 :189,007,165,170,141,015,111 :015,141,027,015,141,190,215	50628 :056,057,0 50634 :052,053,0 50640 :048,049,0 50646 :054,055,0 50652 :050 051,0	48,049,050,051,251 54,055,056,057,017 50,051,052,053,255 56,057,048,049,021 52,053,013,202	51168 51174 5118Ø	:013,018,065,082,067,072,029 :073,086,069,032,068,082,128 :073,086,069,013,013,000,234

Atari Color Mixing

Karl E. Wiegers

This informative tutorial demonstrates the principles of color mixing on Atari 400/800, XL, and XE computers.

Advertisements for home computers often tout the number of different colors that a particular machine can produce. But little is said about how these colors are generated on your TV or monitor screen. Knowing some theory behind these techniques can help you produce more colorful graphics displays.

Atari computers manufactured after early 1982 can generate 256 color variations, based on 16 different hues which each can have 16 luminances (brightnesses). Ataris made before early 1982 can display only 8 luminances per hue for a total of 128 colors, but can be upgraded by replacing the CTIA chip with a GTIA chip. Atari colors are represented by a number from 0-255 using this formula: color number = hue number * 16 + luminance number.

The "Atari Color Mixing" program listed below demonstrates *additive* color mixing and lets you try your hand at *subtractive* color mixing as well. We'll explain these terms in detail in a moment. For now, enter and save Color Mixing, then run it. The program is quite simple and contains all the instructions you need. Just follow the prompts and refer to the rest of this article for additional information.

The colors may look better if you adjust your TV's brightness control somewhat higher than usual. The exact hues may also vary depending on the tint setting. Adjust the tint for good green and red,

and the other colors should be pretty close.

Additive Color Mixing

As every child discovers when painting with watercolors, the three primary colors—red, green, and blue—can be added together in various combinations to make many different colors. Thus, red, green, and blue are known as the additive primary colors.

When primary colors are combined, new colors appear. White light is a balanced combination of red, green, and blue light. Equal intensities of blue and green light produce a greenish-blue color called cyan. Red and blue light mix to create magenta, a reddish-purple. And, believe it or not, mixing red and green light together produces yellow. Many more colors can be produced if the primaries are of different intensities. For instance, combining a given intensity of green with twice that intensity of red is equivalent to yellow plus red, or orange.

Additive color mixing works with pigments as well as lights. However, pigment mixing often results in different colors than those described above. For example, mixing red and green paints usually produces brown, not yellow.

In fact, the brown color really is a yellow. But red and green pigments usually have far less intensity than red and green lights. Besides having a particular hue (light frequency), a color can have different levels of *luminance* (intensity). The effect we usually call color is actually the combined effects of hue and luminance. Because red and green pigments are quite dark

(have little luminance), mixing them together produces the dark yellow we commonly call brown.

A color TV or monitor creates different colors by the additive process using colored light sources. The screens of color TV tubes contain thousands of tiny red, green, and blue dots (phosphors) which glow when struck by electrons from a gun at the back of the tube. If you examine a color screen with a magnifying glass, you'll see individual red, green, and blue phosphors. At normal viewing distances the colored dots merge together and create additive colors. For instance, adjacent red and blue dots look like magenta. When no phosphors are lit, the result is black.

Subtractive Color Mixing

Recall that if red and blue lights are combined, the resulting color is magenta. There's also another way to produce magenta—you can shine white light through a magentacolored filter. White light contains all the primary colors, but the filter absorbs the green light, allowing only the red and blue light to pass. In other words, a magenta filter subtracts or blocks out green light. If you place a green filter and a magenta filter in front of a white light source, all light should be blocked out: The green filter blocks red and blue, and the magenta filter blocks green. The final result is black. For this reason, green and magenta are termed complementary colors (magenta is also sometimes called minus green).

Similar logic applies to the other primary colors: A cyan (blue + green) filter subtracts red light, and a yellow (red + green) filter subtracts blue light. Red and cyan (minus red) are complementary, as are blue and yellow (minus blue).

Cyan, magenta, and yellow are called subtractive primary colors. Just like the additive primaries (red, green, blue), the subtractive primaries can be mixed into virtually any combination of hue and luminance. But the process is reversed. Additive color mixing works by sending specific colors to your eye, while the subtractive process removes specific colors from a color-rich light source, leaving only complementary colors. Most color photographic systems are subtractive, using cyan, magenta, and yellow film dyes.

Color Mixing uses color numbers which—on my system—come closest to producing the six additive and subtractive primary colors (see lines 270-280). Of course, colors can vary greatly from one TV or monitor to the next. Cyan is a little difficult to display; my choice for cyan would look a bit greener, but my computer won't cooperate. The blue is also darker than you might expect, but blue in a color mixing sense is actually quite dark.

Additional Techniques

Note that each display screen in Color Mixing uses several different Atari graphics modes. The heading is displayed in graphics mode 1, other text is in mode 0, and the color squares are drawn in mode 3. Mixed-mode screens like this are created by modifying the computer's display list, a set of instructions which tells the computer how to put data on the screen. The Color Mixing program modifies display lists in lines 210, 1010-1020, 1210-1240, and 4010-4020. (You can read more about modifying display lists in COMPUTE!'s First Book of Atari and COMPUTE!'s First Book of Atari Graphics.)

Atari computers can ordinarily display up to five colors at a time. But some of the screens in Color Mixing show nine colors. This is accomplished with a display list interrupt (DLI). A DLI is a short machine language routine that, among other things, can change the contents of color registers while the computer is displaying each video frame. This technique lets you cre- 11 140 ST=ADR (D2\$): GOSUB 400

ate graphics with extra colors on various parts of the screen. (For more information, consult De Re Atari, published by Atari, Inc.)

The program's colored boxes are drawn in graphics mode 3 using character strings for graphics storage (lines 310-320). Here is the text equivalent of this display:

AAAAA CCCCC	BBBBB
AAAAA CCCCC	BBBBB
AAAAA CCCCC	BBBBB
AAAAA CCCCC	BBBBB

When the computer displays a string in a nontext graphics mode with the PRINT#6 statement, the letters A, B, and C show up as different-colored pixels. The letter A appears as a pixel with the color taken from color register 0; the letter B uses color register 1; and the letter C uses register 2. A SET-COLOR or POKE statement which changes the value in color register 0, for example, would change the color of the A box. This technique is used in lines 4170 and 4210-4220. Line 4270 erases the boxes by setting all their colors to black. As Color Mixing demonstrates, it's far more convenient to store these graphics in strings than to use PLOT, DRAWTO, or XIO fill statements.

Atari Color Mixing

Please refer to "COMPUTEI's Guide to Typing In Programs" before entering this listing.

AJ	10	D	I	М	1	A	\$	(5)	,	в	\$	<	5)	,	С	\$	(5)	,
		D	1	\$	(6	ø)	,	D	2	\$	(1	8	ø)	,	K	0	L	0	R
		S	(6	,	6)	,	B	L	\$	(3	5)								
KH	15	D	I	М	1	R	E	D	\$	(1)	,	G	R	E	E	N	\$	(1)	,
		B	L	UI	E	\$	(1)	,	C	Y	A	N	\$	(1)		M	A	G	Е
		N	т	A	\$	(1)	,	Y	E	L	L	0	W	\$	(1)	,	B	L	A
		C	ĸ	\$	(1)																
GJ	20	A	\$	=	"	A	A	A	A	A	н	1	в	\$	=	"	B	В	B	B	B		:
		C	\$	-	"	С	С	C	C	C													
IB	25	B	L	\$	(1)	=	C	H	R	\$	(3	2)	:	B	L	\$	(3	5
)	=	B	-	\$:	B	L	\$	(2)	=	в	L	\$						
FB	30	G	R	A	PI	н	I	C	S		ø	:	?		:	?			٥	N	E		М
		D	М	EI	N	Т																	
HB	40	F	D	R		I	=	1		Т	٥		3	ø	:	R	E	A	D		A	:	D
		1	\$	(I	,	I)	=	С	H	R	\$	(A)	:	N	E	X	Т		I
		1	D	1 :	\$	(3	1)	=	D	1	\$										
FM	5Ø	D	A	T	A		7	2	,	1	3	8	,	7	2	9	1	6	9	,	6	6	
		1	6	2	,	1	8	ø	,	1	4	1		1	ø	9	2	1	2	,	1	4	1
			2	3	, :	2	ø	8															
LI	60	D	A	T	A		1	4	2	,	2	4	,	2	ø	8	,	1	6	9	,	ø	,
		1	4	1	, 1	ø	,	2	,	1	6	9	,	ø	,	1	4	1	,	1	,	2	
DB	7Ø	D	A	TI	A		1	ø	4	,	1	7	ø	,	1	ø	4	,	6	4			
CB	BØ	D	1	\$	(3	5	,	3	5)	=	С	н	R	\$	(1	ø)	2	D	1
		\$	(3	7	,	3	7)	=	C	н	R	\$	(ø)						
ĦK	90	D	2	\$:	=	D	1	\$:	D	2	\$	(6	1)	=	D	1	\$:	D	2
		\$	(1:	2	1)	-	D	1	\$												
IE	100	1	s	T٠	-	A	D	R	(D	1	\$)	2	G	0	S	υ	B		4	ø	ø
OK	110		D	1 1	\$	(4	8	,	4	8)	=	C	н	R	\$	(L	٥)	:	D
			1	\$	(5	3		5	3)	-	С	н	R	\$	(н	I)			
PK	120		S	T	= ;	5	Т	+	3	ø	:	G	0	S	U	B		4	ø	ø			
DA	130		D	1 :	8	(1	8	,	1	8)	=	C	H	R	\$	(L	0)	:	D
			1	\$	(2	3		2	3)	=	C	H	R	\$	(н	I)			
								•															

_	
LN 150 1	D2\$(168,168)=CHR\$(LD)
EL 160	FOR I=18 TO 138 STEP
	30
CP 180 1	D2s(I.I)=CHRs(L0):D2s
CC 190 1	(I+5, I+5) = CHR\$(HI)
HI 200 1	D2\$(132,132)=CHR\$(22)
HF 21Ø 1	DL=PEEK (56Ø) +256*PEEK
LB 220 1	RESTORE 240:FOR I=1 T
BJ 23Ø	READ A:KOLORS(I,J)=A:
NC 24Ø 1	DATA 66,26,86,4,82,4Ø
NE 25Ø	DATA 86,116,146,150,1
1	02,4,4,164,150,116,14 6,180
ND 260	DATA 82,4,102,146,86, 66,40,200,4,180,66,26
DK 27Ø	RED\$=CHR\$(66):GREEN\$=
	CHR\$(180):BLUE\$=CHR\$(146)
BD 28Ø	CYAN\$=CHR\$(116):MAGEN
	CHR\$(26):BLACK\$=CHR\$(
10 200	Ø) 6010 2000
NP 300	POKE 87.3:605UB 500
NB 31Ø	FOR I=Ø TO 3: POSITION
	5, I:? #6; A\$: POSITION
	16, I:? #6; C\$
DC 320	POSITION 31,1:7 #6;8%
PL 350	POKE 87, Ø:GOSUB 500:R
6J 4ØØ	HI=INT(ST/256):LO=ST-
JH 500	HMEM=256*HMEM+LMEM+BY
EI 51Ø 1	LMEM=HMEM-256*INT(HME
N 520	M/256)
NF 53Ø	POKE 88, LMEM: POKE 89,
NC LOG	HMEM:RETURN
	#1,A:CLOSE #1:RETURN
FD 1000	POKE 559,0:POKE 752, 1
NP 1Ø1Ø	POKE DL+3,70:POKE DL +6,134:POKE DL+14,13
AB 1020	FOR I=7 TO 13:POKE D
00 1030	L+1,8:NEXT I ST=ADR(D1\$):GOSUB 40
	Ø:POKE 512,LO:POKE 5
EJ 1Ø4Ø	LMEM=PEEK (88) : HMEM=P
	EEK (89) : POKE 710, 0: P OKE 54286, 192: RETURN
HI 1200	POKE 559, Ø: POKE 752,
KD 1210	1: RESTORE 1220
	:POKE DL+I, A:NEXT I
88 1 2 2 0	,2,130,8,8,8
01 1230	DATA 136,2,2,130,8,8 .8,136
HH 124Ø	POKE DL+3,70
1220	0:POKE 512,LO:POKE 5
	13,HI
EN 126Ø	LMEM=PEEK(88):HMEM=P
	EEK(89):POKE 710,0:P OKE 54286,192:RETURN
BP 2000	GRAPHICS Ø: GOSUB 100
	711.40

KO 2010	D1\$(5,5)=GREEN\$:D1\$(
	4
03 2020	UB 500
BA 210310	PUSITIUN 6,0:7 #6;"E
	(3 SPACES) primary cc lors""
CB 2Ø4Ø	POKE 87,3:BYTE=40:GO SUB 500
MF 2050	FOR I=2 TO 5:POSITIO
	ON 17, I:? #6; B\$: POSI
	TION 30, I:? #6;C\$:NE XT I
CE 2060	POKE 87,0:BYTE=80:GO SUB 500
AA 2Ø7Ø	POSITION 5,0:? "BLUE (8 SPACES)GREEN
NR 20 PA	(9 SPACES)RED"
LD 2090	? "These are the CDE
	lors. The eye sees t
6L 2100	he combination" ? "of blue, green, a
	nd red as white.":? "Pairs of these prim
112110	aries are"
NI ZI I D	colors, the":? "EUDO
	rs."
BK 212Ø	URI TO GO ON, ESTE TO
LE 2130	QUIT"; GOSUB 600:IF A=155 T
P0 2140	HEN 2500 IF A=27 THEN GRAPHIC
W 2150	S Ø: END
C6 25ØØ	GRAPHICS Ø: GOSUB 120
-	711,40
FH 2030	\$(7,7)=RED\$;D2\$(65,6
EL 254Ø	D2\$(67,67)=GREEN\$:D2
FD 255Ø	\$ (125,125) = RED\$ D2\$ (95,95) = YELLOW\$:D
DC 256Ø	2\$(127,127)=GREEN\$ POKE 559,34
PD 257Ø	POKE 87,1:BYTE=0:GOS
JK 258Ø	POSITION 3, Ø:? #6; "E
EE 259Ø	BYTE=40:GOSUB 300:GO
11 2600	POSITION 5,1:? #6; "B
	4 SPACES RED
	<pre>{5 SPACES}= {4 SPACES}MAGENTA"</pre>
HL 261Ø	BYTE=120:GOSUB 300:B
E0 262Ø	POSITION 5,1:? #6; "B
	(3 SPACES) GREEN
	(5 SPACES)CYAN"
HN 263Ø	BYTE=120:GOSUB 300:B YTE=40:GOSUB 350
LF 264Ø	POSITION 6,1:? #6;"R ED(3 SPACES)+
	(3 SPACES) GREEN
	(5 SPACES) YELLOW"
18 2660	ET TO GO ON, ESE TO
LJ 267Ø	REVIEW"; GOSUB 600:IF A=155 T
	HEN 3000

NH 2480	TE A=27 THEN 2000
N1 2400	COTO 2474
NJ 2690	
UN 3000	GRAPHICS Ø: GOSUB 100
	Ø: POKE 708, 26: POKE 7
	11,40
11 3010	D1\$(5,5)=MAGENTA\$:D1
	\$ (7. 7) = CVANE . DOVE FE
	STATISTIC THRE STORE SS
	7,34
0K 3Ø2Ø	POKE 87,1:BYTE=Ø:GOS
	UB 500
PC 3030	POSITION 5.0:? #6:"E
	TISTET # # . 7 # 4 . "
	AT EBACEES THE
	13 SPACESTIME EIN ALL
	LEO MESHI"
CC 3Ø4Ø	POKE 87,3:BYTE=40:GO
	SUB 500
M6 3Ø5Ø	FOR I=2 TO 5: POSITIO
	N 5. I: 7 #A: AS: POSITI
	ON 17 1.7 #4.84.POST
	TION 70 1.0 #(.04.15
	11UN 30,1:? #0;L\$:NE
	TOKE OF ALOUTE-DAL OF
1 3060	FUKE 87, 0: BYIE=80:60
	SUB 500
JA 3070	POSITION 4, Ø:? "YELL
	DW(6 SPACES) MAGENTA
	(P SPACESSCYAN)
	DODITION C A
NL 3080	PUSITION 2,4
11 3090	? "These are the EUE
	TRACTIVE PRIMARY": ?
	"colors, A vellow fi
	lter subtracte"
11 - 1	a subtracts
11 3100	The blue componen
	t out of white":? "1
	ight, only passing t
	he red and"
FC 3110	? "oreen components
	Vallay and bluelle?
	Terrow and Diue":?
	"are thus called EC
	MPLEMENTARY COLORS, "
KK 312Ø	POSITION 5,13:? "113
and a started	THEY TO GO ON. FATE TO
	REVIEW".
10 7 1 70	CORUD LAG. IS ALLES T
18 31 310	GUSUB 600:1F A=155 T
	HEN 3500
DE 314Ø	IF A=27 THEN 2500
HJ 315Ø	GOTO 313Ø
CE 3500	BRAPHICS A. BOSUR 124
	A. DOVE 740 114-DOVE
	DIFUKE /08,116:PUKE
	/11,40
0L 353Ø	D2\$(5,5)=BLUE\$:D2\$(7
	,7)=MAGENTA\$: D2\$ (65.
	65) = GREENS
NI TRAC	D24 (47 47) - VELLOWARD
NU 33410	DZP(D/, B/)=TELLUWSID
	2\$(125,125)=MAGENTA\$
LO 355Ø	D2\$(95,95)=YELLOW\$:D
	2\$(127,127)=RED\$
00 3540	POKE 559 TA
00 3000	POKE 037,34
PE 357Ø	PUKE 87,1:BYTE=0:GOS
	UB 500
HL 358Ø	POSITION 1, Ø:? #6: "E
C. C. C. C. C.	ubtractive mixing"
FF 3500	BYTE=40. BOSUR 300. CO
1 3370	CUD 754
NJ 3600	PUSITION 5,1:? #6;"C
	YAN (3 SPACES) + MAGE
	NTA(4 SPACES)=
	(4 SPACES) BLUE"
	BYTE=120. COCUP 300. P
HU 2016	BTIE-120:00508 SUD:B
	YIE=40:00SUB 350
AD 3620	POSITION 5,1:? #6;"C
	YAN (3 SPACES) +
	(3 SPACES) YELLOW
	IA SPACEST-
	(4 SPALES)=
	{4 SPACES} GREEN"
40 3430	POKE 87 3. BYTE-124.0
HU 3030	FURE DI, SIBTLE=12010
	USUB 500: FUR I=0 TO
	3
BN 3634	POSITION 5.1:? #6:A\$
	POSITION 14. 1.7 #4.
	RE. PORTTION 74 T-O
	B#1FUSITION 31,117 #
	6;C\$:NEXT I
PL 3638	BYTE=40:GOSUB 350
CONTRACTOR OF A STATE	DOCTTION A 1.0 HA.IM
EA 3640	FUSILIUN 4.11/ BOI M

1	
	AGENTA + YELLOW
	(5 SPACES) RED"
10 3660	POSITION 5.3:? "RET
	INT TO GO ON. FATE TO
	REVIEW":
LL 3670	GOSUB 600: IF A=155 T
	HEN 4000
DJ 3680	IF A=27 THEN 3000
NL 3690	GOTO 367Ø
HA 4000	GRAPHICS Ø: GOSUB 100
	Ø
PF 4010	FOR I=6 TO 8:POKE DL
	+I,6:NEXT I:POKE DL+
	9,134
HP 4020	FOR I=10 TO 14:POKE
	DL+I.8:NEXT I:POKE D
	L+15,136
10 4030	POKE 711, 40: POKE 708
	,ø
IC 4Ø4Ø	D1\$(5,5)=BLACK\$:D1\$(
	7,7)=BLACK\$
CO 4Ø5Ø	POKE 559,34
0P 4060	POKE 87, 1: BYTE=0: GOS
	UB 500
PD 4070	POSITION 2,1:? #6;"E
	Ubtractive color":PO
	SITION 3,2:? #6; "THE
	ing practice"
H0 4080	BYTE=100:GOSUB 300:B
	YTE=60:GOSUB 350
HH 4090	POSITION 12, Ø:? #6;"
	+":POSITION 24, Ø:? #
	6; "="
0J 41ØØ	POSITION 9,4:? #6;"1
	-RED (7 SPACES) 4-CYAN
FF 411Ø	POSITION 9,5:? #6;"2
	-GREEN(5 SPACES)5-MA
	GENTA"
OP 4120	POSITION 9,6:? #6;"3
	-BLUE (6 SPACES) 6-YEL
	LOW"
KC 414Ø	POSITION 2,9:? #6;"E
	NTER A COLOR NUMBER:
	";
114145	505UB 400-C1=0-48
11 4150	TE CICL OR CINA THEN
00 4150	2 CHR\$ (253) GOTO 4
	145
FI 4170	2 #4. C1. POKE 709 KOL
	DRS(C1 C1) POSITION
	7.0:2 #4:01
N6 4180	POSITION 2. 10.2 #4."
10 4100	MIX IT WITH COLOR NU
	MBER: ".
K0 4185	605UB 600: C2=4-48
KD 4190	IF C2<1 OR C2>6 THEN
	? CHR\$(253)::GOTO 4
	185
JD 421Ø	? #6;C2:D1\$(7.7)=CHR
	\$ (KOLORS (C2, C2)) : POS
	ITION 18, Ø:? #6:C2
BH 422Ø	D1\$(5,5)=CHR\$(KOLORS
	(C1,C2))
AK 4230	POSITION 6, 12:? #6:"
	REALURY TO DO MORE, F
	ETE TO QUIT"
L0 424Ø	GOSUB 600: IF A=155 T
	HEN 427Ø
AC 425Ø	IF A=27 THEN GRAPHIC
	S Ø:END
MP 4260	GOTO 424Ø
0L 427Ø	POKE 708,0:D1\$(5.5)=
1	BLACK\$: D1\$ (7.7) = BLAC
	K\$
01 4280	POSITION 7.0:? #6:"
	":POSITION 18.0:7 #4
	;" "
16 4300	FOR I=9 TO 12:POSITI
	ON 2, I:? #6: BL\$: NEXT
	I: GOTO 4140
Mousor: Escape Mode Cursor For The Apple IIc

J. Blake Lambert, Assistant Editor Tim Victor, Editorial Programmer

This short, fast utility makes it simple to use your Apple IIc mouse controller for editing in BASIC or the machine language monitor in escape mode.

Despite all the improvements Apple incorporated into the IIc, the screen editing features when using BASIC or the machine language monitor are not much better than those available on the IIe. Without an editing support package, it is difficult to copy and correct program lines. And there is no way to use the mouse controller to make editing easier.

In BASIC, usually you end up making corrections by just typing the incorrect line all over again. This wastes time and effort. The alternative is to use what is called *escape mode* editing.

"Mousor" makes using escape mode easy. By rolling the mouse over an area of the desk smaller than a 3×5 -inch index card, you can cursor (mousor) anywhere on the screen.

How To Use Mousor

To start mousing around with Mousor, type in and save the program below. It's a BASIC loader which creates the Mousor machine language routine in memory. (Note: Save the BASIC loader on disk before running it for the first time.) When you run Mousor, it automatically checks to see if you're using DOS 3.3 or ProDOS and then adjusts itself accordingly. When the BASIC prompt reappears, you'll have a mouse-driven escape mode cursor. If you don't understand escape mode editing, see the instructions below.

The mouse is trained to work like this:

1. Click the mouse button to activate escape mode.

2. While holding the button down, roll the mouse across the desk to move the escape mode cursor.

3. Release the mouse button to exit escape mode.

Mousor locks out keypresses while it is in escape mode, so if you want to use the escape editing functions (like ESC-E to erase the end of a line), press the ESC key.

Getting A Line Of BASIC

When you type a line of BASIC on the Apple IIc, a routine called GETLN puts the characters into a special area of memory called the input buffer. The first character on the line is stored at the start of the input buffer, and subsequent characters are added to the end of the buffer. This continues until you press the RETURN key to enter the line (with a few important exceptions). The computer clears the rest of the current screen line and stores the carriage return character into the input buffer to mark the end of the line.

When you make a mistake while entering the line, like typing the wrong character, it's easy to fix. For example, if you are entering a line such as 10 PRINT "HELLP" and notice you pressed P instead of O, you can press the left-arrow key (also called backspace) to back up and change the letter. Instead of storing the backspace in the buffer like other keypresses, GETLN treats it differently.

GETLN keeps track of the length of the input buffer by pointing to the end. When GETLN receives a backspace character, it lowers the value of the pointer by one. This removes the last character in the buffer, so all you need to do is continue typing.

If you don't notice your mistake until you've typed in several more characters, you can use the left- and right-arrow keys to make the correction. Press the backspace key until the cursor is on the letter you want to change. Type the correct letter, and then press the rightarrow key (also called retype) until the cursor returns to the end of the line.

Each time you press the retype key, the character currently under the cursor is added to the input buffer and the cursor is moved to the right. In effect, you have removed several characters from the buffer, changed the character you wanted to correct, and retrieved the rest of the characters one by one from the screen.

Now For The Tricky Stuff

Unfortunately, you can't always catch your typing errors before you press RETURN. Often, you don't even know there's a problem in a line until you've run the program. Since the retype key allows you to pick up characters from the screen and add them to the input buffer, it would be handy if you could copy most of the bad line and type only the characters you want to change. This requires a way to move the cursor around the screen without affecting the input buffer.

Pressing the ESC key puts the IIc into escape mode. In this mode, the arrow keys move the cursor but don't change the input buffer. The IIc indicates escape mode by displaying a different cursor—an inverse plus sign. To leave escape mode, press ESC again.

Suppose you want to edit the following line in escape mode:

100 PRINT "THIS IS A TEDT"

If the line is not on the screen, you'll need to LIST 100. Press ESC to enter escape mode and move the cursor up to the 1. At this point, the input buffer is empty. Press ESC again and use the retype key to place the cursor on the D. This enters all but the last three characters into the input buffer. Now type the letter S, and press retype twice, followed by RETURN. If you like, LIST 100 to verify the correction.

To edit the same line with Mousor, you would LIST the line, click the mouse button and drag the cursor to the 1, and release the mouse button. After this, follow the same editing procedure.

Mouse Moves

You can also use escape mode to grab pieces of program lines. Mousor is especially adept at this, since movement is so easy and quick. Just keep in mind that when the mouse button is down no characters are added to the buffer.

To copy a line, first LIST it. Then enter the number for the new line you want to create, click the mouse button and drag the escape mode cursor to just beyond the original line number, and release the button. Copy the line by pressing the right-arrow key until you reach the last character, and then press RETURN.

Inserting is another useful technique. LIST the line first, then

mousor (click and drag the escape mode cursor) to the beginning of the line number. Release the mouse button and right-arrow across the line until you reach the point where you want to insert characters. Press the mouse button and mousor to a blank line on the screen, then release the button and type the insert characters. Click and drag up to the listed line again, release the button, and right-arrow to the end. After making any changes, don't forget to press the RETURN key to enter them.

Mousor For Apple IIc

Please refer to "COMPUTEI's Guide to Typing In Programs" before entering this listing.

- DE 10/ IF PEEK (191 * 256) = 76 T HEN GOSUB 40: GOSUB 50: GO TO 30
- AC 20 GOSUB 50: GOSUB 40
- 25 30 FOR I = 11 TO 207: READ A: POKE I + 768, A: NEXT : CA LL 768: END
- 69 40 FOR I = 0 TO 10: READ A: P OKE I + 768,A: NEXT : RETU RN
- 13 50 FOR I = 0 TO 10: READ A: N EXT : RETURN
- E7 60 DATA 216,169,67,141,50,190 4E 70 DATA 169,3,141,51,190

BE	8ø	DATA	169, 67, 133, 56, 169, 3
7B	9Ø	DATA	133, 57, 32, 234, 3
F7	100	DATA	120, 162, 196, 160, 64, 3
		2	
77	110	DATA	28, 196, 169, Ø, 141, 12Ø
70	120	DATA	4,141,120,5,141,248
EA	130	DATA	5,169,8,141,248,4
ØF	140	DATA	169, Ø, 162, 196, 160, 64
4C	15Ø	DATA	32, 176, 196, 169, 1, 162
62	160	DATA	196, 32, 176, 196, 162, 1
		96	
EF	17Ø	DATA	32, 132, 196, 169, 1, 162
52	180	DATA	196, 160, 64, 32, 61, 196
D6	190	DATA	88, 96, 145, 40, 32, 76
66	200	DATA	204, 44, 99, 192, 16, 8
51	210	DATA	32, 112, 204, 16, 246, 76
28	220	DATA	37, 253, 218, 90, 72, 169
74	230	DATA	4, 141, 124, 4, 141, 252
FC	240	DATA	4, 32, 187, 3, 32, 195
FB	250	DATA	3,44,99,192,16,9
6A	260	DATA	104, 32, 179, 195, 122, 2
		5Ø	
B2	27Ø	DATA	76, 69, 3, 173, 124, 4
B4	280	DATA	240,7,201,8,144,25
5C	290	DATA	162, 156, 44, 162, 136, 1
		Ø4	
E5	300	DATA	32, 179, 195, 138, 32, 88
3A	310	DATA	205, 32, 195, 3, 72, 169
A3	320	DATA	4, 141, 124, 4, 32, 187
40	330	DATA	3, 173, 252, 4, 240, 7
DA	340	DATA	201,8,144,25,162,138
5F	350	DATA	44, 162, 159, 104, 32, 17
		9	
82	360	DATA	195, 138, 32, 88, 205, 32
ØB	37Ø	DATA	195, 3, 72, 169, 4, 141
C7	380	DATA	252, 4, 32, 187, 3, 76
1F	390	DATA	102, 3, 162, 196, 160, 64
69	400	DATA	32, 107, 196, 96, 32, 29
69	410	DATA	204, 72, 41, 128, 73, 171
15	420	DATA	32, 179, 195, 104, 96 0

Commodore 64 Headliner

Create attention-getting headlines and titles with this oversized alphabet for the Commodore 64.

Nearly every program uses titles or headlines of some sort, and you ordinarily want titles to look as impressive as possible. But the standard Commodore character set doesn't permit much variety. You can use different character colors or print in reverse video, but the letters are still pretty small. "Commodore 64 Headliner" lets you create truly striking titles and headlines with an alphabet that's four times bigger than normal.

Enter and save Headliner from the listing below, then run it. After a short pause to form the new char-

Robert F. Lambiase

acters, the program prints the alphabet in giant, quadruple-size characters. The letters can be any color, and the standard-size alphabet is available, too. The only thing you give up are reverse video characters, since Headliner redefines them as large characters.

Using Headliner

Headliner is easy to incorporate in your own programs. The first step is to include lines 100–350 (they can be renumbered, of course) to create the new character set. The program begins storing the new character definitions at memory location 12288. The statement POKE 53272,29 (see line 240) tells the computer to look at this memory area for character definition data. Use POKE 53272,21 to switch back

to normal characters.

After defining the new characters, Headliner prints the expanded alphabet (lines 400–405) and a title (lines 410–430). Whenever a string of large characters is to be printed, the characters are defined as a string (X\$). Then two important variables (SL and CC) are defined. Finally, the statement GOSUB 500 calls the subroutine that puts the big characters on the screen. The subroutine analyzes each character in X\$; if it is not a space character, its pattern is POKEd into screen memory.

The variable SL sets the position of the large characters on your screen. The 64's screen is divided into 25 rows and 40 columns, giving a total of 1,000 different locations. Each screen memory location has a different address, and they are numbered in order, beginning at the upper-left corner of the screen. The upper-left screen position is location 1024; the next location to the right is 1025, and so on. Color memory is a second 1,000byte memory area that corresponds to screen memory. By POKEing the right number into color memory, you can control the color of any screen memory location. Your Commodore 64 User's Guide has maps that show the numbers for every screen memory and color memory location, as well as a list of all the color numbers.

To place large characters on the screen, find the location you want using the screen memory map in your user's guide, then set SL to that value. The upper-left corner of the first large character appears at the location defined by SL, and the others follow in order. For example, to start printing large characters at the upper-left corner of the screen, use the statement SL = 1024.



Note that the title above the alphabet uses a large character to begin a line of standard characters, somewhat like a super-capital letter. Line 420 of the program sets the computer to start printing again at the next location *after* the last expanded character.

Pick Your Colors

The variable CC sets the color of the large characters using the color numbers listed in your user's guide. Line 410 of Headliner uses the statement CC=3 to print in cyan. Use the statement CC=1 to print in white, and so on.

There may be times when you want to print large characters in the current character color. Line 400 of Headliner does this with the statement CC = PEEK(646). Location 646 always contains the current color number for PRINTing characters.

The 64 actually has two alternate character sets: One is used in uppercase/graphics mode, and the other is used in lowercase/uppercase mode. You can switch from one mode to another by pressing SHIFT-COMMODORE. Since Headliner works only in uppercase/ graphics mode, you should disable the SHIFT-COMMODORE key combination to prevent the user from accidentally destroying the display. To do this, insert PRINT CHR\$(8) at the beginning of your program. When the program ends, type PRINT CHR\$(9) to restore things to normal.

Building Giant Characters

Each large character is actually four redefined characters placed together. (To see this more clearly, type POKE 53272,21 and press RE-TURN after the program has run.) The standard Commodore 64 character set contains 256 characters, numbered from 0–255. Characters 0–127 are the "normal" characters and characters 128–255 are the same characters in reverse video. Since each character definition takes eight bytes, a full set of character definitions requires 2,048 (8*256) bytes.

The first step in redefining characters is to copy the standard character set from ROM (Read Only Memory) into RAM (Random Access Memory) where it can be altered. The program does this in lines 200–240. The new character set begins at location 12288. Since we only want characters 0–127 from the standard set, only those character definitions are copied.

Next the program POKEs the expanded character definitions into the memory area that would otherwise store reverse video character data (see lines 300–350). The bit pattern of each standard character is mapped into a four-charactersized memory area, using conversion values stored in the T() array.

Since each large character definition takes four times the memory of a standard definition, we have room for a maximum of 32 (128/4) expanded definitions. That's enough for 26 letters, but not enough space to hold ten numeral definitions, too. However, you could squeeze in six more characters—perhaps punctuation or other symbols.

By sacrificing all the standard characters, you can get as many as 64 large characters—but remember to define a space character so you can still clear the screen. The *Commodore 64 Programmer's Reference Guide* contains much more information about using redefined characters.

Headliner

Please refer to "COMPUTEI's Guide to Typing In Programs" before entering this listing.

LØØ	DIMT(15):POKE53281,Ø:POKE5
	3280,0:PRINICHR9(8):0-5427
110	PORE646,1:FORJ=01013:READ1
	(J):NEXT :rem 93
120	DATA 0,3,12,15,48,51,60,63
	,192,195,204,207,240,243,2
	52,255 :rem 220
200	PRINTCHRS (147) TAB (125) DOW
	NLOADING THE CHARACTER SET
	":G=53248:GN=12288:rem 118
220	POKE 56333,12/:POKE1,51:FO
	R Q=0101023:POKEGN+Q,PEEK(
	G+Q):NEXT :rem 89
2410	PORE1, 55 PORE56535, 129 POR
	E532/2,29 :rem 190
300	PRINTCHRS (147) TAB(125) FOR
	MING THE LARGE CHARACTERS
	:POKE13312,0 :rem 15
320	FORR=010212STEP8:BI=12288+
224	R:BZ=13312+4°R :rem 19
330	-DEEK(D1+K+T)-N-D2+2*(K+T)
	=PEEK(BI+K+1):N=B2+2*(K+1)
240	+1 :rem 233
540	ND15)
250	DOKEN XI · DOKEN+1 XI · DOKEN+
550	16 X2 · POKEN+17 X2 · NEXTK . I
	R trem 72
360	PRINTCHRS(147) trem 20
100	XS="ABCDEFGHTJKLM":SL=1270
	+CC=PEEK(646) + GOSUB 500
	:rem 110
105	XS="NOPORSTUVWXYZ":SL=1350
100	:CC=PEEK(646):GOSUB500
	:rem 27
410	X\$="H":SI=1158:CC=3:GOSUB
	[SPACE] 500 :rem 62
120	NS=SL+40:POKE210,INT(NS/25
	6): POKE209, NS AND 255
	:rem 179
130	POKE646,7:PRINT"EADLINER":
	FORJ=1TO10:PRINT:NEXT:END
	:rem 70
5ØØ	FORP=1TOLEN(X\$):L=(ASC(MID
	\$(X\$,P,1))-64)*4+128:IFL=Ø
	THEN550 :rem 111
53Ø	POKESL+G,CC:POKESL+1+G,CC:
	POKESL+4Ø+G,CC:POKESL+41+G
	,CC :rem 137
540	POKESL, L: POKESL+1, L+2: POKE
	SL+40,L+1:POKESL+41,L+3
	:rem 241
50	SL=SL+2:NEXT:RETURN :rem 5
	Ô

Using The Commodore USR Function

Keith R. Bergerstock

The USR function provides a convenient way for BASIC programs to call machine language subroutines—and it's more versatile than the SYS statement. Although this article is oriented toward the Commodore 64, the general principles apply to all Commodore computers. A demonstration program shows how to add five new functions to Commodore 64 BASIC.

It's often overlooked, but the USR function is a powerful and convenient tool for accessing machine language (ML) routines from BASIC. In its simplest form, USR works just like the more familiar SYS command. SYS makes the computer halt BASIC program execution and jump to an ML routine at a specified address. When the ML routine is done, BASIC resumes what it was doing. SYS lets you jump anywhere in the computer's memory, to a system routine stored in Read Only Memory (ROM) or a user-written ML program stored in free memory.

To see an example on the Commodore 64, move the cursor to a blank line somewhere near the middle of the screen, type SYS 59626, and press RETURN. SYS 59626 jumps to the computer's ROM scrolling routine: The screen scrolls up and the blinking cursor reappears.

Although USR requires a little preparation, it's much easier to use after the preparation is done. Let's call the same scrolling routine with USR. Type the following line in direct mode (without a line number) and press RETURN.

POKE 785,234: POKE 786,232: A=USR(0)

The screen scrolls upward, just as it did when you typed SYS 59626. The POKEs set up the routine's address for USR. This method looks cumbersome, but the POKEs are needed only once. Afterward you can call the scrolling routine whenever you like, just by entering A=USR(0). Program 1 below contains a formula that automatically performs the correct POKEs to prepare any address for USR.

Like PEEK and other BASIC functions, USR must be followed by a value in parentheses. However, in the simplest case (when you just want to jump to an ML routine), the value and the preceding variable name are both irrelevant: You get the same result with A=USR(XYZ) or GG=USR(12345678). You can even use PRINT USR(X), though that usually prints something on the screen.

Parameter Passing

The real value of USR lies in its ability to pass parameters (values) back and forth between BASIC and machine language. To see how this works, type in and save Programs 1 and 2 below. Then run Program 1; it puts a short, multipurpose ML program in memory and sets up the USR *address vector* (a pair of memory locations that point to the ML routine).

The variable SA in line 10 defines the starting address of the ML routine. This ML program is relocatable, so you can put it elsewhere if you like. For instance, to put the routine at 49152, change line 10 so that SA=49152 and rerun Program 1.

The rest of line 10 converts the address into *low byte/high byte* format for the USR vector. Since 255 is the largest number any single memory location can hold, the

computer must use two adjacent locations to store addresses like 59626. Program 1 stores the high byte of the address in the variable HI% and the low byte in LO.

Line 20 POKEs LO and HI% into vector locations 785 and 786. You must always put the target address in these locations before using USR. The rest of Program 1 POKEs the ML into the computer's memory. To use this technique in your own programs, just duplicate the method shown in Program 1.

If you get an ?ILLEGAL QUANTITY error message when experimenting with USR, it probably means that you forgot to put a vector address in 785–786. When you turn the computer on, the vector in 785–786 points to 45640, the BASIC routine that prints that message.

USR works virtually the same on all Commodore computers; the only difference is the location of the USR vector. You'll find it at locations 1–2 on the VIC-20 and 812–813 on the Commodore Plus/4 and 16. The other vectors mentioned below also are located in different places on various machines.

Using USR

Program 1 provides five handy functions which you select by inserting a number from 0–4 in the parentheses after USR. For an illustration, plug a joystick in port 2, then load and run Program 2 after running Program 1 to install the ML. As you move the joystick, the program prints the joystick directions on the screen. To exit the program, press the fire button.

Line 50 of Program 2 does the important work. The statement

JV = USR(3) calls the ML routine and selects function 3 (read joystick). Each time the ML routine performs this function, it gives the variable JV a numeric value representing the joystick position. IV is 0 when the joystick is centered, 9 when the fire button is pressed, and so on.

Note that Program 2 passes information in both directions. The value in parentheses-USR(3)sends information to the ML routine (telling it to perform function 3). And the ML routine passes other information back in the form of a variable (IV).

The other four functions work in similar fashion. Function 4 returns the size of the BASIC program currently in memory. Whenever you want to know your program size, use the statements A = USR(4): PRINT A. Function 2 changes the screen background and border colors. To activate this function, use A = USR(C*256+2), replacing C with the number of the screen color you want (your 64 User's Guide lists the color numbers).

Function 1 reads the Y and N keys, returning the value of 1 when Y is pressed, and 2 when N is pressed. The ML routine waits until you press Y or N, ignoring all other keys. This function is useful in the common case where a program asks the user a Yes/No question. Combining USR with ON-GOTO or ON-GOSUB is a very efficient technique. For instance, type in and run the following program (make sure the ML routine is in memory):

10 PRINT"ENTER Y/N":ON USR(1) **GOSUB 100,200** 20 GOTO 10 100 PRINT"YES":RETURN 200 PRINT"NO":RETURN

Function 0 is similar to Function 1, but reads the eight special function keys. Enter and run this program to see how it works:

10 A=USR(0) 20 PRINT A: GOTO 10

In this case USR returns a number from 1–8 in the variable A. (But note that the numbers returned don't correspond directly to the function key numbers. Keys f1, f3, f5, and f7 return values 1-4 respectively, while the shifted keys, f2, f4, f6, and f8, return values 5-8.) In your own pro-

grams, of course, you can use any variable name you like; this function could also be used with ON-GOTO or ON-GOSUB to select as many as eight different options.

The Facts About FAC1

If you simply want to use the new functions provided by Program 1, you needn't read any further. If you're ready to write your own ML routines for USR, here are a few additional tips. First, when you pass a value from BASIC, the value is converted into a different number format (floating point) and placed in the computer's floating point accumulator (locations 98-101).

The floating point accumulator-usually called FAC1 to distinguish it from the secondary accumulator-is a special numberprocessing area used internally for many purposes. Since floating point numbers are quite difficult to handle, it's helpful to convert the floating point value into an integer (whole number) before using it in your ML routine. Fortunately, the 64 has built-in routines to convert floating point numbers to integers and vice versa. These routines can be accessed directly with JSR, or indirectly through the vectors in locations 3-4 and 5-6.

The routine at location 45482 (\$B1AA) converts a floating point number in FAC1 to an integer. Use this routine when passing a value from BASIC to ML. At the point where you want to retrieve the passed value, use JSR \$B1AA to do the conversion. The computer returns the low byte of the integer in the Y register and the high byte in the A register. If you'd rather use the vector, use LDA #\$4C: STA \$02: ISR \$0002.

Passing a value from ML back to BASIC often requires the opposite conversion. The routine at 45969 (\$B391) converts an integer to floating point format and stores the result in FAC1. At the point where you want to return to BASIC, load the low byte of your integer value in the Y register and the high byte in A. Then call the integer-tofloating point conversion routine with JSR \$B391: RTS (you can also compress these two instructions into JMP \$B391). The value is converted and stored in FAC1, and RTS returns you to BASIC. If you prefer to use the vector, JMP (\$0005) accomplishes the same thing.

Like other vectors, the vectors at 3-4 and 5-6 will presumably be safe to use even if the actual ROM addresses of the routines change after a ROM update. However, there's one danger in using them. Since BASIC never uses locations 2-6, many ML programmers use them as free zero page space. If your routine jumps through these vectors after some other ML program overwrites them, it may send the computer into never-never land.

Program 1: USR Loader For Commodore 64

1Ø	SA=53088:HI%=SA/256:LO=SA-H
	1%*256 :rem 23
20	POKE785, LO: POKE786, HI%: CK=Ø
	:rem 33
3Ø	READQ: IFQ>-1THENPOKESA,Q:SA
	=SA+1:CK=CK+0:GOT030
	:rem 213
40	TECK=14485 THENPRINT "OK" . NEW
10	rom 130
Ea	DETNEREDOD IN DAMA COMMENT
20	MICH STATEME
-	N15 :rem 121
60	DATA 169,0,133,198,169,76,1
	33,2,32,2,0,132,2 :rem 254
61	DATA 192,0,240,19,192,1,240
	,35,192,2,240,50 :rem 197
62	DATA 192,3,240,71,192,4,240
	,54,108,0,3,32,228 :rem 43
63	DATA 255,201,133,144,249,20
	1,141,176,245,56 :rem 218
64	DATA 233,132,168,169,0,108,
	5.0.32.228.255.201 :rem 51
65	DATA 89.240.8.201.78.208.24
	5.160.2.208.236 +rem 177
66	DATA 160.1.208.232.141.32.2
	08.141.33.208
67	DATA 169 Ø 168 108 5 Ø 56 1
01	65 45 229 43 168
69	DATA 165 46 229 44 169 5 6
00	172 @ 220 72 21
60	1/3,0,220,/3,31 :rem 102
69	DATA 41, 31, 168, 201, 3, 144, 12
	,136,201,8,144,/ :rem 204
10	DATA 136,201,16,144,2,160,9
	,169,0,108,5,0,-1 :rem 236
Pr	oaram 2: Joystick Demo
Ec	r Commodore 44
FU	r commodore 64
10	DATA NONE, UP, DOWN, LEFT, UP/L
	EFT :rem 98
20	DATA DOWN/LEFT.RIGHT.UP/RIG
	HT :rem 54
30	DATA DOWN / RICHT FIRE BUTTON
50	The bound Right Fire Bollon
10	PRIMOUDS (147) - POD T- (POD - DE
40	PRINICIRO(14/):FURD=0109:RE

1

2

3

XT

\$(JV)SP\$

70 IFE<20THEN50

60 IFJV=9THENE=E+1

:rem 73

:rem 44 :rem 93

:rem 109

O

ADA\$(J):SP\$=SP\$+CHR\$(32):NE

50 JV=USR(3):PRINTCHR\$(19)JV,A

Sound And Music On The Commodore 128 Part 1

Philip I. Nelson, Assistant Editor

The Commodore 128's advanced BASIC makes it easy and fun to create music or sound effects. Part 1 of this two-part series shows how to use the VOL, TEMPO, and ENVELOPE statements. Part 2 explores the FILTER, SOUND, and PLAY commands and includes three short tutorial programs.

If you've heard much about the new Commodore 128, you probably know that it contains a very powerful music maker: the SID (Sound Interface Device) chip, exactly as found in the Commodore 64 and still the best sound chip in any personal computer. The SID chip provides three independent voices (tone generators) for playing up to three notes at once, and four different waveforms to simulate virtually any sound.

Although both computers use the SID chip, the comparison ends there. Since Commodore 64 BASIC has no sound commands, even simple 64 sound effects require several POKE statements. The 128's BASIC eliminates the POKEs by adding six new music and sound commands: PLAY, SOUND, VOL, TEMPO, ENVELOPE, and FILTER.

Simplicity And Power

The PLAY command is both powerful and easy to use. If you have access to a 128, type in and run the

following one-line program. (The spaces make the statement more readable, but are not necessary.)

100 PLAY "C D E F G F E D C"

The 128 plays nine notes, going up the scale and down again. It would take a lot more work to play the same nine notes on the 64 you'd need at least three preliminary POKEs (to set the volume and sound envelope), plus four POKEs for each note (one to turn on the voice, two to set the pitch, and one to turn off the voice).

Interestingly, you can control the SID chip in 128 mode with the same POKEs as on the 64. That's usually a waste of time, since the 128's BASIC commands are more convenient than POKEs. However, 128 BASIC has certain limitations (SOUND statements can't use ring modulation or synchronization, for example). If you already know sound programming on the 64, you may still find uses for old-fashioned 64 programming techniques.

The PLAY command is so versatile that it's almost a minilanguage in itself. In addition to playing notes, you can insert rests, change octaves, choose any of ten different instrument voices, use filtering, and even play multivoice music. This month we'll stick to simple PLAY statements and examine the VOL, TEMPO, and ENVE-LOPE commands in detail. In Part 2, we'll look at the FILTER and SOUND commands and more advanced uses of PLAY.

VOL Means Volume

The 128's VOL command affects all three voices at once and accepts values from 0 (silence) to 15 (maximum). Add the following line to the example program and run it again:

10 VOL 15

Since the song plays at the same volume, it seems VOL had no effect. In fact, VOL just duplicated the *default* volume setting that PLAY uses when no volume is specified. When you turn on the 128, it establishes several music and sound settings (parameters) in advance. For instance, the PLAY statement above plays the notes at maximum volume with a sound envelope and waveform that simulate a piano. Other default sound parameters, too, remain in effect until you change them.

In many cases you can set the volume at the beginning of a program and leave it alone. However, gradual changes in volume can add to the dynamics of a song. Since drastic volume changes make the SID chip "pop," don't use VOL to turn individual notes on and off. (To hear the pop, turn up the volume on your monitor or TV set, enter the following line without a line number, and press RETURN: VOL 15:VOL 0:VOL 15.)

Unlike PLAY statements, SOUND statements (to be discussed in Part 2) default to a volume of 0. Before using SOUND you must always use VOL to set the volume to some nonzero value.

TEMPO

TEMPO is another command that affects all voices equally, setting the speed at which a song plays. TEM-PO is followed by one number in the range 0–255. The default tempo setting is 15, a pedestrian speed. Add the following line to the example program and run it again:

20 TEMPO 50

At a tempo of 50, the song plays much faster. Try several different TEMPO values in line 20. As you'll find, the highest tempos are exceedingly fast—too speedy for playing whole songs, but handy for simulating trills and grace notes. Change the TEMPO value back to 15 when you're done experimenting with line 20.

Don't confuse tempo—the overall speed of the music—with the individual *duration* of each note (quarter note, sixteenth, etc.). In conventional music a quarter note lasts one "beat," an eighth note lasts one-half beat, and so on. Tempo defines how many beats are played in a minute. At faster tempos every note plays faster, but quarter notes still last twice as long as eighth notes The default note duration for PLAY is a quarter note.

A Built-In Orchestra

The ENVELOPE command is more versatile than VOL or TEMPO. It is used to create customized instrument sounds for your songs. ENVE-LOPE takes the following general form:

ENVELOPE i, a, d, s, r, w, p

In the above example, *i* stands for the *instrument number*, *a* for the *attack rate*, *d* for *decay rate*, *s* for *sustain rate*, *r* for *release rate*, *w* for *waveform*, and *p* for *pulsewidth*. Naturally, in a program these letters are replaced with appropriate numbers.

The first number in an ENVE-LOPE statement chooses one of the 128's *instrument* voices. There are ten predefined instruments, numbered 0–9 as shown here:

Instrument	ENVELOPE #		
Piano	0		
Accordion	1		
Calliope	2		
Drum	3		
Flute	4		
Guitar	5		

Harpsichord	
Organ	
Trumpet	
Xylophone	

Since PLAY commands use the same instrument numbers, you'll want to become familiar with this list. To pick an instrument within PLAY, add a T (for tune) followed by the desired instrument number. For instance, PLAY "T5 C D T3 E F" selects instrument 5 (guitar) and plays notes C and D, then selects instrument 3 (drum) and plays notes E and F. The same numbering scheme identifies customized instruments, as you'll see in a moment. The default instrument for PLAY statements is instrument 0 (piano); if you don't specify an instrument, PLAY always produces a piano sound.

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Sound Envelopes

To create new instrument sounds, you'll need to learn about sound envelopes and waveforms. Every natural sound has a distinctive *envelope* or sound pattern. Consider the difference between a snare drum and a violin. Drum sounds begin and end very sharply. The drumhead starts vibrating the instant you strike it, and fades quickly. Violin sounds start out more softly, as the string gradually picks up vibrations from the bow, and fade softly as the vibration dissipates.

The 128 defines different sound envelopes in terms of four values: attack, decay, sustain, and release (ADSR). The attack value defines how quickly the sound rises from silence to its peak volume. Decay defines how quickly the sound fades from peak volume to the volume at which it will be sustained (held). Sustain sets the volume level for the sound's main duration. Release defines how quickly the sound fades from its sustained volume back to silence again. Figure 1 illustrates a typical sound envelope.

In ENVELOPE statements, the four numbers after the instrument number define the ADSR envelope. ADSR numbers can range from 0-15.

Waveforms

ENVELOPE also lets you pick different *waveforms*. Each of the SID chip's three voices can produce four different waveforms, diagrammed in Figure 2. The *triangle* waveform (used for the flute, instrument 4) is soft and rich. The *sawtooth* wave (used for the guitar, instrument 5) creates a louder, harsher sound.

The *pulse* waveform (used for the organ, instrument 7) is the most versatile of all. It's louder than the triangle wave and can be adjusted to make sounds that are rich and full or thin and faint. The *noise* waveform (used for the drum, instrument 3) is a random mish-mash of frequencies that make a hissing or rushing sound. ENVELOPE uses the following waveform numbers:

Number Waveform

0	Triangle
1	Sawtooth
2	Pulse
3	Noise
4	Ring Modulation

Ring modulation is a special effect, different from the other waveforms. The SID chip creates ring modulation by combining the frequencies of two voices into one complex sound. Note that ENVE-LOPE cannot use *synchronization*, another SID effect familiar to 64 programmers.

Finally, ENVELOPE lets you choose different pulsewidth values for the pulse waveform (2). The pulsewidth number can range from 0-4095. Look again at the pulse wave diagram in Figure 2. The top portion of each wave is wider than the bottom portion. The pulsewidth value defines the ratio between these two parts of the wave. Medium pulsewidth values (roughly from 1000-3000) produce fairly symmetrical waves and full, solid tones. Very small or very large pulsewidth values produce assymetrical waves and thin, hollow tones.

ENVELOPE With PLAY

To see what ENVELOPE can do, add line 30 to the example program and insert T1 in line 100 as shown below:

30 ENVELOPE 1, 7, 0, 0, 0, 2, 2000 100 PLAY "T1 C D E F G F E D C"

Run the program again and notice how different the new instrument sounds. Line 30 selects instrument 1, sets attack at 7, decay, sustain, and release at 0, waveform at 2 (pulse), and pulsewidth at 2000.

The T1 in line 100 might seem redundant at first: If ENVELOPE selects instrument 1, why specify instrument 1 again in the PLAY statement? This is necessary because of the default system. Until you specify otherwise in a PLAY statement, PLAY always uses instrument 0, the piano. Thus, whenever you define a new instrument with ENVELOPE, you must use the same instrument number after T in the appropriate PLAY statement. If you forget, PLAY ignores the EN-VELOPE statement and uses instrument 0 or whatever instrument you last selected with T.

Redefining an instrument with ENVELOPE replaces the predefined instrument of that number. Thus, you can never have more than ten instruments at once. However, new instruments can be introduced at any time with new ENVELOPE statements.

ENVELOPE can be tricky to handle, since it gives you total control over the ADSR envelope and



Colorful Text For IBM Graphics

Peter F. Nicholson, Jr.

IBM personal computers provide a wealth of graphics modes. Here's a method of printing text on graphics screens with different foreground colors to brighten up your screen displays. The technique works on the IBM PCjr with Cartridge BASIC or the PC with BASICA and color/ graphics adapter card. The IBM PCjr and the PC with a color/graphics adapter both have the ability to print different-colored foreground characters on the same colored background. Medium-resolution graphics mode gives you a choice of 16 different background colors and two different foreground color palettes (red/brown/green or cyan/magenta/white). According

to page I-9 of the BASIC reference manual for the PC, the following statement changes character colors (substitute 1, 2, or 3 for *color number*):

DEF SEG:POKE &H4E,color number

Although this changes the character color, it also replaces the background color with color 0

(black). It's not mentioned in the manual, but there is a way to change the foreground color without losing the background color. Simply add 128 to the color number in the above statement. This performs a bit manipulation called an exclusive OR (XOR) of the color value, allowing you to print any foreground color on the background.

To see a demonstration, type in and save the program below, then run it. The program illustrates the difference between normal and XOR printing and lets you experiment with many different background and foreground color combinations.

Character Colors For XOR Printing

Color Wher	e R	Resulting Character		
Character Will Be Color XOR PRINTed		olor		
	&H4E=	&H4E=	&H4E =	
	12	9 130	131	
0	1	2	3	
1	0	3	2	
2	3	0	1	
3	2	1	0	

Remember to restore the value in memory location &H4E to either 1, 2, or 3 when you're editing. Otherwise anything you type is XORed with whatever is on the screen. The easiest way to avoid this problem is to clear the screen (press CTRL-HOME) and press function key 10 to edit in SCREEN 0. The table shows the values you can POKE into &H4E to generate various color combinations.

XOR Printing

- JB 100 SCREEN 1:KEY DFF:PAL=0:BA CK=Ø:GOSUB 1500:COLOR BAC K, PAL
- BH 110 CLS:COL=3:X0=40:Y0=28:GOS UB 1000:COL=0:GOSUB 1000 FN 120 COL=3: X0=40: Y0=116: GOSUB
- 1000:COL=0:GOSUB 1000 6A 13Ø GOSUB 2000: POKE &H4E, 1:LO
- CATE 3, B: PRINT "&H4E=1" DL 140 FOR I=5 TO 9 STEP 2:LOCAT
- E I, B: PRINT PAL\$ (PAL, 1);: NEXT I
- KC 150 POKE &H4E,2:LOCATE 3,18:P RINT "&H4E=2"
- LN 160 FOR I=5 TO 9 STEP 2:LOCAT E I, 18: PRINT PAL\$ (PAL, 2); :NEXT I
- ₽1 17Ø POKE &H4E, 3:LOCATE 3, 28:P RINT "&H4E=3"

- AH 180 FOR I=5 TO 9 STEP 2:LOCAT E I,28:PRINT PAL\$(PAL,3); INEXT I
- NH 190 POKE &H4E, 1: LOCATE 14, 7:P RINT "&H4E=129": POKE &H4E .129
- BJ 200 FOR I=16 TO 20 STEP 2:LOC ATE I,8:PRINT COL1\$(FIX((I-16)/2));:NEXT I
- BH 210 POKE &H4E, 2:LOCATE 14, 17: PRINT "&H4E=130":POKE &H4 E,13Ø
- LI 220 FOR I=16 TO 20 STEP 2:LOC ATE I, 18: PRINT COL2\$ (FIX ((I-16)/2));:NEXT I
- LN 230 POKE &H4E. 3: LOCATE 14.27: PRINT "&H4E=131": POKE &H4 E,131
- AA 240 FOR I=16 TO 20 STEP 2:LOC ATE I,28:PRINT COL3\$(FIX((I-16)/2));:NEXT I
- LA 250 POKE &H4E, 3:LOCATE 1,1:PR INT "Normal Printing";
- PL 260 LOCATE 12,1:PRINT "XOR Pr inting"; KL 270 LOCATE 22,1:PRINT STRING\$
- (4Ø, CHR\$(32));
- DN 280 LOCATE 22,1:PRINT "Backgr ound "; BACK\$ (BACK) ; : LOCAT E 22,25:PRINT "Palette "; PAL;
- BE 290 LOCATE 23, 1: PRINT "Press Q To Quit"+STRING\$ (24, CHR \$(32));
- FA 300 LOCATE 24, 1: PRINT "Press Esc To Change Palette";
- 11 310 LOCATE 25, 1: PRINT "Press Space Bar To Change Backg round": JH 320 KB\$=INKEY\$: IF KB\$="" THEN
- 33Ø ELSE 32Ø ED 330 KB\$=INKEY\$: IF KB\$="" THEN
- 330 06 34Ø IF KB\$="q" OR KB\$="Q" THE
- N CLS:END

- AG 350 IF ASC(KB\$)=32 THEN 380 E LSE IF ASC(KB\$)><27 THEN 330
- NI 360 IF PAL=1 THEN PAL=0 ELSE PAL=1
- NF 370 COLOR BACK, PAL: GOTO 130 K6 380 LOCATE 25,1:PRINT STRING\$ (38, CHR\$ (32)):
- KL 390 LOCATE 24, 1: PRINT STRING\$ (38, CHR\$ (32));
- LL 400 LOCATE 23,1: INPUT "Enter Color Number (Ø-15) "; BAC
- NK 410 COLOR BACK, PAL: GOTO 130
- DO 1000 PRESET (X0, Y0)
- AC 1010 FOR I=1 TO 3
- BN 1020 LINE STEP (0,0)-STEP (240, 16), COL, B
- 0L 1030 PRESET STEP (-240,0) 6L 1040 NEXT I
- EN 1050 PRESET (XØ, YØ)
- BB 1060 FOR I=1 TO 3
- HL 1070 LINE STEP (0,0)-STEP (80,4 B), COL, B
- AF 1080 PRESET STEP (0, -48) NN 1090 NEXT I: IF COL=0 THEN GOT
- 0 1130 HO 1100 FOR I=1 TO 3:FOR J=1 TO
- PP 1110 PAINT (X0+20+80*(I-1), Y0+
- 8+16#(J-1)),J,3 IA 1120 NEXT J:NEXT I
- 16 113Ø RETURN
- BN 1500 DIM PAL\$(1,3)
- KH 1510 FOR I=0 TO 1:FOR J=1 TO
 - 3:READ PAL\$(I, J):NEXT J: NEXT I
- JB 1520 DATA "GREEN", "RED", "BROW

		N", "CYAN", "MAGENTA", "WHI
NM	1530	DIM BACK\$ (15)
66	1540	FOR I=Ø TO 15:READ BACK\$
PR	1550	DATA "BLACK" "BLUE" "GRE
	1000	EN", "CYAN", "RED", "MAGENT
AA	156Ø	DATA "WHITE", "GRAY", "L B LUE", "L GREEN", "L CYAN", "L RED", "L MAGTA"
OI	157Ø	DATA "YELLOW", "HI WHITE"
OL	1580	BLOCK\$=STRING\$ (8, CHR\$ (25
		5)) : A%=PEEK (VARPTR (BLOCK
		\$)+1):B%=PEEK(VARPTR(BLO
		CK\$)+2)
NG	1590	DEF SEG=Ø:POKE 124, A%:PO
		KE 125, B%: POKE 126, PEEK (
		&H51Ø):POKE 127, PEEK (&H5
		11)
NN	1600	DEF SEG: RETURN
EC	2000	COL1\$(Ø)=BACK\$(BACK):COL
		1\$(1)=PAL\$(PAL,3):COL1\$(
		2)=PAL\$(PAL,2)
CK	2010	COL2\$(Ø)=PAL\$(PAL,3):COL
		2\$(1)=BACK\$(BACK):COL2\$(
		2)=PAL\$(PAL, 1)
E6	2020	COL3\$ (Ø) = PAL\$ (PAL, 2) : COL
		3\$(1)=PAL\$(PAL, 1):CUL3\$(
14	2070	2)=BALK\$ (BALK)
In	2030	DEF SEGIFURE «H4E, I
ur	2040	CATE 5 I POINT CTDINCE (0
		CUPS(129)) NEYT I
11	2050	EOP 1-9 TO 29 STEP 10-10
~	2030	CATE 16. LEPRINT STRINGS (
		8. CHR\$ (128)) : : NEXT I
NC	2060	POKE &H4E.2
ND	2070	FOR I=8 TO 28 STEP 10:10
		CATE 7. I: PRINT STRING\$ (8
		.CHR\$(128))::NEXT I
PK	2080	FOR I=8 TO 28 STEP 10:LO
		CATE 18. I: PRINT STRING\$ (
		8. CHR\$ (128)) :: NEXT I
OL	2090	POKE &H4E.3
PG	2100	FOR I=8 TO 28 STEP 10:LO
		CATE 9, I: PRINT STRING\$ (8
		,CHR\$(128));:NEXT I
OK	2110	FOR I=8 TO 28 STEP 10:LO
		CATE 20, I: PRINT STRING\$(
		8, CHR\$(128));:NEXT I
IE	212Ø	RETURN

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Advanced 1541 Disk Commands

Dave Straub

If you want to go beyond the basics of Commodore disk programming, you'll need to learn direct access disk commands. These powerful commands allow you to read and write individual blocks on a disk. However, since improper use can irretrievably scramble a disk, they are recommended for intermediate and advanced programmers only. You should experiment with them on a scratch disk before attempting to manipulate any important files. The techniques work on any Commodore computer with a 1541 disk drive.

The 1541 disk drive is a complex device, often called an *intelligent peripheral* because it contains its own microprocessor and operating system. With most computers (such as Apple, Atari, and IBM), the Disk Operating System (DOS) is a program you must load into the computer before using the disk drive. Commodore's DOS, on the other hand, is permanently stored in Read Only Memory (ROM) inside the drive itself.

The Commodore system has some real advantages: DOS does not take up any of the computer's memory, and it's available the instant you turn on the drive. It also makes the 1541 drive independently programmable. By sending *direct access* commands to the drive, you can read or write to any area on the disk, read or write to the drive's internal memory, and even run your own ML programs in the drive.

In this article we'll cover three commands used to manipulate individual disk *blocks*. A block, also called a *sector*, is a small area on the disk that stores 256 bytes of data. As shown in your 1541 User's Manual, each disk is divided into 35 separate tracks, with each track subdivided into anywhere from 17 to 21 individual blocks or sectors. This yields a total of 683 blocks, each with its own track and block number. For example, the first part of the disk directory is stored in track 18, block 1.

The Command Channel

The first step in most Commodore disk programs is to open the command channel to the drive. This is a special channel used to send instructions to the drive and check for errors. Open it with a line similar to this:

10 OPEN 3,8,15

This opens communications on channel number 3 to device number 8 (the drive) with a secondary address of 15. The channel (sometimes called a logical file) number can be anything from 1–15. Once a channel is open, GET#, INPUT#, and PRINT# statements are used with the channel number to send or retrieve information on that channel. The number following the # character in these statements must match the channel number used in the OPEN statement. For example, if the channel is opened with OPEN 3,8,15, then PRINT#3,"IO" sends an initialization command to the drive on the command channel.

The *device number* specifies which drive is being accessed. The device number of the 1541 drive is always 8 unless you change it through software or by modifying the drive.

A secondary address of 15 has a

special meaning: It activates the command channel regardless of what channel number is used. For example, OPEN 1,8,15 or OPEN 15,8,15 both activate the command channel, using channel numbers 1 and 15, respectively.

In this article the command channel is used only to send direct access commands to the drive. However, the command channel also serves the important function of relaying drive error messages to the computer, as explained in your 1541 User's Manual.

Buffer Channels

The command channel's abilities are vital but limited: It can only transmit commands and error messages. To transfer data (information stored on the disk), you must open a second channel. When this is done, the drive sets aside a 256byte buffer area within its internal memory. It's no coincidence that the buffer is exactly the right size for storing a block of disk data. Since all data moves through the drive's buffers, this type of channel is often called a buffer channel, although data channel might be a more descriptive term. To open a buffer channel, use "#" as a filename in an OPEN command:

OPEN 2,8,2,"#"

This statement tells the 1541 to open buffer channel 2 to device number 8 with a secondary address of 2, and the special filename "#" reserves a buffer in the drive. The secondary address can be any number from 2–14.

Now that the channel is open, you can find out which buffer the 1541 has reserved. Use GET# to retrieve the first character available from that channel:

10 OPEN 2,8,2,"#":GET#2,X\$ 20 PRINT "BUFFER"ASC(X\$+CHR\$ (0))"USED" 30 CLOSE 2

This program opens a data channel and retrieves the number of the buffer reserved for that channel. The 1541 has five 256-byte buffers located at these addresses:

Buffer 0 \$0300-03FF (786-1023) Buffer 1 \$0400-04FF (1024-1279) Buffer 2 \$0500-05FF (1280-1535) Buffer 3 \$0600-06FF (1536-1791) Buffer 4 \$0700-07FF (1792-2047)

In most cases you needn't worry about which buffer is reserved for your data. The 1541 manages the buffers by itself and always reserves one for you unless none is available. However, by adding a number after the # character, you can force the drive to reserve a specific buffer. For instance, the statement OPEN 2,8,2,''#1'' makes the drive set aside buffer number 1 for channel number 2.

To avoid needless errors, don't specify a buffer unless you really need to do so. The buffers are also the 1541's main data area, and at any given time one or more of them may already be in use. For instance, buffer 4 stores the Block Availability Map (BAM) of the current disk and is almost never available. The 1541 generates a NO CHAN-NEL error message when you try to use a buffer that's already reserved or try to access a channel that wasn't properly opened.

Block-Read

The Block-Read command does exactly what the name implies, reading a block of information from the disk and storing it in a data buffer in the drive. Once the block has been read, you can transfer all or part of it to the computer's memory with GET# or INPUT# statements.

Block-Read has two alternate forms, one that works as expected and another that doesn't. Despite what your 1541 User's Guide says, don't use the B-R form of Block-Read. Use the alternate form (U1) instead. U1 always reads an entire block in correct order, beginning with the first byte of the block and ending with the last. To see how U1 works, type in and save Program 1 below. Program 1 works as listed on the Commodore 64 and the 128 in 64 mode. For the unexpanded VIC, change line 0 to:

Ø POKE 36879,30:X1=7680:X2=384 ØØ :rem 212

For the Commodore 16 or Plus/4, ignore the :rem numbers at the end of each line (they are for the VIC/64 "Automatic Proofreader" program) and change line 0 to:

Ø X1=3072:X2=2048:COLOR0,2

Before running Program 1, put an unimportant disk in the drive. Direct access commands are very powerful; even a slight typing error in these programs can garble an entire disk, destroying all of its data. Until you have gained some experience with these commands, it's best to practice on a disk that doesn't contain important programs or data.

When you run Program 1, it displays the 256 bytes stored in track 18, block 0 of your disk. Among other things, this disk block contains the disk name and ID. Line 10 of the program opens the command channel (to send commands to the drive) and line 20 opens the buffer channel to reserve a data buffer. Line 30 contains the Block-Read command (U1). Note that line 30 uses PRINT#3 to send the U1 command. Block-Read is an instruction to the drive; like other instructions it must be sent via the command channel (in this case channel 3).

The actual command is enclosed in quotation marks. First comes the command itself, followed by several parameters separated by spaces. The first number after U1 is 2, telling the drive to read the block into the buffer reserved for channel 2.

The next parameter must always be 0 to indicate drive number 0. (This is a holdover from the old Commodore PET dual drives that are numbered 0 and 1. The 1541 drive is always drive 0, even when two 1541s with different device numbers are daisy-chained together.) The last two parameters inside quotes are the track and sector numbers of the block you wish to read. In this case, 18 and 0 are used to read block 0 of track 18 from the disk.

In line 50 of Program 1, GET#2 retrieves data from the buffer channel. (Since GET# reads incoming zero bytes as null characters which would crash the ASC function with an error message—it's always necessary to concatenate X\$ with CHR\$(0).) Line 70 ends the program by closing both channels. Since channel 2 was the last channel opened, it is the first one closed. Always end a program of this type by closing every channel you opened.

Buffer-Pointer

U1 always reads a whole block, but in some cases you'll be interested in only part of the block. For example, you might want one program name from a directory block. The Buffer-Pointer command (abbreviated B-P) is designed for just such occasions. It points the drive to a designated byte within the data buffer, allowing you to read only the bytes you want. The general procedure is to read a block into the buffer with U1, set the pointer with B-P, then retrieve the desired bytes with GET#.

Type in and save Program 2, then run it. The program first reads the block from track 18, block 1 into a buffer. Then B-P sets the buffer pointer to byte 5. Like other direct access commands, B-P is also enclosed in quotes. The second parameter in the command is 2, telling the drive to use buffer channel 2. After 2 comes 5, the number of the byte you want to point at. The remainder of the program simply prints the name of the first program stored on the disk.

Block-Write

The Block-Write command is the opposite of Block-Read, letting you write a block of data from a buffer to any block on the disk. Block-Write also comes in two forms, good and bad. Skip the B-W command; it has the same defects as B-R. Use U2 whenever you want to write a block of data to disk.

To see Block-Write at work, first load Program 2, then add the lines listed below as Program 3. Note that line 80 of Program 3 replaces line 80 of Program 2, and be sure to save a copy of this program before you run it. This program combines all three of the commands discussed so far. First it reads the name of the first program in the disk directory from block 1 of track 18, then it asks you to type in a new program name. If the new name is less than 16 characters, line 110 "pads" the end of the name with SHIFTed space characters.

You're almost ready to write the new name back to the data buffer. But first it's necessary to set the buffer pointer back to the spot where the old name begins in the buffer (line 120). This step is critical, because GET# affects the buffer pointer much as PRINT affects the cursor on the screen. Every time GET# fetches a character from the buffer, the pointer automatically moves one byte forward. Lines 50-70 repeated GET# 16 times, moving the pointer 16 bytes forward. Thus, before writing the new name back into the buffer, it's necessary to reset the pointer with a second B-P command.

Line 130 writes the new name to the buffer; since the name is data (not an instruction), it's transmitted over the data channel with PRINT#2. Line 140 sends the U2 command over channel 3 to complete the process, telling the drive to write the entire contents of the buffer back to track 18, block 1 of the disk.

As you've probably gathered by now, the 1541 drive handles disk data in block-sized chunks. Though you may want to change only one or two bytes in a block, it's necessary to read the whole block into the drive, make the changes, then write the altered block back to disk again. There's much more to direct access programming, of course, but you can do a great deal with these few commands, moving freely around the disk to examine or modify whatever you find.

Please refer to "COMPUTEI's Guide to Typing In Programs" in this issue before entering the following listings.

Program 1: Block-Read Demo

Ø POKE53281,1:X1=1024:X2=55296 :rem 146 5 PRINTCHR\$(147)CHR\$(9)CHR\$(14):FORJ=1TO10:PRINT:NEXT :rem 15 10 OPEN3,8,15 20 OPEN2,8,2,"#" :rem 188 20 OPEN2,8,2,"#" :rem 27 30 PRINT#3,"U1 2 0 18 0" :rem 55 40 FOR X=0 TO 255 :rem 79

5Ø	<pre>Ø GET#2.XS:Y=ASC(XS+CHRS(Ø))</pre>		
		:rem	99
6Ø	POKEX1+X,Y:POKEX	2+X,Ø:NE	XT
		:rem	113
7Ø	CLOSE2:CLOSE3	:rem	242

Program 2: Buffer-Pointer Demo

1Ø	OPEN3,8,15	:rem 188
2Ø	OPEN2,8,2,"#"	:rem 27
3Ø	PRINT#3, "U1 2 Ø 18	1"
		:rem 56
4Ø	PRINT#3, "B-P 2 5"	:rem 221
5Ø	FORX=ØTO15:GET#2,X	\$:rem 49
6Ø	IFX\$<>CHR\$(160)THE	NPRINTX\$+
	CHR\$(Ø);	:rem 244
7Ø	NEXT	:rem 166
8Ø	CLOSE2:CLOSE3	:rem 243

Program 3: Block-Write Demo

BØ	PRINT: PRINT "WHAT	IS	THE NEW
	NAME?"		:rem 251
90	INPUT C\$:rem 96
100	FORJ=1T016:D\$=D	\$+C	HR\$(16Ø)
	:NEXT		:rem 14
110	C\$=LEFT\$(C\$+D\$,	16)	:rem 99
120	PRINT#3,"B-P 2	5"	:rem 12
130	PRINT#2,C\$:rem 9
140	PRINT#3,"U2 2 Ø	18	1"
			:rem 107
200	CLOSE2:CLOSE3		:rem 29
			Ô

IBM Filecopy

John Klein and Jeff Klein

Here's a fast and easy way to backup multiple files on your disks for safekeeping. It works on any IBM PC, PCjr, or compatible with at least 64K RAM and one or two floppy disk drives.

What is rule number one when you use a computer? Always make backup copies of all important files. But despite one of the most powerful disk operating systems in personal computing, that rule isn't always easy to follow on the IBM. DOS's DISKCOPY utility indiscriminately copies the entire disk, while the COPY command backs up only individual files. Neither allows you to copy groups of specific files from disk to disk or directory to directory very easily. Even if you have two drives, it's time-consuming to combine files from several disks onto a single backup disk, or to backup a group of updated files. As a result, many of us don't make backups as often as we should.

"IBM Filecopy" offers a solution to this problem. It's a utility program that works on any IBM PC, PCjr, or true compatible with one or two disk drives. Filecopy lets

Table 1: Using IBM Fil	ecopy	Table 2: End of Copy Phase			
Type of copy wanted: Target path to enter:		Screen Message:	Operation/Response:		
Same drive, directory "TEST" Drive B, same directory Drive B, directory "TEST"	\TEST (DOS 2.1 only) B: B:\TEST	REM *** COPY COMPLETE A>ERASE FILECOPY.BAT Insert disk with batch file	Copies completed. Batch file erases itself.		
		and press any key when ready DOS error message. P key	DOS error message. Press any key		
		A>^C	Press BREAK.		
		A>	DOS message. Type Y. Backup process finished; returned to DOS.		

you backup disks, directory by directory, or selectively backup individual files. These files can be of any type: BASIC, binary, command, etc. The files can be copied to any subdirectory on any other disk or the same disk.

Using Filecopy

Filecopy is a BASIC program which creates a temporary DOS batch file to copy the specified files to the backup destination. When run, the program first asks you to insert the source disk. This is the disk which contains the files you want to backup. Then the program asks for the source directory of the source disk. If you're not copying from a subdirectory, just type N at this prompt. In either case, Filecopy reads the filenames from the source directory and stores them in an array for later use.

Next the program asks you for the target path, the destination for the backups. Type B: for drive B or A: for drive A (be sure to type the colon after the drive designator-B: instead of B). Then type \directory name if you're copying the files to a subdirectory on the destination disk. You don't have to specify a directory if you're copying the files to the root (default) directory. If you're using a one-drive system, type B: for the target path as if you really have two drives. Never specify the same drive and directory as the source drive and directory, because the program won't copy files onto themselves. (See Table 1 for sample copy procedures.)

Filecopy then displays each filename from the source directory and asks if you want a copy. Simply type Y for each file you want copied, or N for those you don't want copied. Note: When Filecopy encounters a subdirectory name on your source disk, it's fooled into thinking the subdirectory is a regular file. Since it can't copy subdirectory names, you must answer N when the program asks if you want to backup the subdirectory.

After Filecopy queries you on all of the filenames, it asks for confirmation: "Is this all okay?" If you accidentally typed a wrong Y or N at a previous prompt, type N at this one to get another chance. When you confirm your choices by typing Y, Filecopy stores the names of the files you want copied in a temporary batch file on the source disk. (If the source disk is write-protected, an error message appears and the program halts.) Then it returns you to DOS.

The next step is to type FILE-COPY at the DOS prompt. This commands the batch file to copy each of the files you selected from the source disk to the target disk and directory. If you're using a onedrive system, DOS asks you to swap disks as it copies each file.

After the backup is complete, the temporary batch file erases itself off the source disk. This brings up an unavoidable DOS error message, "Insert disk with batch file and press any key when ready." When this message appears, just press CTRL-BREAK on the PC or Fn-B on the PCjr. Another DOS message asks if you want to terminate the batch job. Answer yes. The backup process is now complete. (Table 2 shows the screen messages and responses that should appear during this phase.)

Additional Tips

If you have another BASIC program in memory before running Filecopy, remember to save it on disk. Otherwise it will be replaced when you load and run Filecopy.

Filecopy works with all versions of DOS, but subdirectories are supported only in DOS 2.1 or higher. Do not specify directory changes in the target or source paths if you're using an earlier version of DOS.

If you have two drives and generally use the first drive for the DOS disk and the second for your programming disk, change the first statement in line 100 from P="A:" to P\$="B:". This lets you keep the source disk in drive B and put the target disk in drive A.

IBM Filecopy

Please refer to "COMPUTEI's Guide to Typing In Programs" before entering this listing.

6	1Ø	SCREEN Ø:WIDTH 80:COLOR 7,
		0
CF	2Ø	CLS:PRINT "Insert source d
		isk in drive A and hit any
		key to continue"
	70	COCUP 700. At-THOUTE (1)

- AH 30 GOSUB 700:A\$=IN MM 40 FILES
- NE 50 PRINT: INPUT "Enter directo ry change (N=None) > ",DIR
- CB 60 IF DIR\$="N" OR DIR\$="n" TH EN 100
- CH 70 ON ERROR GOTO 720
- DK 80 CHDIR DIR\$
- NP 90 ON ERROR GOTO 0: GOTO 40
- DL 100 P\$="A: ": GOSUB 420: CLS
- LF 110 '*** get target path *** 60 120 INPUT "Target path> ",PAT
- H\$ DA 13Ø IF PATH\$="B:" OR PATH\$="b :" OR PATH\$="A:" OR PATH\$ ="a:" OR PATH\$="" THEN 19 Ø
- 6K 14Ø PRINT: INPUT "Do you want to create this directory on the target disk (Y/N) ",A\$:IF A\$="N" OR A\$="n" THEN 19Ø ELSE IF A\$<>"Y" AND A\$<>"y" THEN 14Ø FI 15Ø ON ERROR GOTO 73Ø
- FB 160 MKDIR PATH\$:PRINT:P
- RINT P 170 '*** get files to copy **
- * *
- ON 180 ON ERROR GOTO 0

CK 19Ø	FOR Z=Ø TO FILENUM	HO 39Ø	**** enter DOS ***	EA 57Ø	NEXT Z1,Z
EE 200	PRINT "COPY> ";FILE\$(Z);	HN 400	CLS: SYSTEM	HB 58Ø	ERASE TEMS: FILENUM=FILENU
	TAB(24); "?"; :COLOR 31,0	AA 410	'\$\$\$ directory read in ar		M-1
HN 210	GOSUB 700		ray FILE\$ ###	EN 59Ø	DEF SEG
0A 22Ø	A\$=INPUT\$(1): IF A\$<>"Y" A	IK 420	DEF SEG=Ø	OF 600	'### remove spaces from f
	ND AS<>"y" AND AS<>"N" AN	OK 43Ø	CLS: COLOR 31, Ø: PRINT"One		ilename \$\$\$
	D A\$<>"n" THEN 220		moment please"	BP 610	FOR Z=Ø TO FILENUM
LC 230	PRINT SPC(2);A\$:COLOR 7,Ø	LA 440	COLOR 7, Ø: ON ERROR GOTO 4	CK 620	A\$="":PERIOD=Ø
0J 24Ø	IF AS="Y" OR AS="y" THEN	1000	60	CJ 63Ø	FOR Z1=1 TO 17
	$TY(Z) = 1$ ELSE $TY(Z) = \emptyset$	AD 450	FILES PS:ON ERROR GOTO Ø:	EA 640	IF MID\$(FILE\$(Z),Z1,1)="
IN 25Ø	NEXT Z		GOTO 47Ø	10000	" THEN 660 ELSE IF MIDS (F
60 260	INPUT "Is this all okay (HN 460	BEEP: COLOR 31: CLS: PRINT"C		ILE\$(Z), Z1, 1) ="." THEN PE
10.000.00	Y/N) ":A\$		annot read directory":COL		RIOD=1
06 270	IF AS="N" OR AS="n" THEN		OR 7: ON ERROR GOTO Ø: END	LN 650	A\$=A\$+MID\$(FILE\$(Z),Z1,1)
	CLS: GOTO 190	BD 470	DIM TEMS (48) :LOCATE 3.1:C	KN 660	NEXT Z1
NF 280	TE ASCO YY AND ASCO YT TH		OLOR 7: ROWS=Ø	EB 67Ø	FILE\$(Z)=A\$: IF PERIOD=Ø T
	EN 260	LL 480	POKE 1050.30: POKE 1052.34	1	HEN FILE\$(Z)=FILE\$(Z)+"."
10 290	'### batch file creation		:POKE 1054.0:POKE 1055.79	E0 68Ø	NEXT Z:RETURN
	111		:POKE 1056, 13: POKE 1057, 2	DD 690	'### clear keyboard buffe
PF 300	OPEN "FILECOPY. BAT" FOR O		8		r \$\$\$
	UTPUT AS #1	EI 490	LINE INPUT TEMS (ROWS)	FL 700	DEF SEG=Ø:POKE 1050, PEEK(
6J 310	PRINT #1. "VERIEY ON"	P6 500	IF TEMS (ROWS) <>"" THEN RO		1052):RETURN
80 320	FOR Z=Ø TO FILENUM	1	WS=ROWS+1:GOTO 480	OH 71Ø	'### error messages ###
18 330	IF TY(7)=0 THEN 350	0E 51Ø	DIM FILES (ROWS#4-1) . TY (RO	BN 720	BEEP: COLOR 31, Ø: PRINT "Di
HO 340	PRINT #1. "COPY ";FILE\$(Z)		WS\$4-1)		rectory does not exist":C
	1" "1PATH\$	HE 520	ROWS=ROWS-1		OLOR 7, Ø: RESUME 50
IN 35Ø	NEXT Z	6J 53Ø	FOR 7=0 TO ROWS	MN 73Ø	BEEP: COLOR 31. Ø: PRINT: PRI
00 360	PRINT #1. "REM ### COPY CO	FC 540	FOR 71=0 TO 3	Contraction of the second	NT:PRINT "Cannot create d
20.0000	MPLETE"	0E 55Ø	T\$=MID\$ (TEM\$ (Z) . Z1\$18+1.1		irectory reenter path"
66 370	PRINT #1. "ERASE FILECOPY.		7)		COLOR 7. Ø: RESUME 120 0
	BAT"	00 560	IF T\$<>"" THEN FILES (FILE		
AF 380	CLOSE #1		NUM) =T\$: FILENUM=FILENUM+1		
	A CONTRACTOR OF	1		0	

Apple Text Windows

Daniel L. Joynt

If you use an Apple II-series computer, you may have cast longing eyes at the flashy windowing capabilities of the Macintosh. What you may not realize is that the Apple II has a builtin windowing feature of its own—the text window. The following techniques work on any Apple II-series computer with at least 48K RAM.

While it's difficult for an Apple IIseries computer to emulate the slick graphics of the Macintosh, the Apple II does have a simple windowing capability known as the *text window*. Basically, a text window is a section on a low- or high-resolution graphics screen where text can be printed. The text window is easily controlled, too.

You're probably already famil-

iar with some aspects of the Apple II text window. When the computer is in text mode, in effect the text window covers the entire screenyou can print characters wherever you like. In graphics modes, the text window is confined to four lines at the bottom of the screen. When the four-line window fills up, text scrolls off the top of the window to make room for new text at the bottom. Ordinarily the computer manages the text window automatically. However, with a few simple POKEs you can manipulate the text window on your owncontrolling its size and screen location.

To see a demonstration of four different text windows, type in, save, and run Program 1. To add windowing to your own BASIC

programs, you can use the subroutine in Program 2 (see instructions below).

Open Your Own Windows

As you know, the Apple text screen is 40 columns wide and 24 rows tall. Any screen location can be defined in terms of an X (column) coordinate and a Y (row) coordinate. X coordinates range from 0 (far left) to 39 (far right). Y coordinates range from 0 (top) to 23 (bottom).

The Apple text window is controlled with four memory locations at decimal addresses 32, 33, 34, and 35. By POKEing values in these locations, you can set the boundaries of the window anywhere on the screen. Location 32 defines the left boundary of the text window; it takes any value from 0–39, corresponding to X coordinate values. Location 33 defines the maximum length of text lines inside the window, which effectively sets the right boundary; it accepts any value from 1-40.

Memory location 34 defines the top boundary of the text window. It takes any value from 0-23, corresponding to Y coordinates. Location 35 defines the window's bottom boundary; it accepts values from 1-24, where 24 is the bottom row of the screen.

To keep a program from crashing, you must keep all the boundaries on the screen. For instance, the values in locations 32 and 33 when added together must not exceed 40. Otherwise, the right boundary would be off the screen. Illogical configurations—such as setting the top boundary below the bottom boundary—also cause a crash.

Give The Cursor A Home

Once the window is opened, you'll want to fill it with text. Unfortunately, resetting locations 32–35 does not automatically relocate the cursor inside the new window. The HOME command sends the cursor to the upper-left corner, but also erases everything inside the window. To move the cursor less destructively, you can use the HTAB and VTAB commands.

HTAB and VTAB set the screen location where all following text will be printed. HTAB moves the text pointer to a specified column (1-40), and VTAB moves the text pointer to the designated row (1-24). Note that HTAB and VTAB act differently when used outside of a text window.

An Easy Window Routine

Program 2 is a subroutine that creates a text window of any size and shape and even surrounds it with a border if you like. It uses line numbers 10000–10070, but you can renumber the lines when adding the routine to your own programs. Note that this is a subroutine, not a complete program; certain steps must be followed when using the routine *after* it has been added to another program. Before calling the subroutine with GOSUB 10000, you must give each of the following variables a value within the range indicated. In addition to setting these variables, your program should not use the variables WX and WY, which the routine uses to draw borders.

Variable Range

WL	2-39
WR	2-39
WT	2-22
WB	2-22
W\$	any single character
WI	0-2

Line 10000 resets the text window to the size of the entire screen. This insures that HTAB and VTAB place the border properly. In lines 10010–10030 the variable WI defines the print mode of the border. A value of 0 maintains NORMAL mode, 1 sets the mode to INVERSE, and 2 sets it to FLASH.

The variable W\$ defines the character used for the border, which is drawn in lines 10040-10050. If you don't want a border, define W\$ as a null string (W\$=""). Line 10060 locates the new text window, setting the left, right, top, and bottom boundaries with the variables WL, WR, WT, and WB, respectively. Note that the left and right boundaries (WL and WR) must be in the range 2-39 to allow room for a border. For the same reason, WT and WB (top and bottom boundaries) should be in the range 2-22. Once the window is defined, line 10070 resets the Apple to NORMAL mode, clears the inside of the new text window, and ends the routine.

Program 1: Window Demonstration

```
29 100 TEXT
46 110 HOME
```

F1 120 REM -- DRAW MENU WINDOW F7 130 WL = 10:WR = '30:WT = 5:WB = 18:W\$ = "\$":WI = 0 D0 140 GDSUB 10000 EA 150 PRINT F0 160 PRINT TAB(4);"==== MENU ===="

```
60 170 PRINT : PRINT
89 180 FOR Y = 1 TO 4
```

34 190 PRINT TAB(4);Y;"- WINDOW ("; CHR\$ (64 + Y);")" E6 200 NEXT Y C8 210 PRINT : PRINT : PRINT C5 220 PRINT "CHOOSE WINDOW (1-4

```
C5 220 PRINT "CHOOSE WINDOW (1-4
)";
DA 230 GET Y$
```

```
D 24Ø IF Y$ < "1" OR Y$ > "4" T
HEN GOTO 100
```

69 250 W = VAL (Y\$) 84 260 ON W GOSUB 1000, 2000, 3000 ,4000 EC 270 FOR Z = 1 TO 1000: NEXT Z 99 28Ø LIST 57 29Ø HOME

 37
 270
 HOHE

 BF
 300
 PRINT :
 PRINT :

 CA
 310
 PRINT TAB(3); "WINDOW (";

 CHR\$
 (64 + W);")"

 E3
 320
 FOR Z = 1
 TO 10000:
 NEXT Z

 86 330 REM -- DRAW RETURN WINDOW #8 34Ø WL = 6:WR = 34:WT = 12:WB = 12:W\$ = CHR\$ (32):WI = 1 04 350 GOSUB 10000 62 360 PRINT TAB(5); "PLEASE PRE SS ANY KEY"; E3 37Ø GET Y\$ 9F 38Ø GOTO 13Ø C8 1000 REM -- DRAW WINDOW (A) FA 1010 WL = 2:WR = 15:WT = 2:WB = 8:W\$ = CHR\$ (32):WI = 49 1020 GOSUB 10000 DD 1030 RETURN D9 2000 REM -- DRAW WINDOW (B) $\begin{array}{rcl} 3E & 2010 & WL &= & 26:WR &= & 39:WT &= & 2:W\\ B &= & B:W &= & "*":WI &= & 1 \end{array}$ 4A 2020 GOSUB 10000 DE 2030 RETURN EA 3000 REM -- DRAW WINDOW (C) $\begin{array}{r} 18 & 3010 \text{ WL} = 2:\text{WR} = 15:\text{WT} = 16:\text{W} \\ \text{B} = 22:\text{WS} = "0":\text{WI} = 0 \end{array}$ 48 3020 GDSUB 10000 DF 3030 RETURN FB 4000 REM -- DRAW WINDOW (D) 94 4010 WL = 26:WR = 39:WT = 16: WB = 22:W\$ = "+":WI = 1 4C 4020 GOSUB 10000 EØ 4Ø3Ø RETURN 84 10000 POKE 32,0: POKE 33,40: POKE 34, Ø1 POKE 35,24 DB 10010 IF WI = 0 THEN NORMAL FD 10020 IF WI = 1 THEN INVERSE 4E 10030 IF WI = 2 THEN FLASH 89 10040 FOR WY = WT - 1 TO WB + 1: VTAB WY: HTAB WL -1: PRINT W\$;: HTAB WR + 1: PRINT W\$1: NEXT C9 10050 FOR WX = WL TO WR: VTAB WT - 1: HTAB WX: PRINT W\$: VTAB WB + 1: HTAB WX: PRINT W\$;: NEXT 6F 10060 POKE 32, WL - 1: POKE 33 , WR - WL + 1: POKE 34, W T - 1: POKE 35, WB % 10070 NORMAL : HOME : RETURN

Program 2: Window Subroutine

84 10000 POKE 32,0: POKE 33,40: POKE 34, Ø: POKE 35, 24 DB 10010 IF WI = 0 THEN NORMAL FD 10020 IF WI = 1 THEN INVERSE 4E 10030 IF WI = 2 THEN FLASH 89 10040 FOR WY = WT - 1 TO WB + 1: VTAB WY: HTAB WL -1: PRINT W\$;: HTAB WR + 1: PRINT WS: NEXT C9 10050 FOR WX = WL TO WR: VTAB WT - 1: HTAB WX: PRINT W\$; 1 VTAB WB + 11 HTAB WX: PRINT W\$:: NEXT 6F 10060 POKE 32, WL - 1: POKE 33 WR - WL + 1: POKE 34,W T - 1: POKE 35,WB % 10070 NORMAL : HOME : RETURN 0

COMPUTE!'s Guide To Typing In Programs

Before typing in any program, you should familiarize yourself with your computer. Learn how to use the keyboard to type in and correct BASIC programs. Read your manuals to understand how to save and load BASIC programs to and from your disk drive or cassette unit. Computers are precisetake special care to type the program exactly as listed, including any necessary punctuation and symbols, except for special characters as noted below. To help you with this task, we have implemented a special listing convention as well as a program to help check your typing-the "Automatic Proofreader." Please read the following notes before typing in any programs from COMPUTE!. They can save you a lot of time and trouble.

Commodore, Apple, and Atari programs can contain some hard-toread (and hard-to-type) special characters, so we have developed a listing system that indicates the function of these control characters. (There are no special control characters in our IBM or TI-99/4A listings.) You will find Commodore and Atari special characters within curly braces; do not type the braces. For example, {CLEAR} or {CLR} instructs you to insert the symbol which clears the screen on the Atari or Commodore machines. For Commodore, Apple, and Atari, a symbol by itself within curly braces is usually a control key or graphics key. If you see {A}, hold down the CTRL key and press A. This will produce a reverse video character on the Commodore (in quote mode), a graphics character on the Atari, and an invisible control character on the Apple. Commodore computers also have a special control key labeled with the Commodore logo. Graphics characters entered with the Commodore logo key are enclosed in a special bracket that looks like this: [<A>]. In this case, you would hold down the Commodore logo key as you type A. Our Commodore listings are in uppercase, so shifted symbols are underlined. A graphics heart symbol (SHIFT-S) would be listed as <u>S</u>. One exception is {SHIFT-SPACE}. When you see this, hold down SHIFT and press the space bar. If a number precedes a symbol, such as {5 RIGHT}, {6

<u>S</u>}, or [<8 Q>], you would enter five cursor rights, six shifted S's, or eight Commodore-Q's. On the Atari, inverse characters (printed in white on black) should be entered after pressing the inverse video key.

Since spacing is sometimes important, any more than two spaces will be listed. For example, {6 SPACES} means to press the space bar six times. Our listings never leave a space at the end of a line, instead moving it to the next printed line as {SPACE}. For your convenience, we have prepared this quick-reference chart for the Commodore and Atari special characters:

Atari 400/800/XL/XE

then you see	Туре	See	
(CLEAR)	ESC SHIFT <	15	Clear Screen
(UP)	ESC CTRL -	+	Cursor Up
(DOWN)	ESC CTRL =	+	Cursor Down
{LEFT}	ESC CTRL +	+	Cursor Left
(RIGHT)	ESC CTRL #	+	Cursor Right
(BACK S)	ESC DELETE	4	Backspace
(DELETE)	ESC CTRL DELETE	KI .	Delete character
(INSERT)	ESC CTRL INSERT	D	Insert character
{DEL LINE}	ESC SHIFT DELETE	G	Delete line
(INS LINE)	ESC SHIFT INSERT	D	Insert line
(TAB)	ESC TAB		TAB key
(CLR TAB)	ESC CTRL TAB	G	Clear tab
(SET TAB)	ESC SHIFT TAB	Ð	Set tab stop
(BELL)	ESC CTRL 2	5	Ring buzzer
(ESC)	ESC ESC	£	ESCape key

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

When You Read:	Dec		See.	When You Read	J Dream			
neau:	FIE		See:	nead:	Press	5.	_	See:
{CLR}	SHIFT	CLR/HOME	#	E13	COMM	ODORE	1	+
{HOME}		CLR/HOME	5	K 2 3	СОММ	ODORE	2	10
{UP}	SHIFT	↑ CRSR ↓		E 3 N	СОММ	ODORE	3	
(DOWN)		↑ CRSR ↓	Q	E 4 3	СОММ	ODORE	4	0
{LEFT}	SHIFT +	$- CRSR \rightarrow$		E 5 3	СОММ	ODORE	5	-2
{RIGHT}	•	$- CRSR \rightarrow$	J	E 6 3	СОММ	DORE	6	
{RVS}	CTRL	9	R	E 7 3	СОММ	DORE	7	•
{OFF}	CTRL	0		E 8 3	СОММО	DORE	8	
{BLK}	CTRL	1		{ F1 }		f1		
{WHT}	CTRL	2	E	{ F2 }	SHIFT	f1		1
{RED}	CTRL	3	12	{ F3 }	[f3		
(CYN)	CTRL	4		{ F4 }	SHIFT	f3		1
{PUR}	CTRL	5		{ F5 }	[f5		
{GRN}	CTRL	6	Ť	{ F6 }	SHIFT	f5		
{BLU}	CTRL	7	÷	{ F7 }	-	f7		
YEL}	CTRL	8	T	{ F8 }	SHIFT	f7		
	- Contraction			4	-			*

Cwww.commodore.ca

The Automatic Proofreader

We have developed a series of simple, yet effective programs that can help check your typing. Type in the appropriate Proofreader program listed below, then save it for future use. On the VIC, 64, or Atari, run the Proofreader to activate it, then enter NEW to erase the BASIC loader (the Proofreader remains active, hidden in memory, as a machine language program). Pressing RUN/ STOP-RESTORE or SYSTEM RESET deactivates the Proofreader. You can use SYS 886 to reactivate the VIC/64 Proofreader, or PRINT USR(1536) to reenable the Atari Proofreader. On the Apple, the Proofreader automatically erases the BASIC portion of itself after you activate it by typing RUN, leaving only the machine language portion in memory. It works with either DOS 3.3 or ProDOS. Disable the Apple Proofreader by pressing CTRL-RESET before running another BASIC program. The IBM Proofreader is a BASIC program that simulates the IBM BASIC line editor, letting you enter, edit, list, save, and load programs that you type. Type RUN to activate.

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

All you need to do is compare the value provided by the Proofreader with the checksum printed in the program listing in the magazine. In Commodore listings, the checksum is a number from 0 to 255. It is set off from the rest of the line with *rem*. This prevents a syntax error if the checksum is typed in, but the REM statements and checksums need *not* be typed in. It is just there for your information.

In Atari, Apple, and IBM listings, the checksum is given to the left of each line number. Just type in the program one line at a time (without the printed checksum) and compare the checksum generated by the Proofreader to the checksum in the listing. If they match, go on to the next line. If not, check your typing: You've made a mistake. On the Commodore, Atari, and Apple Proofreaders, spaces are not counted as part of the checksum, so be sure you type the right number of spaces between quote marks. The Commodore and Atari Proofreaders do not check to see that you've typed the characters in the right order, so if characters are transposed, the checksum still matches the listing. Because of the checksum method used, do not type abbreviations, such as ? for PRINT. The IBM Proofreader is the pickiest of all; it *will* detect errors in spacing and transposition. Be sure to leave Caps Lock on, except when typing lowercase characters.

IBM Proofreader Commands

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

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

Special Proofreader Notes For Commodore Cassette Users

The Proofreader resides in a section of memory called the cassette buffer, which is used during tape LOADs and SAVEs. Therefore, be sure to press RUN/STOP-RESTORE to get the Proofreader out of the way before saving or loading a program. If you want to use the Proofreader with tape, run the Proofreader, then enter these two lines *exactly* as shown, pressing RETURN after each one:

A\$="PROOFREADER.T":B\$="{10 SPACES}":FOR X=1 TO 4:A\$=A\$ +B\$:NEXT

FOR X=886 TO 1018:A\$=A\$+CHR\$ (PEEK(X)):NEXT:OPEN 1,1,1,A\$: CLOSE1

Then insert a blank tape and press RE-CORD and PLAY to save a special version of the Proofreader. Anytime you need to reload the Proofreader after it has been erased—for example, after you reload a paritally completed program—just rewind the tape, type OPEN1:CLOSE1, then press PLAY. You'll see the message FOUND PROOFREADER.T, but not the familiar LOADING message. Don't worry; the Proofreader is in memory. When READY comes back, enter SYS 886.

Program 1: VIC/64 Proofreader

By Charles Brannon, Program Editor

1Ø	PRINT" {CLR } PLEASE WAIT ":
	FORI=886TO1018:READA:CK=CK+
	A: POKEI, A:NEXT
2Ø	IF CK<>17539 THEN PRINT"
	[DOWN YOU MADE AN ERROR": PR
	INT"IN DATA STATEMENTS. ":EN
	D
3Ø	SYS886:PRINT" [CLR] [2 DOWN]P
	ROOFREADER ACTIVATED. ":NEW
40	DATA 173.036.003.201.150.20
-	8,001,096,141,151,003,173
50	DATA 037.003.141.152.003.16
	9,150,141,036,003,169,003
60	DATA 141,037,003,169,000,13
~~	3, 254, 096, 032, 087, 241, 133
70	DATA 251,134,252,132,253,00
	8 201 013 240 017 201 032
RA	DATA 240 005 024 101 254 13
00	3. 254 165 251 166 252 164
aa	DATA 253 040 096 169 013 03
	2 210 255 165 214 141 251
100	DATA 003 206 251 003 169 0
100	00 122 216 169 019 022 210
110	DATE 255 160 010 022 210 2
	EE 160 E0 022 210 2EE 166
1 20	55,109,56,052,210,255,100
124	72 151 002 102 007 200 006
1 20	72,151,003,192,087,208,000
136	DATA 032,205,189,076,235,0
	03,032,205,221,169,032,032
146	DATA 210,255,032,210,255,1
	73,251,003,133,214,076,173
150	

Program 2: Atari Proofreader

By Charles Brannon, Program Editor

100	GRAPHICS Ø
110	FOR I=1536 TO 1700:RE
	AD A: POKE I, A: CK=CK+A
	INEXT I
120	IF CK<>19072 THEN ? "
	Error in DATA Stateme
	nts. Check Typing.":
	END
130	A=USR(1536)
140	7 17 "Automatic Proof
	reader Now Activated.
150	END
160	DATA 104,160,0,185,26
	,3,201,69,240,7
170	DATA 200,200,192,34,2
	08.243.96.200.169.74
180	DATA 153.26.3.200.169
	.6.153.26.3.162
190	DATA Ø. 189. Ø. 228. 157.
	74.6.232.224.16
200	DATA 208.245.169.93.1
	41.78.6.169.6.141
210	DATA 79.6.24.173.4.22
	0 145 1 141 05

220 DATA 6,173,5,228,105,	
230 DATA 0, 133, 203, 96, 247	
.238,125,241,93,6	
240 DATA 244,241,115,241,	
124, 241, 76, 295, 238 250 DATA 0, 0, 0, 0, 0, 32, 62,	
246,8,201	
260 DATA 155,240,13,201,3	
2,240,7,72,24,101	
40.96.72.152.72.138	
280 DATA 72,160,0,169,128	
,145,88,200,192,40	
74.74.74.74.24.105	
300 DATA 161,160,3,145,88	
,165,203,41,15,24	
310 DATA 105,161,200,145,	
320 DATA 170,104,168,104,	
40,96	
Program 3: IBM Proofreade	r
By Charles Brannon, Program Edito	r
10 'Automatic Proofreader Ver	
sion 2.00 (Lines 270,510,5	
15,517,620,630 changed fro	
100 DIM L\$ (500) . LNUM (500) : COL	
OR Ø,7,7:KEY OFF:CLS:MAX=	
Ø:LNUM(Ø)=65536!	
CHR\$(4)+CHR\$(70):0N KEY(1	
5) GOSUB 640:KEY (15) ON:	
GOTO 13Ø	
120 RESUME 130	
140 ON ERROR GOTO 650:PRINT:P	
RINT"Proofreader Ready."	
1EG I THE THOUT I & V-CCDI TH TH	

- 100 LINE INPUT L\$:Y=CSRLIN-IN T(LEN(L\$)/W)-1:LOCATE Y,1 160 DEF SEG=0:POKE 1050,30:PO KE 1052,34:POKE 1054,0:PO KE 1055,79:POKE 1054,13:P
- OKE 1057,28:LINE INPUT L\$:DEF SEG:IF L\$="" THEN 15 Ø 170 IF LEFT\$(L\$,1)=" " THEN L
- \$=MID\$(L\$,2):GOTO 170
- 180 IF VAL(LEFT\$(L\$,2))=0 AND MID\$(L\$,3,1)=" " THEN L\$ =MID\$(L\$,4)
- 190 LNUM=VAL(L\$):TEXT\$=MID\$(L \$,LEN(STR\$(LNUM))+1)
- 200 IF ASC(L\$)>57 THEN 260 'n o line number, therefore command
- 210 IF TEXT\$="" THEN GOSUB 54 Ø:IF LNUM=LNUM(P) THEN GO SUB 560:GOTO 150 ELSE 150
- 22Ø CKSUM=Ø:FOR I=1 TO LEN(L\$
):CKSUM=(CKSUM+ASC(MID\$(L
 \$,I))\$I) AND 255:NEXT:LOC
 ATE Y,1:PRINT CHR\$(65+CKS
 UM/16)+CHR\$(65+(CKSUM AND
 15))+" "+L\$
- 23Ø GOSUB 540:IF LNUM(P)=LNUM THEN L\$(P)=TEXT\$:GOTO 15 Ø 'replace line
- 240 GOSUB 580:GOTO 150 'inser t the line

26Ø TEXT\$="":FOR I=1 TO LEN(L \$):A=ASC(MID\$(L\$,I)):TEXT \$=TEXT\$+CHR\$(A+32*(A>96 A ND A<123)):NEXT

- 270 DELIMITER=INSTR(TEXT\$," "):COMMAND\$=TEXT\$:ARG\$="": IF DELIMITER THEN COMMAND \$=LEFT\$(TEXT\$,DELIMITER-1):ARG\$=MID\$(TEXT\$,DELIMIT ER+1) ELSE DELIMITER=INST R(TEXT\$,CHR\$(34)):IF DELI MITER THEN COMMAND\$=LEFT\$ (TEXT\$,DELIMITER-1):ARG\$= MID\$(TEXT\$,DELIMITER)
- 280 IF COMMAND\$<>"LIST" THEN 410
- 290 OPEN "scrn:" FOR OUTPUT A S #1
- 300 IF ARG\$="" THEN FIRST=0:P =MAX-1:GOTO 340
- 310 DELIMITER=INSTR(ARG\$,"-") :IF DELIMITER=0 THEN LNUM =VAL(ARG\$):GOSUB 540:FIRS T=P:GOTO 340
- 320 FIRST=VAL(LEFT\$(ARG\$,DELI MITER)):LAST=VAL(MID\$(ARG \$,DELIMITER+1))
- 330 LNUM=FIRST:GOSUB 540:FIRS T=P:LNUM=LAST:GOSUB 540:I F P=0 THEN P=MAX-1
- 340 FOR X=FIRST TO P:N\$=MID\$(STR\$(LNUM(X)),2)+" "
- 350 IF CKFLAG=0 THEN A\$="":GO TO 370
- 360 CKSUM=0:A\$=N\$+L\$(X):FOR I =1 TO LEN(A\$):CKSUM=(CKSU M+ASC(MID\$(A\$,I))*I) AND 255:NEXT:A\$=CHR\$(65+CKSUM /16)+CHR\$(65+(CKSUM AND 1 5))+" "
- 370 PRINT #1, A\$+N\$+L\$(X)
- 380 IF INKEY\$ <> " THEN X=P
- 390 NEXT :CLOSE #1:CKFLAG=0
- 400 GOTO 130
- 410 IF COMMAND\$="LLIST" THEN OPEN "lpt1:" FOR OUTPUT A S #1:GOTO 300
- 420 IF COMMAND\$="CHECK" THEN CKFLAG=1:GOTO 290
- 430 IF COMMAND\$<>"SAVE" THEN 450
- 44Ø GOSUB 600:0PEN ARG\$ FOR 0 UTPUT AS #1:ARG\$="":GOTO 300
- 450 IF COMMAND\$<>"LOAD" THEN 490
- 460 GOSUB 600:OPEN ARG\$ FOR I NPUT AS #1:MAX=0:P=0
- 470 WHILE NOT EDF(1):LINE INP UT #1,L\$:LNUM(P)=VAL(L\$): L\$(P)=MID\$(L\$,LEN(STR*(VA L(L\$)))+1):P=P+1:WEND 480 MAX=P:CLOSE #1:GOTO 130
- 480 MAX=P:CLUSE #1:BUTU 130 490 IF COMMAND\$="NEW" THEN IN
- PUT "Erase program Are you sure";L\$:IF LEFT\$(L\$, 1)="y" OR LEFT\$(L\$,1)="Y" THEN MAX=0:GOTO 130:ELSE 130
- 500 IF COMMAND\$="BASIC" THEN COLOR 7,0,0:0N ERROR GOTO 0:CLS:END
- 510 IF COMMAND\$<>"FILES" THEN 520
- 515 IF ARG\$="" THEN ARG\$="A:" ELSE SEL=1:GOSUB 600
- 517 FILES ARG\$:GOTO 130 520 PRINT"Syntax error":60T0 130

540 P=0:WHILE LNUM>LNUM(P) AN D P<MAX:P=P+1:WEND:RETURN

- 560 MAX=MAX-1:FOR X=P TO MAX: LNUM(X)=LNUM(X+1):L\$(X)=L \$(X+1):NEXT:RETURN
- 580 MAX=MAX+1:FOR X=MAX TO P+ 1 STEP -1:LNUM(X)=LNUM(X-1):L\$(X)=L\$(X-1):NEXT:L\$(P)=TEXT\$:LNUM(P)=LNUM:RET URN
- 600 IF LEFT\$(ARG\$,1)<>CHR\$(34)) THEN 520 ELSE ARG\$=MID\$ (ARG\$,2)
- 610 IF RIGHT\$(ARG\$,1)=CHR\$(34) THEN ARG\$=LEFT\$(ARG\$,LE N(ARG\$)-1)
- 620 IF SEL=0 AND INSTR(ARG\$," .")=0 THEN ARG\$=ARG\$+".BA S"
- 63Ø SEL=Ø:RETURN
- 640 CLOSE #1:CKFLAG=0:PRINT"S topped.":RETURN 150
- 650 PRINT "Error #"; ERR: RESUM E 150

Program 4: Apple Proofreader

By Tim Victor, Editorial Programmer

- 10 C = 0: FOR I = 768 TO 768 + 68: READ A:C = C + A: POKE I ,A: NEXT
- 20 IF C < > 7258 THEN PRINT "ER ROR IN PRODFREADER DATA STAT EMENTS": END
- 30 IF PEEK (190 * 256) < > 76 T HEN POKE 56,0: POKE 57,3: CA LL 1002: GOTO 50 40 PRINT CHR\$ (4);"IN#A\$300"
- 50 POKE 34,0: HOME : POKE 34,1: VTAB 2: PRINT "PROOFREADER

INSTALLED" 60 NEW 100 DATA 216,32,27,253,201,141

110 DATA 208,60,138,72,169,0 120 DATA 72,189,255,1,201,160 130 DATA 240,8,104,10,125,255 140 DATA 1,105,0,72,202,208 150 DATA 238,104,170,41,15,9 160 DATA 48,201,58,144,2,233 170 DATA 57,141,1,4,138,74 180 DATA 74,74,74,41,15,9 190 DATA 48,201,58,144,2,233 200 DATA 57,141,0,4,104,170 210 DATA 169,141,96

C

Machine Language Entry Program For Commodore 64 Charles Brannon, P

MLX is a labor-saving utility that allows almost fail-safe entry of machine language programs published in COM-PUTE!. You need to know nothing about machine language to use MLX-it was designed for everyone. At least 8K expansion memory is required.

MLX is a new way to enter long machine language (ML) programs with a minimum of fuss. MLX lets you enter the numbers from a special list that looks similar to BASIC DATA statements. It checks your typing on a line-by-line basis. It won't let you enter illegal characters when you should be typing numbers. It won't let you enter numbers greater than 255 (forbidden in ML). It won't let you enter the wrong numbers on the wrong line. In addition, MLX creates a ready-to-use tape or disk file.

Using MLX

Type in and save the appropriate version of MLX (you'll want to use it in the future). When you're ready to type in an ML program, run MLX. MLX for the 64 asks you for two numbers: the starting address and the ending address. These numbers are given in the article accompanying the ML program.

When you run MLX, you'll see a prompt corresponding to the starting address. The prompt is the current line you are entering from the listing. It increases by six each time you enter a line. That's because each line has seven numbers-six actual data numbers plus a checksum number. The checksum verifies that you typed the previous six numbers correctly. If you enter any of the six numbers wrong, or enter the checksum wrong, the computer rings a buzzer and prompts you to reenter the line. If you enter it correctly, a bell tone sounds and you continue to the next line.

MLX accepts only numbers as input. If you make a typing error, press the INST/DEL key; the entire number is deleted. You can press it as many times as necessary back to the start of the line. If you enter three-digit numbers as listed, the computer automatically prints the comma and goes on to accept the next number. If you enter less than three digits, you can press either the space bar or RETURN key to advance to the next number. The checksum automatically appears in inverse video for emphasis.

To simplify your typing, MLX redefines part of the keyboard as a numeric keypad (lines 581-584):

	U	I	0			7	8	9
H	J	K	L	become	0	4	5	6
	M					1	2	3

64 MLX Commands

When you finish typing an ML listing (assuming you type it all in one session), you can then save the completed program on tape or disk. Follow the screen instructions. If you get any errors while saving, you probably have a bad disk, or the disk is full, or you've made a typo when entering the MLX program itself.

You don't have to enter the whole ML program in one sitting. MLX lets you enter as much as you want, save it, and then reload the file from tape or disk later. MLX recognizes these commands:

SHIFT-S: Save SHIFT-L: Load SHIFT-N: New Address SHIFT-D: Display

When you enter a command, MLX jumps out of the line you've been typing, so we recommend you do it at a new prompt. Use the Save command to save what you've been working on. It will save on tape or disk, as if you've finished, but the tape or disk won't work, of course, until you finish the typing. Remember what address you stop at. The next time you run MLX, answer all the prompts as you did before, then insert the disk or tape. When you get to the entry prompt, press SHIFT-L to reload the partly completed file into memory. Then use the New Address command to resume typing.

To use the New Address command, press SHIFT-N and enter the address where you previously stopped. The prompt will change, and you can then continue typing. Always enter a New Address that matches up with one of the line numbers in the special listing, or else the checksum won't work. The Display command lets you display a section of your typing. After you press SHIFT-D, enter two addresses within the line number range of the listing. You can abort the listing by pressing any key.

64 MLX: Machine Language Entry

10 REM LINES CHANGED FROM MLX [SPACE] VERSION 2.00 ARE 750 ,765,77Ø AND 860 :rem 50 20 REM LINE CHANGED FROM MLX V ERSION 2.01 IS 300 :rem 147 100 PRINT"{CLR} [6]"; CHR\$(142); CHR\$(8); : POKE53281,1: POKE5 3280,1 :rem 67

1Ø1	POKE 788,52:REM DISABLE RU
11ø	PRINT"[RVS][39 SPACES]";
120	:rem 176 PRINT" [RVS] {14 SPACES}
	[RIGHT][OFF][*]f[RVS]
	[RIGHT] [RIGHT][2 SPACES] [*][OFF][*][[RVS][[RVS]]
	{14 SPACES}"; :rem 250
130	PRINT"(RVS)(14 SPACES) [RIGHT] [G][RIGHT]
	{2 RIGHT } {OFF } £ {RVS } £
	14 SPACES]": :rem 35
140	PRINT" [RVS] [41 SPACES]"
	:rem 120
200	PRINT" [2 DOWN] [PUR] [BLK] M
	ACHINE LANGUAGE EDITOR VER
210	PRINT \$53 2 UP STARTING AD
	DRESS? [8 SPACES] [9 LEFT] ";
	:rem 143
215	INPUTS:F=1-F:CS=CHRS(31+11
220	155(2560R(S)40960ANDS(4915
	2) ORS>53247THENGOSUB3000:G
	OTO21Ø :rem 235
225	PRINT: PRINT: PRINT : rem 180
230	ESS218 SPACES19 LEFT :: I
	NPUTE:F=1-F:C\$=CHR\$(31+119
	*F) :rem 20
240	IFE<256OR(E>40960ANDE<4915
	2)ORE>5324/THENGOSUB3000:G
25Ø	IFE <sthenprintc\$;"[rvs]end< td=""></sthenprintc\$;"[rvs]end<>
	<pre>ING < START{2 SPACES}":GOS</pre>
	UB1000:GOTO 230 :rem 176
300	PRINT:PRINT:PRINT : rem 1/9 PRINT" { CLR }" • CHRS(14) • AD=S
500	:rem 56
31Ø	A=1:PRINTRIGHT\$("0000"+MID
	\$(STR\$(AD),2),5);":";
215	:Tem 33
315	GOSUB570 · I FN=-1 THFN.I=.I+N ·G
510	OTO32Ø :rem 228
39Ø	IFN=-211THEN 710 :rem 62
400	IFN=-204THEN 790 :rem 64
410	DOWN ENTER NEW ADDRESS":Z
	z :rem 44
415	IFN=-206THENIFZZ <sorzz>ETH</sorzz>
	ENPRINT" (RVS)OUT OF RANGE"
417	:GOSUBI000:GOTO410:rem 225 IFN=-206THENAD=77:PRINT:GO
	TO310 :rem 238
420	IF N<>-196 THEN 480
430	PRINT: INPUT "DISPLAY: FROM";
	F:PRINT, "TO"; :INPUTT
	:rem 234
440	IFF SORF EORT SORT ETHENPR
	OT MORE THAN": E:GOTO430
	:rem 159
450	FORI=FTOTSTEP6:PRINT:PRINT
	RIGHTS("0000"+MIDS(STRS(I)
451	FORK=ØTO5:N=PEEK(I+K):PRIN
	TRIGHT\$("ØØ"+MID\$(STR\$(N),
	2),3);","; :rem 66

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1		
	75Ø	DV=1-7*(A\$="D"):IFDV=8THEN F\$="Ø:"+F\$:OPEN15,8,15,"S"
Contraction and	76Ø	+rş:CLOSE15 :rem 212 Tş=F\$:ZK=PEEK(53)+256*PEEK (54)-LEN(T\$):POKE782,ZK/25
	762	POKE781,ZK-PEEK(782)*256:P OKE780,LEN(T\$):SYS65469
	763	POKE780,1:POKE781,DV:POKE7 82.1:SYS65466 :rem 69
	765	K=S:POKE254,K/256:POKE253, K-PEEK(254)*256:POKE780,25 3 :rem 17
	766	K=E+1:POKE782,K/256:POKE78 1,K-PEEK(782)*256:SYS65496 :rem 235
	77Ø	IF(PEEK(783)AND1)OR(191AND ST)THEN780 :rem 111
	775	PRINT" [DOWN]DONE. [DOWN]":G OTO310 :rem 113
	78Ø	PRINT"{DOWN}ERROR ON SAVE. {2 SPACES}TRY AGAIN.":IFDV =1THEN720 :rem 171
	781	OPEN15,8,15:INPUT#15,E1\$,E 2\$:PRINTE1\$;E2\$:CLOSE15:GO TO720 :rem 103
	790	PRINT"{CLR} {RVS}*** LOAD * **{2 DOWN}" :rem 212
and a second second	795	PRINT"{2 DOWN}(PRESS {RVS} RETURN{OFF} ALONE TO CANCE L LOAD)" :rem 82
	800	F\$="":INPUT"{2 DOWN} FILEN AME";F\$:IFF\$=""THENPRINT:G OTO310 :rem 144
	81Ø	PRINT:PRINT" [2 DOWN] [RVS]T [OFF] APE OR [RVS]D[OFF] ISK
	82Ø	: (T/D)" :rem 227 GETA\$:IFA\$<>"T"ANDA\$<>"D"T
1000	830	HEN820 :rem 34 DV=1-7*(A\$="D"):IFDV=8THEN
	84Ø	rş="0:"+rş :rem 157 T\$=F\$:ZK=PEEK(53)+256*PEEK (54)-LEN(T\$):POKE782,ZK/25
	841	<pre>c :rem 2 POKE781,ZK-PEEK(782)*256:P OKE780,LEN(T\$):SYS65469</pre>
	845	:rem 107 POKE780,1:POKE781,DV:POKE7
	850	POKE780,0:SYS65493 :rem 11 IF(PEEK(783)AND1)OP(101AND
	865	ST) THEN870 :rem 111 PRINT [DOWN] DONE. ":GOTO 310
	87Ø	PRINT" [DOWN]ERROR ON LOAD.
	88Ø	12 SPACES TRY AGAIN. [DOWN] ":IFDV=1THEN800 :rem 172 OPEN15,8,15:INPUT#15,E1\$,E S. DENMEN: P20.00715.20
	1000	TO800 :rem 102 J REM BUZZER :rem 135
	1001	POKE54296,15:POKE54277,45 :POKE54278,165 :rem 207
	100:	2 POKE54276,33:POKE 54273,6 :POKE54272,5 :rem 42
	100:	<pre>3 FORT=1T0200:NEXT:POKE5427 6,32:POKE54273,0:POKE5427 2,0:RETURN :rem 202</pre>
	2000	Ø REM BELL SOUND :rem 78 1 POKE54296,15:POKE54277,Ø: POKE54278,247 :rem 152
	2002	POKE 54276,17:POKE54273,4 Ø:POKE54272,0 :rem 86
	2003	FORT=1T0100:NEXT:POKE5427 6,16:RETURN :rem 57
	3000	GE OR ROM":GOTO1000
		:rem 89 ©

_	a service and the second state of the second	2.2.2
460	GETAS: IFAS> "THENPRINT: F	RI
470	NEXTK:PRINTCHR\$(20);:NEX	25 (TI
	:PRINT:PRINT:GOTO310 :rem	50
480	IFN<Ø THEN PRINT:GOTO310 :rem 1	68
490	A(J)=N:NEXTJ :rem 1 CKSUM=DD_INT(DD/256)*256	.99
500	ORI=1TO6:CKSUM=(CKSUM+A)	(1)
510)AND255:NEXT :rem 2 PRINTCHPS(18):COSUR570	200
510	INTCHR\$(146); :rem	94
511	IFN=-1THENA=6:GOTO315 :rem 2	254
515	PRINTCHR\$(20):IFN=CKSUM	THE
52Ø	PRINT: PRINT"LINE ENTERED) <u>W</u>
	RONG : RE-ENTER":PRINT:C UB1000:GOTO310 :rem	50S
530	GOSUB2000 :rem	218
540	FORI=1TO6:POKEAD+1-1,A(1 NEXT:POKE54272,Ø:POKE542	[): 273
550	AD=AD+6:IF AD <e 310<="" td="" then=""><td>3</td></e>	3
56Ø	GOTO 710 :rem 1	212 LØ8
570	N=0:Z=0 :rem	88
580	GETA\$:IFA\$=""THEN581	31
582	:rem AV=-(AS="M")-2*(AS=".")-	95
	(A\$=".")-4*(A\$="J")-5*(A	4\$=
	"K")-6*(AŞ="L") :rem	41
583	AV=AV-/*(A\$="0")-8*(A\$=)-9*(A\$="0"):IFA\$="H"THI	ENA
	S="Ø" :rem :	134
584	:rem	134
585	PRINTCHR\$(20);:A=ASC(A\$ FA=13ORA=44ORA=32THEN670 :rem):1 J 229
59Ø	IFA>128THENN=-A:RETURN	137
600	IFA<>20 THEN 630 :rem	10
610	GOSUB690:IFI=IANDT=44TH =-1:PRINT"{OFF}{LEFT}	SNN
	{LEFT}";:GOTO690 :rem	62
62Ø 63Ø	IFA<480RA>57THEN580	109
640	:rem : PRINTAS::N=N*1Ø+A-48	1Ø5
CEQ.	TENN DEE THEN N-20.COSUR	106
000	Ø:GOTO600 :rem :	229
660	Z=Z+1:IFZ<3THEN580 :rem	71
070	:rem :	114
68Ø	PRINT", ";:RETURN :rem : S%=PEEK(209)+256*PEEK(2)	240 10)
	+PEEK(211) :rem :	149
691	rorI=ITO3:T=PEEK(S%-I) :rem	67
695	IFT<>44ANDT<>58THENPOKES	5%- 2Ø5
7ØØ	PRINTLEFT\$("[3 LEFT]",I	-1)
710	PRINT"{CLR} RVS}*** SAVI	n / E *
715	**{3 DOWN}" :rem : PRINT"{2 DOWN}(PRESS [RV	236 /S}
	RETURN (OFF) ALONE TO CAN	ICE
720	F\$="":INPUT"{DOWN} FILE	NAM
	E";F\$:IFF\$=""THENPRINT:I NT:GOTO310 :rem	PRI 71
73Ø	PRINT: PRINT" [2 DOWN] [RVS	S)T
	: (T/D)" :rem 2	228
740	GETAS . TEAS () "T" ANDAS () "I	דייר

:rem 36

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